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THE POLITICAL SHAPING OF ENERGY TECHNOLOGY:
COMBINED HEAT AND POWER IN BRITAIN

VOL I

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Doctor of Philosophy

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October 1986

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**The Political Shaping of Energy Technology:
Combined Heat and Power in Britain**

Stewart Russell

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There has been negligible adoption of combined heat and power (CHP) for district heating (DH) in Britain, despite continued advocacy. This thesis constructs an account of the treatment of the option, and devises a framework for explanation.

Analysis of technological development and adoption, it is argued, should be similar to that of other social processes, and be subject to the same requirements and criticisms. They will, however, show features peculiar to the institutions developing and selecting technologies, their relation to different social groups, and the forms of knowledge in and about technology. Conventional approaches - organisation and interorganisation theories, and analyses of policy-making - give useful insights but have common limitations. Elements of an analytical framework situating detailed issues and outcomes in a structured historical context are derived from convergent radical critiques.

Thus activity on CHP/DH is essentially shaped by the development and relations of energy sector institutions: central and local government, nationalised industries and particularly the electricity industry. Analysis of them is related to the specific character of the British state.

A few CHP and DH installations were tried before 1940. During postwar reconstruction, extensive plans for several cities were abandoned or curtailed. In the 1960s and 70s, many small non-CHP DH schemes were installed on housing estates. From the mid-70s, the national potential of CHP/DH has been reappraised, with widespread support and favourable evaluations, but little practical progress.

Significant CHP/DH adoption is shown to have been systematically excluded ultimately by the structure of energy provision; centralised production interests dominate and coordination is weak. Marginal economics and political commitment have allowed limited development in exceptional circumstances. Periods of upheaval provided greater opportunity and incentive for CHP/DH but restructuring eventually obstructed it. Explanation of these outcomes is shown to require analysis at several levels, from broad context to detailed action.

Keywords: COMBINED HEAT AND POWER

DISTRICT HEATING ENERGY POLICY POLITICS OF TECHNOLOGY

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Staff at local authorities throughout the UK who responded to a questionnaire in September 1983

My family and friends

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CHAPTER 1 CHP/DH AND THE SOCIAL SHAPING OF TECHNOLOGY

1.1 INTRODUCTION

CHP/DH

It is inherent in the process of producing mechanical and hence electrical energy from a heat engine that much of the energy input is released as relatively low temperature heat. By various techniques dependent on the prime mover, it is possible to produce reject heat at a temperature useful for space heating or industrial process heating, thereby achieving a much higher overall efficiency of conversion and saving fuel over separate production of electricity and heat.¹

Heat from combined heat and power plant, or from another central source, can be transmitted and distributed in pipes in the form of hot water or steam to users' premises. The terms communal, group or more commonly district heating are used, as distinct from the on-site production of heat in individual heating plant.²

The basic techniques of CHP production and district heating were devised at the end of the last century. Many of the technical and economic problems, the economic and social merits and disadvantages, and the different ways of assessing them, were rehearsed by early this century.

Large scale DH with CHP sources is used extensively in other countries, notably in Scandinavia, Eastern Europe and the USSR.³ In Britain, a limited number of heat-only district heating schemes are found and CHP/DH is virtually non-existent. Electricity production and the provision of heat are almost entirely separate activities.

This thesis explores the social processes leading to the virtual absence of CHP/DH in Britain. It has a dual objective:

- to construct an account of the treatment of the CHP/DH option in this country;
- to devise and justify an approach adequate for explaining these activities and outcomes.

These two pursuits are obviously closely related in execution. The developing framework necessarily guides the interpretation of material and the construction of the account. The account itself is intended to throw light on the adequacy of a framework derived from general theoretical material.

The basic motivation in the choice of topic and the approach is to contribute to an understanding of the social processes of technological development and adoption. In particular it is argued that an analysis of political activity - in terms of organisations and social groups and their interactions in public arenas - is needed in this case, and has been lacking in accounts of technology in general.

The major theoretical theme is that specific outcomes cannot be explained just at the level of detailed action but require broader social structures and processes to be taken into account.

Interest and Challenges

CHP/DH presents a number of interesting features and challenges as a case study in the social analysis of technology. The basic techniques have been available since the turn of the century, and in several periods in this country it has been advocated in terms of generally accepted objectives, such as fuel efficiency and conservation. Nevertheless its adoption has been negligible.

No secondary account exists of the treatment of the option in Britain.⁴ This largely reflects the general tendency in historiography and contemporary social depiction to rationalise actual social arrangements as somehow natural or inevitable and to ignore alternatives which remained undeveloped. For similar and more specific reasons a strong determinism

operates in accounts of technological development. Thus CHP/DH has largely been written out of histories of the energy sector.⁵

CHP/DH has become topical again in the 1980s, with proposals being formulated for its introduction in some British cities. The debate which has revived around the technique is being conducted with little reference to any past history and in very limited terms. Typical explanations of its lack of development are unsatisfactorily positivistic: the economics of proposals, influenced by fuel prices, climate, and perhaps cultural preferences, precluded it.⁶ At the same time, while the content of the debate is unsatisfactory, its form points to interesting features: the shaping of appraisals by institutions presenting them; shifts in attention to the option, and perception of the issues around it, according to broader developments in the energy sector and the relative importance attached to different objectives; and the different views of different social interests.

The presence of established CHP/DH schemes in other countries, with differing technical features and economic and political contexts, would also allow a cross-national comparison, one of the most powerful methods for demonstrating the specificity of outcomes, and the possibility and conditions of alternatives. Such comparison, however, would itself be a major undertaking and is not developed in this thesis.⁷

CHP/DH, then, is by no means a new technology. It has little of the immediate attraction of areas such as microelectronics or biotechnology - areas of revolutionary changes brought about by the application of breakthroughs in fundamental research. An understanding of the technological ensemble of a society, however, must come as much from investigating the bulk of its accepted and inconspicuous technology, as from the dynamics of its more exciting parts.

As argued later in relation to Marxist views of technology, technologies in the public sector - especially those in infrastructure - have received relatively little attention despite the pervasive and increasing involvement of the state in the development and control of technology in general.⁸ This neglect includes choices in energy technology, with the exception of nuclear power. Political scientists have mainly tackled international aspects of energy supply, rather than aspects of energy use

within countries.⁹

Scope and Emphases

The topic of CHP/DH would doubtless provide a useful case study for other research objectives. More instrumental work, for example, might provide prescriptive models of optimal generation systems, or techniques or critiques of economic appraisals, or analysis of the problems of planning, financing or managing large scale projects. CHP/DH presents an ideal subject for an international comparison of the social arrangements producing different degrees of development. No such comprehensive analysis has yet been done. Closer to the focus here, the topic could be used as a case study in more detail of one of the major organisational actors - of the internal processes, say, of local authority policy-making.

This thesis concentrates on those aspects judged to be important in an explanation of technological choice as an outcome of political processes. Comprehensive coverage of the treatment of the technique at the level of the energy sector has meant a cursory treatment of some aspects which merit more thorough investigation, particularly the processes of generating policies internal to organisations. It also entails relying on general views of related developments which themselves merit separate and much larger studies than have been done. The organisational development, technological trajectory and policy commitments of the electricity supply industry, for example, require a much more systematic explanation than has been attempted; here it is only possible to indicate lines on which it could be undertaken.

The first two sections of the study, up to 1940 and the 40s and 50s, are reconstructed from published material, mainly journal articles and official reports, and from the records of participating organisations. The third and fourth periods, the 60s and 70s and from 1975 to date, rely on publications, a limited number of unpublished records, and interviews with participants and observers. The different sources used are reflected in the nature of the account that can be constructed. In particular, the closure of government and other public agency records from the mid-50s means that much of the detail of internal negotiation is lost.¹⁰ On the other hand the possibility of interviewing participants in more recent activities is

a rich source of material, both as information and as qualitative data on objectives, motivations and reasoning.

Epistemology

There are a number of points concerning epistemology and method which it is worth making at the outset, though their justification, individually and as a consistent and coherent set of principles, is part of the critique of conventional approaches and development of a framework undertaken in the early chapters. They entail, and at the same time arise from, the need for reflexivity in social analysis: that analysts should be aware of their own role in the processes they are studying and able to account for it, and that a major inadequacy of conventional approaches is their inability to do so.¹¹ This failing reflects the origins and the context of their development, and leaves them open to incorporation as ideology. Thus an adequate critical theory should be able to demonstrate both the explanatory inadequacy and the ideological role of dominant approaches - in particular, any claim of absolute objectivity and a value-free standpoint.

The starting point here is both a concern to understand technology as a social product, and a political commitment to opening up the processes of technological development to sections of society denied access to them. The two motivations are inextricably linked. To show past or existing determinants of technology is to demonstrate the possibility of alternative technologies for alternative goals, to explore the conditions for these, and thereby to show how interventions may be made in those processes. It constitutes a critique of deterministic views of technology, as ideology legitimating present structures of control.¹² Conversely a convincing argument can be made that a partisan view, if not actual involvement in practical attempts to challenge and change structures of control, is necessary for adequate analysis.¹³

If the general argument is accepted that social knowledge is itself a social construct, and that competing social theories are aligned to conflicting social interests, then the choice of one framework and the falsification of others cannot be decided entirely on the basis of some impartial assessment of merits. Each paradigm will provide its own internally coherent criteria for evaluation, and communication between

paradigms will be limited. The objective must be to develop the internal consistency, explanatory power and implications of a framework.¹⁴

The difficulty of communication between paradigms, however, does not mean that there is no point in dialogue or critique. Nor does it preclude the use in one of material or insights from others. An adequate analysis must be able to explain the plausibility of their findings, and the extent or conditions of their validity, and be able to reinterpret and incorporate them in its own framework.

Nor can it be taken to support a position of total relativism between paradigms, a view that there can be no rational choice between them. A critical framework must be able to demonstrate how another body of theory is itself a product of its social context mediated by the practices of its theorists, and legitimates the retention of a social order favouring certain interests. The argument of social construction must also apply reflexively: insofar as the analysis treats technology as a product of structures of domination and a means of their maintenance, it is aligned to the interests of dominated groups in society.

The method, then, is retroductive, as outlined by Reed:

...hypothetical conjectures concerning the underlying mechanisms and conditions which are assumed to generate their corresponding phenomenal form are formulated. Such conjectures are then subjected to a process of empirical demonstration through the detailed examination of individual cases and subsequently recombined within the logical structure of the general theoretical framework from which they were originally derived.¹⁵

In this case, as argued in 1.2, the exercise is made difficult by the limited development of radical analyses of technology, and the controversial nature of theories of the state. Thus substantial work needs to be done on general substantive accounts as a prerequisite of more detailed studies.

The approach developed in chapter 3 eschews the notion of a general theory and instead attempts to provide theoretical tools for analysing specific social arrangements and outcomes.¹⁶ It warns against a number of objectives, tendencies and failings of conventional theories and accounts. In principle it should be able to overcome them - though many radical analyses can be criticised as showing one or other tendency - and its

application in any case should be judged accordingly. They include:

- generalisation from superficial, historically specific phenomena to other conditions;
- reductionism - that is, explaining an outcome in terms of a single principle, without allowing for the articulation of different social levels and the intervention of other influences;
- mechanistic one-way causation;
- abstraction, structurally or historically, leaving social phenomena isolated from the mechanisms and conditions which produced them, and therefore unexplained and deemed natural or universal;
- both determinism and voluntarism, the one denying the possibility of altering a course determined by some principle beyond social analysis, and the other leaving human action unconstrained and motivation unexplained.
- functionalism, with its failure to demonstrate mechanisms whereby actions produce the integrated system postulated, and its teleological implications.

One important and often confused epistemological aspect of studies of social processes is normative orientation and the relation between description and prescription. The argument above for the necessary connection of analytical approach and political function or motivation, implies a particular form of normative orientation. The approach here is concerned with analysis and explanation. It is not based on advocacy of CHP as a technical option. It does not advocate particular forms of organisation or decision technique per se. It takes, for example, no prescriptive position on centralisation versus decentralisation as such.¹⁷ It is concerned to understand why certain actions were taken and others not.

It does not, however, amount to a substantive relativist position which claims to be devoid of normative content. Rather, the normative

orientation is inherent in the analytical approach in its dual function of explanation of existing arrangements and demonstration of the possibility of progressive change. Its evaluation of particular concrete options or outcomes, then, follows from an alignment to the interests served by these.

The approach also implies a particular status for technical arguments in an explanation of outcomes. On the one hand a scientific notion of 'facts', and its corollary that establishing these facts does and should determine the action taken, must be rejected. But neither is a substantive relativism acceptable, which sees any view of social reality as equally valid. A case against the adoption for the study of technologies of relativism as anything other than a heuristic device has been made at length elsewhere.¹⁸ A position of neutrality towards technical knowledge and arguments leads into a relativism with respect to social interests, that is, political neutrality. Rather it must be demonstrated how particular arguments are constructed and used; they should be interpreted as products of their institutional context as mediated by situated social practices. This argument is developed further in section 3.5.

Layout

In the remainder of chapter 1 some brief observations are made on the social analysis of technology. Some general requirements and principles of an approach are indicated. Though it should not differ in essence from that adopted for other social phenomena, some specific features are noted which it must be able to accommodate.

Given the focus of this study on political processes of choice over the introduction of a technology, in chapter 2 certain bodies of conventional social theory are considered which would be expected to be of use: theories of organisations and of interorganisational networks, policy studies, and political science accounts of policy-making. The review identifies common inadequacies in the dominant approaches in these fields, and a convergent critique suggesting how they may be reformulated.

Chapter 3 is an attempt to devise guidelines for constructing an account of a specific set of actions, consistent with the requirements and

principles outlined in 1.2 and the critique of chapter 2. The discussion draws on a limited number of radical theoretical works and centres on means of relating detailed action to wider social structures and processes. It treats both the determination of action and interaction over an issue, and the relation between these processes and the form and content of that issue. It includes consideration of the key concepts of power and interests, and of ways of delimiting the scope of inquiry.

Having established procedures and concepts for analysis, and the importance of situating specific actions in their context, the discussion moves in chapter 4 to a general substantive account of the energy sector in Britain. The development and characteristics of major actors in the study - central government, the nationalised industries and the electricity supply industry in particular, and local authorities - are described; these are related to an account of the state.

The account of activity on CHP and DH in Britain is contained in chapters 5 to 8, divided into four periods: up to 1940; the 50s and 60s; the 70s; and current events.

Though the account of chapters 5 to 8 is structured and directed by the guidelines derived in 3, it is left largely unanalysed, so as to form a reasonably self-contained narrative history. In chapter 9, then, observations on the study are organised around three themes: CHP and its treatment by the electricity supply industry; DH and local authorities; and the role of central government. In chapter 10, the account is reconsidered in terms of levels of analysis: broad context; interactions between organisations; issues and arguments; and the relation between those levels.

1.2 SOCIAL ANALYSIS OF TECHNOLOGY

Introduction

This thesis is intended as a contribution to the broad endeavour of explaining technology as a social product - as both a crucial part of social activities and relations, and in its form and content as an outcome of them. It takes as an assumption that the activities involved in developing technologies; the processes of their selection and adoption; their utilisation, roles and impacts; should all be amenable to analysis with the same approach used for other social phenomena. It therefore rejects a prevalent view that technology is somehow outside the realm of social analysis - technological determinism as a largely implicit view or as explicit theory. An analysis of technology should therefore be subject to the same requirements and criticisms as other social theory.

Conversely, a body of social theory which claims to be comprehensive must be held inadequate to the extent that it avoids engaging with technology other than as externally determined, or cannot treat the specific characteristics of technological activities and issues. These concern the character and role of the institutions dealing with technology, the ways in which technologies confront and affect different social groups, and the forms of knowledge both in and about technology. It is the ontological and epistemological relations of technology as mediator between human activity and the natural world - its use of physical properties, its ability to transform physical reality, and its reliance on knowledge of that reality - which crucially have placed knowledge about technology outside most traditions of social inquiry. The reluctance of social analysts to engage with technology is derived from, and at the same time sustains, positivistic assumptions about knowledge in technology, and a deterministic view of its connection to the rest of society.¹⁹

A social analysis of technology should overcome this traditional division. Much of the theoretical discussion of this thesis consists of an attempt to explore bodies of social theory - and because of the topic, especially political theory - to assess their adequacy in terms both of requirements which can be placed on inquiry into any area, and of an

ability to treat the specific considerations applying to technology. This is itself a reaction to the character of much technology studies work; detailed and useful case studies have been produced but in the absence of readily applicable theoretical frameworks have frequently remained empiricist in method and implicitly pluralist in their underlying model of society.

This remainder of this chapter, however, starts from consideration of technology and the way its social aspects have been treated. It is not the intention here to undertake a review of the various theoretical or empirical works in the field of technology studies, nor to develop a comprehensive framework. It is indeed argued that while principles for an approach can be put forward, the idea of a unified theory of technology is itself questionable. Rather, the discussion first considers some basic principles for an approach and argues that the essential requirement is for a coherent and developed model of the society in which technologies are embedded. It outlines the contexts of technology as depicted in a broadly Marxist framework. Second it suggests some specific considerations applying to processes of selection of technology, taking as a starting point a critique developed elsewhere of technological determinism.²⁰ To some extent the points here logically follow those of chapters 2 and 3, particularly in that those chapters develop an account of political processes and key concepts which are assumed in some of the substantive observations in 1.3, and assertions made here are justified and further explained later.

Principles of Approach

While a general project can be identified based on the objective of explaining how technology is socially shaped,²¹ and it can be contrasted with deterministic treatments, the notion of a comprehensive theory of technology, or of a framework which can readily accommodate any particular technology, must be rejected.²² The most that can be claimed in general terms is a set of principles of approach and a set of analytical concepts and procedures which are consistent with them. Within this project, contributions may address different levels of abstraction - for example, general trends in technological activity in relation to movements in the economy,²³ or detailed internal structures and practices of technical

communities.²⁴ They may deal with different social domains - say, military or domestic technologies.²⁵ They may treat limited aspects of technological development in terms of stages of innovation, or the scale of device or system. Each may be subject to specific criticisms on assumptions, methods or substantive findings. Whether or not they can be included as part of the general project - or require modification of their approaches and reinterpretation of their findings - depends on their compatibility and adherence to these principles.

No attempt is made here to classify or review the various approaches and techniques which have been applied to the broad subject of technological development.²⁶ Most are inappropriate for this study, which focusses on limited areas on its various dimensions: stages of innovation, scale of device or system, level of social structure, domain of activity, etc. Activity on CHP/DH has concerned the adoption of a technology already accepted as technically feasible, or rather the construction of systems from component technologies already available.²⁷ The small number of examples then rules out the approach of many adoption studies, where large populations of adopters allow the diffusion of an innovation to be mapped and correlated with their characteristics or events over time.²⁸

The major requirement to which all contributions to the project should be subject - asserted here but argued later as essential to all social analysis, and forming a central theme throughout - is that phenomena at a detailed level can only be fully accounted for when related to broader social structures and processes, recognising that the complexity of influences rules out any simple model. To sever these connections, to abstract specific technological outcomes from their context, produces accounts which are inadequate for understanding, either being tautologous or resting on some unexplained principle, and therefore obscure the possibility of achieving different outcomes through broader change.

The approach used for explaining any individual technology will depend on the sphere in which it is, or could be, developed or introduced. That is not to advocate unstructured eclecticism. It is to recognise the fundamental differences in social influences shaping technologies in different domains; to avoid unwarranted generalisation from failure to see

the specificity of any one context; and at the same time to appreciate that a unified approach to understanding technology cannot come through its abstraction to obtain some supposedly essential properties, but only through a coherent model of the society in which different technologies are embedded - that is, by understanding the social structures underlying their various contexts. Thus it will be argued that many of the problems encountered in understanding technology will come from a disparity in the depth to which different domains and levels of social life have been theorised.

But the ensemble of techniques in the project should be capable of more than just explaining particular detailed outcomes in the form of individual devices and their features. It should also be able to account for broad patterns, characteristics and changes in a society's technology. Thus it should allow an understanding in capitalist societies the continuous nature of technological change; differences in rate and character of change between different spheres of activity; the periodic surges in significant innovations related to economic cycles; and the relative importance of different forms of, say, collective versus individual transport, or preventive versus remedial medicine.²⁹

Contexts of Technologies

It is a major contention of this thesis that a broadly Marxist analytical approach and substantive social model provide a basis for analysing technology which can meet these requirements.³⁰ It aims to contribute to developing some limited parts of both aspects. A case for the advantages of such an approach over conventional social theory is made in chapter 3 and it provides the basis of the critique in chapter 2. It should be able to provide a structured, historical and dynamic account of a social formation; explain the specificity of social phenomena; and allow engagement with both the general forms and changes in technological ensembles and the detailed content of specific artefacts and techniques. It has been successful in its as yet limited application in this field. That is not to deny that Marxist theory is unevenly developed; that there are substantial areas dominated by conventional approaches where a Marxist alternative is poorly developed; that there are major controversies within Marxism; and that a strong technicist strand within Marxist thought is

itself subject to the criticisms directed at other determinist views.³¹ Here, though it prejudices some of the arguments made later, it is useful for completeness to sketch out the contexts of technologies which a Marxist social model provides and the extent of treatment of technology so far based on it.

Marxist labour process theory has been used fruitfully, in the decade since Braverman's pioneering work, in analysing changes in technology at the point of production, largely in capitalist manufacturing industry. Studies have concentrated on capital's strategy of intensifying work through increased control over labour, with consequent deskilling of craft workers. New technologies in the workplace are thus shown to embody the objectives of capital, and to the extent that change is resisted or negotiated, conflict and compromise with labour. The analysis is now being extended to different relations - gender as well as class - and to other activities besides manufacture - office work, domestic labour, services, and, significantly, design and other intellectual work.

Changes at the labour process level in industry can thus be related to underlying changes in the capitalist economy. But while the labour process approach has been productive, in terms of understanding technology its focus has been narrow, even in the sphere of production. Cutting labour costs is only one of the uses to which technology can be put. It may also be used to reduce the cost of production plant; to economise on raw materials, component stocks or energy; in devising radically new techniques to supersede traditional production routes; in creating new products, improving existing ones incrementally or making superficially different products, to compete; and in reducing the time taken to get revenue through improvements in communications and transport.³²

Moving beyond production, different roles of technology are encountered in individual and collective consumption - in homes, in communities, in public services, and in changes in them. Here there is a need to analyse the influence which user groups - more often as individuals, families or other small social entities without the political unity implied by 'group' - have over the form, range and nature of goods and services offered, and conversely the means by which their providers can manipulate consumption and change its forms. The critical analyst of

technology must therefore fathom debates on concepts of 'market', 'choice', 'need', and so on, and requires a critique of them.

In moving away from participants and contexts which fit into the fundamental categories of a Marxist framework - classes and class fractions, in economic relations in the spheres of production and exchange - so the analysis gets more complex, with a wider range of groups and different relations between them.³³ In political processes in particular - technological change in a context of state funding and direction of research and development, the dominance of military objectives, state ownership of infrastructure and other production facilities, state purchasing and investment, state regulation of many activities, state mediation between management and labour, political and legal battles between project developers and objectors, and so on - the analysis of technology needs a better framework to avoid the empiricism and implicit pluralism which has characterised many case studies. The discussion of chapters 2 and 3 is directed to this end; the last section of this chapter suggests specific characteristics of technological activities and issues with which a political analysis must be able to deal.

1.3 TECHNOLOGY: PECULIARITIES IN SOCIAL ANALYSIS

Critique of Technological Determinism

As a starting point for considering the specific nature of social activities involving technology, the discussion here draws on a critique developed elsewhere of technological determinism.³⁴ It appears sometimes as explicit theory, but underlies many more case studies of technologies, treatments of technology in social science fields, general histories, popular accounts of society and general reflections on technology.³⁵

Deterministic elements in conceptions of technology vary, may appear separately, and may coexist with contradictory views.³⁶ For the purposes of this discussion, however, a typical and reasonably coherent view can be outlined. There are two main components. Technology is isolated from the social whole and related back to it in a mechanistic causality. First, then, technology is seen as autonomous, self-generating and directed by an internal logic, often assumed to be derived from scientific discovery. Second, technology is considered the main determinant of social patterns and change. A number of subsidiary notions follow, such as technological imperatives, social lag, a single path of economic development, and convergence of social formations.³⁷

From a critical point of view, technological determinism is a powerful ideology. It obscures the social relations behind technology, mystifying their origins and purposes, legitimating their introduction and protecting existing structures of control and direction. It depicts historical outcomes as inevitable and denies the possibility of change other than along a determined path.³⁸

Most criticisms of technological determinism have, however, been too dismissive, and have failed to consider insights which need to be taken seriously.³⁹ A critical analysis of technology, at the same time as exposing deterministic myths, should seek to explain them as attempts to understand complex and contradictory reality and to account for the plausibility of such notions in specific conditions. Several different notions of autonomy are attributed to technological development, and each can be

followed through to identify how it corresponds to the appearance of technology in specific circumstances or to possible real constraints on choice.

Forms of Autonomy

The first form is pursued no further here: the existence of a higher-order determination, so that technology is determined as part of an externally imposed or internally generated inevitable pattern.⁴⁰ Second, an anarchic multitude of individual decisions may produce an undesired total effect. The depiction may be valid in certain circumstances; its explanation and resolution depend on wider views on social organisation and possibilities of change.⁴¹ Third, 'unforeseen consequences' of technological activity become uncontrollable. This idea should be dissected by asking who controls the technology; who suffers the consequences; by whom they were unforeseen or undesired; and whether they were unforeseeable or simply ignored. The extent of truly unforeseeable impacts will be less than assumed. The consequences, however, of a lack of understanding of increasingly complex and interlinked technological systems should not be underestimated and the validity of impressionistic ideas of technological 'drift' remains an open question.⁴²

Fourth are initial limits on choice.⁴³ At any time there exists a limited capability in terms of skills, materials, tools, and scientific and other forms of understanding. Several observations are pertinent here. First, the state of technology at a particular instant is the product of previous social processes. Second, nothing precludes the pursuit of other objectives from the starting point of a particular set of forces of production - halting lines of development, or sidestepping to other objectives. Third, it is not necessary to plan production with the existing capabilities or with merely infinitesimal advances on them. Objectives can be specified which require significant improvement in one or more areas of technology, even though this takes time and runs the risk of failure through insuperable natural limitations or insupportable expense. Here the specific forms of the relation between science and technology are important: the ways in which and extent to which technology draws on or directs science. New generic technologies such as microelectronics and biotechnology have required substantial inputs of fundamental research.

Alternatives were thus precluded by the course of those research programmes; the options which emerged for application, that is, were circumscribed by a series of decisions going back to its outset.

Fifth, the relation of technologies to physical reality provides other limits to technological options. First, natural laws obviously restrict what can be done. These limits are, however, by no means static. What may have been considered as an immutable natural law, to be avoided, deferred to, or at best channelled to suit, may come to be understood as a combination of a more basic law and a set of initial conditions. These initial conditions may be amenable to manipulation by technology. Second, though the concept of efficacy is problematic and must itself be examined as a social construct, most technologies actually have to perform - that is, efficacy is seldom judged without reference to empirical observations, however they may be mediated.⁴⁴

Sixth is the role of technical rationality, which is discussed further in 3.5. It is seen as characterising the approach of both technical groups and a society in which they have too prominent a role. It is depicted at its most extreme in Ellul's technique.⁴⁵ There are two associated features in what is often seen as a technicist mentality: the technical 'fix' - a technical prescription which treats the immediate manifestations of a problem but fails to tackle, or exacerbates, the social causes; and the technological imperative - a compulsive fascination with technical achievement for its own sake which dictates the utilisation of capabilities regardless of their worth.⁴⁶ The extent of adherence to such a rationality and of its effect in shaping the technological ensemble can only be impressionistically assessed, but to treat this rationality as a psychologistic explanation, or to overstate its significance, could itself be ideological.⁴⁷

Next are contextual constraints on choice exerted by existing technological systems and their associated organisational structures, considered to limit options or even predetermine outcomes. How they might be categorised and explained, and how they should be incorporated in an analytical framework, are considered shortly. The key concern is the extent to which they actually occur in specific cases and to which they constitute real constraints on choice - that is, whether they are real, imagined or contrived. Again, however, the significance of the totality of

such constraints for technology as a whole remains to be debated.⁴⁸

Finally comes the product of social divisions: the real absence of control over much technology by all but limited sections of society.⁴⁹ This is indeed an underlying theme throughout this thesis. Deterministic views serve to obscure, legitimate and hence protect actual structures of control. Most significant developments are independent of any semblance of democratic or participative control. Perceptions of a lack of influence over their direction, and of only a partial relation between technology and social needs, are thus quite valid for groups alienated from development and decision processes, which simply consume its outputs and suffer its effects. Demystifying technological determinism entails identifying the different ways in which technology confronts different social groups, the different consequences for them, and the degree of control available to them. The ideology is sustained by the assumption of a uniform society of undivided interests.⁵⁰

These last three postulated sources of lack of control over technology - rationalities, contextual constraints, and social divisions - indicate three substantial areas which need separate treatment, respectively:

- the forms of social evaluation of technology;
- restrictions on technological decisions;
- and the character, location and practices of technical communities.

Evaluation of Technologies

An argument will be developed in 3.5 that knowledge formation, including the construction of arguments in debate, needs to be seen as a social activity, involving both discursive and practical forms of consciousness. Of particular importance in technological issues are the conceptual frameworks and procedures for evaluating the merits or effects of a technological option. It should be possible to identify several elements:

- a general view of technology, possibly containing deterministic elements such as a denial of alternatives or an assumption that debate can only deal with externalities;
- a broad view of the problem or purpose which the specific technology addresses, incorporating further assumptions about the economy, social objectives, future conditions, etc.;
- formal procedures such as investment appraisals, projection, cost-benefit analyses and risk assessment.

The formal procedures - formulated within the broad view though not necessarily entirely consistent with it - will thus contain varying mixtures of logical calculi in accordance with specific interests and objectives, and ideological elements imposing a particular narrow view. Critiques of such methods have demonstrated how constraints are imposed on choice through narrow problem definitions, restricted terms of reference, quantification and exclusion of unquantifiables, objective functions, selective criteria, biased interpretation of data, tendentious presentation, etc.⁵¹

Technocratic ideology upholds such techniques as the rational way to assess options, and protects them from criticism with an appearance of objectivity and neutrality. Critics have not only to try to dissect and criticise the internal judgements, data selection, calculations and so on, but also to demonstrate the specificity of the framework of assessment.⁵² They are disadvantaged by the correspondence of the assumptions made in such frameworks to prevalent views, and by the appearance that they are rejecting a supposedly rational and scientific approach in favour of their own idiosyncratic and subjective value judgements. To adopt this critique does not, of course, entail irrational rejection of all systematic and perhaps quantified approaches to evaluation.⁵³

As will be argued generally for arguments in debate, the role of such techniques needs to be examined specifically; their form and content, that is, need to be related to their context - their purpose, the relation of the experts producing such assessments to political arenas and controlling interests, and so on. Where such technocratic assessments are presented in

political arenas, they may well serve to remove political power from a nominal decision-making body, by predetermining outcomes or allowing only token choices whose exact outcome presents no challenge, while projecting a legitimacy image of objectivity and neutrality.⁵⁴ In 10.4 this critique is applied to the economic assessments by which the feasibility of CHP has been judged.

Restricted Decisions

The constraints suggested as creating recalcitrance in technological projects or directions of development are essentially the hypothetical consequences of different courses of action in relation to existing technological systems and institutional structures.⁵⁵ Each option will to a differing extent require the destruction, replacement, enhancement or modification of already entrenched structures necessary for production, maintenance and operation in the system of which it is to be a part. These will incur differing technical problems; related to this, expense; organisational changes; and ideological effects, such as disturbance to symbolic functions fulfilled by existing systems and commitment to them. Two special cases can be identified. The first is abandoning a project or programme during implementation or before the investment has been written off: the specific economic costs are loss of investment; the other effects are disruption to the system insofar as it has been developed. The second is not adopting a technology, when the consequences of doing so may be detrimental; probably the most important specific type is non-adoption in a competitive context, when competitors will gain a significant advantage.⁵⁶

Large technological projects or systems require, and become entrenched in, complex networks of technical and organisational support structures as they are developed. Collingridge has suggested several ways in which this entrenchment operates to restrict subsequent decisions.⁵⁷ Kaldor has indicated the momentum which carries major military projects through nominal decision points.⁵⁸ Thus as Wynne has argued, these features render the conventional policy-implementation distinction inapplicable and create special problems in the politics of controlling projects:

For big technology ... this (policy-implementation) separation

breaks down; the notion of 'policy' is problematic. It is wrong to think of technology as a response to independent social demand. Although some form of social demand can be identified, modern technology entails huge commitments of finance and social infrastructure. Once established, these influence social needs as well as reflect them. Further, early decisions constrain later ones, limiting public participation in policy.

Paradoxically, it is in fields where such commitments are greatest that great uncertainty takes matters beyond the control of even decision-making elites. To protect their authority and what control they enjoy, these elites seek to retain as many options as they can; clear policy statements therefore become encumbrances. At the same time, uncertainty is covered by images of factual certainty ... In these circumstances, typical of the energy and transport fields, policy exists only as prior commitments, informal presumptions, and ad hoc reactions. Policy in practice is created by each big technology development.⁵⁹

Thus 'programme-setting' becomes a more appropriate term than 'policy-making', and, it is suggested, corporatist modes of interaction between government and organisations responsible for major programmes are favoured.

In considering how to deal with these constraints in an explanation, a number of observations need to be made. First, a priori the mechanisms are plausible. In each case, however, if a course of action is to be attributed to the operation of these restrictions, it must be demonstrated empirically that these limits on choice did operate, in particular that they were perceived as operating and accepted as such in the practices and decisions of participants. A greater constraint may be ignorance of, or unwillingness to explore, alternatives and their comparative merits and costs. Second, precisely because the mechanisms are plausible, such constraints may be used by participants to legitimate action or inaction; their extent or significance may be exaggerated, or the possibility of removing them by changing external factors denied or obscured. Third, the constraints are created by previous practices or decisions in development or implementation, and this process is amenable to control, as indeed Collingridge intends in his technical prescriptions for avoiding inflexibilities.⁶⁰ The process is only uncontrollable to the extent that constraints are unforeseeable; here again the notion of unforeseen or unintended consequences must be dissected. Fourth, similarly but looking more widely, the difficulty and expense of alternative courses of action are determined by the social context beyond the technological system,

which is itself amenable to change or control. Fifth, if alternatives are considered only in terms of their cost of adoption, a narrow economic rationality is dictating how the choice is made. It is in principle possible to make a political decision that alternative objectives are worth paying for. The expense or disruption of each option is also being compared implicitly with the perceived benefits of its adoption. This comparison too is open to challenge.

Technical Communities and Paradigms

A major theme of this thesis is the effect of institutional structures on technological development and adoption. Of particular importance is the character of technical or professional communities and their relation to controlling economic or political groups. Groups responsible for design and development frequently have a monopoly on technical expertise and limited accountability. The prevalent deterministic ideology of autonomous technology thus both reflects and reinforces this removal from public scrutiny of certain stages in the process of development. Needs and demands, not to mention notions of the acceptability of consequences, are thus mediated, interpreted and often anticipated by a limited social group imposing its own view from the start.

Because of the organisational autonomy often given to such communities, many technical activities do appear to have only very limited direct social control. The channels of social influence on their outputs only become clear when their organisational form is located in its context, and the degree of independence is seen not as given but as a social product in itself, which may advantage dominant interests - and yet at the same time offer opportunities for intervention. At the boundary then, analysis must include the origins of the organisation, its mandates, the training and ideology of personnel, the way projects are negotiated with sponsors and defined, and the way outputs are taken up.⁶¹

In relation to the form of knowledge and practices which guide technological development activity, Dosi has proposed the concept of technological paradigms.⁶² Specific selection and definition of problems, criteria for progress, stocks of material technologies and techniques, and repertoires of scientific principles and properties exploited, guide

development along a particular trajectory. This pursuit of a single path and neglect of others is assumed to be, and plausibly rationalised as, a matter for technical judgement. Its social specificity is demonstrated only, if ever, by a dramatic change of external circumstances which lays bare the assumptions behind it. Like the contextual constraints on adoption considered in the last section, the notion has serious implications for theories of the political or market direction of technology and of prescriptions for such. Similarly the idea of the 'style' of a technological community, suggested by Johnston and Bijker, indicates how practices are transmitted and maintained without conscious decisions or other discursive acknowledgement.⁶³ So far, however, studies of trajectories have mostly stopped at systematic description, and style has been left as an independent explanatory principle, rather than being related to wider social objectives and influences. Economic assumptions are often deeply embedded in ostensibly technical practices, as they are in rationalities of technology assessment. Noble, for example, has demonstrated the intimately interwoven technical and corporate objectives embodied in the practices of professional engineers in the US.⁶⁴

With this concentration of technical expertise and isolation of design and development activities, an issue as it enters public debate and political arenas is likely to have been defined already as a choice between technical entities, or the desirability of one such system, rather than as a problem in need of solution. Indeed the need addressed may be unacknowledged, unclear or open to conflicting interpretations. The issue may become a comparison of means according to one unexpressed and unchallenged criterion. Where real political control over technology is limited - that is, the development is in private hands - the political issue may concern only a consequence of its introduction for another social group or the population or environment at large - an 'externality'.

When need is considered, a technical option already formulated may be seen to fulfil to some extent the demands of several groups, producing odd coalitions of interest. In terms of historical analysis, it may prove difficult to define what was the source of the process which culminated in a particular decision or implementation.

CHAPTER 2 CONVENTIONAL APPROACHES: REVIEW AND CRITIQUE

2.1 INTRODUCTION

Conventional Disciplines

An analysis of the social shaping of a particular technology should aim to situate it in the activities of each social group or organisation on which it impinges and in the structure of relations between them. The technology is both a part of those activities and relations, and a result of them. It therefore requires an understanding of the structure and activities of organisations, their relations to each other and to the wider social structure, and the process of change within and between them. A number of conventional areas of social science would claim to be useful: theories of organisations, and of interorganisational networks; various approaches drawn under the umbrella of policy studies; and political science approaches to policy-making and agenda-formation, sometimes claimed for the previous category but treated separately here.

Starting from a focus on a concrete social arrangement or content - an issue, a technology or a sector, say - which straddles these categories, that there should be interconnections, overlaps and unclear boundaries between the objects of the associated theoretical fields is readily apparent. But the fields have developed to a great extent separately with a notable lack of cooperation. Though there was some distinction of content, in emphases on structure and on process, their separation has been sustained mainly by the defensive divisions between their parent disciplines and the different practical concerns of their respective constituencies - management on the one hand, political science on the other, with sociology and public administration somewhere between. From within each there have been some attempts to find common ground and mutually helpful insights. And from outside, an emergent critique based largely on Marxist principles and identifying similar analytical inadequacies and ideological functions, has been concerned to transcend the separation. The contributions to this critique, though focussing on the individual disciplines or sub-disciplines, have converged, producing similar criticisms and

guidelines for reconstructing the fields.

The intention here is not to review comprehensively the literature under each general heading, but rather

- to outline the general concerns of the theories, and decide to what extent they are appropriate;
- to consider their analytical inadequacies and limited perspectives, and to indicate how they might be understood as a product of specific relations between theoretical and practical activity;
- and to see what insights may be retained and reinterpreted in a more comprehensive framework, as valid descriptions in specific circumstances which remain to be explained.

This third objective is to be distinguished from an eclecticism which merely draws expediently and uncritically on different approaches and insights as they appear necessary and helpful.

Generic Criticisms

Essentially the dominant theoretical approaches are derived from and closely related to the specific practices they study: that is, not only the intentionally prescriptive but also the ostensibly descriptive work elevates normative notions and managerial and administrative concerns to the status of analytical concepts. They are unable to be critical, essentially reaffirming the existing order. Only variations or deviations from the norm are acknowledged; these are pathologies to be diagnosed and cured. The problematic thus suggests that society faces no fundamental structural contradictions but that its problems are amenable to technical solutions. It is thus readily incorporated into technocratic ideology.¹

The accounts are plausible and appealing. They accept uncritically the conceptions of the participants. They articulate the self-image of the dominant groups. They justify and rationalise actions at the same time as acting as a normative model for them. And they correspond to common

sense notions of social action. This does not support their validity; rather, as Benson puts it in a discussion of organisation theory,

That the model corresponds to our experience and seems reasonable is an indicator of our indoctrination with the administrative perspective and of the success of administrators in constructing a world in this image.²

At the same time the theories are unable to be reflexive, to look beyond the rationally conceived model and see its relation to practice, in this case its role as ideology in sustaining the existing order.

The approaches are nomothetic: they attempt to abstract categories and hypotheses which are universally applicable, to all organisations, say, or to all political processes, which hold in all contexts. The theories are often formal, without reference to specific context or content. Much of the work is concerned to develop typologies which reify superficial features and reinforce simplistic comparisons. They entail abstraction in another sense too, in that structures are severed at some point from the wider social structure. The units of analysis, with unproblematic, unexplained and unchanging boundaries, are then related back to an environment in a simplistic, often mechanistic and unidirectional way. A failure adequately to theorise a context leaves the theories open to appropriation and instrumental application by interests which are beyond their analysis.³

The accounts are therefore generally static and ahistorical, unable to cope with change, whether drastic or continuous development, or to recognise the specificity of the contexts and forms which they take as universal. The character of a structure or process is accepted as fixed. The origins or production of the current order are not questioned. Its maintenance is assumed to be automatic. Fundamental change is not contemplated. Rather theorists tend to predict and often advocate the extension of the rationality supposedly underlying that order to ever more social activities.

Within mainstream theory there are of course different approaches. Each to some extent challenges the others, criticising them as concentrating unduly on what is actually one element of a dialectic: process versus content, say, or process versus structure. Shortcomings are often recognised within the mainstream. Authors see the need to broaden

their focus and incorporate more explanatory variables but are unable to structure the different factors.⁴ Most remain within the limiting problematic derived from normative concerns and are unable to transcend these dichotomies.

Critique should not, however, lead to categorical rejection of all such approaches. There exist useful insights or categories to be retrieved, reinterpreted and incorporated in a better framework. Some may provide accurate and predictive accounts of limited aspects of reality in specific circumstances. Moreover, some approaches push toward the limits of the problematic and can be considered to break free of it in certain respects, to indicate the beginnings of a potentially radical departure from the mainstream - even though they tend to be reincorporated instrumentally, ending up as 'a technocratic effort to reduce irrational bases of resistance to authority.'⁵

2.2 ORGANISATION THEORY

Intraorganisation Theories

Organisation theory developed mainly in management and administrative studies and to some extent in sociology, but largely outside political science. It avoided being drawn under the umbrella of policy studies, and both have pursued separate courses, despite obvious overlaps even as conventionally defined. Thus only recently has common ground and a potential for cross-fertilisation between mainstream approaches in organisation theory and policy studies been acknowledged and attempts made to bring the two together.⁶

There is little need here to engage with much of the subject area; in terms of understanding processes internal to organisations, the study in this thesis has limited requirements. It focusses on the conscious formation of policies and objectives; on the intellectual practices involved in the selection of technological routes; and on internal organisational divisions as they affect these. It is not concerned with the organisation of primary labour processes.

Fortunately Clegg and Dunkerley, for example, review comprehensively and critically from a similar viewpoint the succession of rationalist and functionalist theories in the area. The former derived from the concerns of scientific management in capitalist enterprises and from formal theories of administration. The latter drew on functionalist sociology and systems theory.⁷

The dominant focus has been on internal structure and functioning as directed towards an assumed goal. The organisation is treated as a coherent integrated entity, rationally articulated or functionally adjusted, abstracted from its context, and static and stable. Much activity has consisted of demonstrating empirical correlations between structural features and tasks and inferring a rational or functional relation between them. The theories produced have been intended to cover all organisations, regardless of basis, function or context.

Each separate theme pursued has produced elaborations in recognition of shortcomings in the basic model. Unofficial goals were distinguished from official ones, and informal structures were identified operating alongside formal ones. Connections to an environment were reinstituted, though often deterministically with the organisation purely reacting to exogenous change. Organisations in systems guise were seen to be composed of subsystems, albeit usually undifferentiated. Continuing disagreement on the theoretical object - what an organisation actually is⁸ - produced questioning of the boundaries of the organisation and its environment.

There have thus emerged potentially critical strands, which though limited can form elements of a better framework:⁹

- exploration of power structures in organisations and of the bases of this power inside and outside;¹⁰
- phenomenological concern with action, process and subjective meaning;¹¹
- depictions of organisation structures as negotiated order, and of goals as constructs;¹²
- and differentiation between types of organisation based on their location in a political economy rather than on formal homologies.¹³

Interorganisation Theories

Interorganisation theories developed mainly out of organisation theory, from the recognised need to theorise relations with outside bodies rather than just to depict a matrix-like uniform environment.¹⁴ In particular Child's work on strategic choice, developed in opposition to various deterministic views of the relation of an organisation to its environment, showed the possibility of organisations to some extent choosing or manipulating their environment.¹⁵ Like its parent, interorganisation theory has continued to develop separately from treatments of interaction between social groups in political science and elsewhere.

The impetus for such analysis and the dominant problematic shaping it have come, even more explicitly than the other areas looked at here, from practical objectives and associated problems: in this case the division, coordination and control of services, and their recalcitrance, duplication, etc. 'In short,' as Benson puts it, 'interorganizational analysis seems tied to a program of building a more smoothly operating division of labor among agencies.'¹⁶ Though the objectives of each organisation may be acknowledged as differing, the overall objective is again consensual.¹⁷

The main direction once more has been a set of 'context-free generalizations'¹⁸ about the nature of relations between organisations, applicable to all organisations and contexts. Specifically, in an extension of the equivalent pursuit in intraorganisation theory, it assumes that there exist, and attempts to discover

determinate relations between specific combinations of differentiation and control on the one hand, and specified value outcomes on the other hand. The task of interorganisational analysis in this view is to discover the functional relations of administrative structure (differentiation and hierarchy) to effectiveness under specified conditions.¹⁹

Benson identifies three main contending approaches: functionalist, exchange and resource dependence. Each to some extent challenges the others, though within the confines of the dominant problematic. Each is subject to specific criticisms, generally versions of those which apply to the generic approach from which this application is derived - functionalist approaches, for example, from systems theory and functionalist sociology.²⁰

Each approach, in emphasising a limited aspect, or pertaining only to specific and often limiting conditions, is then open to criticism and tends to be extended or elaborated. In some cases contributions push toward the limit of the problematic. Thus some exchange and dependence theories have acknowledged the need to situate diadic relations in a context, to allow for inequality in many relations, to stretch the idea of exchange to accommodate avoidance of sanctions, and to introduce a dynamic to account for changes in network structure.²¹ Resource dependence theorists stress inequalities of exchange, and have made starts towards explaining dependences in terms of a wider political economy. Both exchange and

dependence accounts, following Child's insights, have pointed to strategies of organisations in trying to reduce their dependence, for example, by seeking alternative sources of material inputs.

The shift of locus from an organisation in its environment to a network of relations between organisations - or better still to a field or sector without the assumption about the form of relation implicit in network²² - is in itself a major advance. Benson, in earlier guise, suggests a need to focus on processes of resource acquisition in the network; the network is in effect a political economy itself, based on distribution of resources, particularly money and authority. The characteristics of the network then affect the internal character of each organisation.²³ Contributors have seen the potential in considering societies as multi-organisation networks - a welcome move towards a broader perspective.

Cook's version of exchange theory, one of the better efforts, shows both the potential and the limitations of the model.²⁴ For Cook an exchange relation consists of 'voluntary transactions involving the transfer of resources ... between two or more actors ... for mutual benefit', where a resource is 'any valued activity, service or commodity'.²⁵ Her account goes beyond a narrow concern with coordination; indeed her conception of exchange takes on an exclusive concern with commodities and thus a focus on capitalist firms in market exchange relations and a tendency to project a commodity form onto all relations. She then admits that the theory is limited in scope, unsuitable for say public bodies with mandates, but offers no clear criteria for that limitation. In her discussion of power and dependence in resource exchanges the approach becomes virtually indistinguishable from resource dependence approaches. She claims that her approach focusses attention on power, but her conception of power is the ability to change the exchange relation, not the ability to gain resources through its normal operation. Thus she can deny that such versions of exchange necessarily give an impression of equality in relations, and the corollary, one of her main propositions, is that exchange relations 'tend towards balance'. Cook's approach is highly formalised, and she admits 'there is a paucity of empirical research devoted to testing exchange propositions'.²⁶ Perhaps the most useful insights to emerge are two reasonable propositions:

Given functional specialisation among organisations and a scarcity of resources, organisations seek to reduce uncertainty by creating "negotiated" environments.²⁷

Organisations seek to form the type of interorganisational exchange relationship which involves the least cost to the organisation in loss of autonomy and power.²⁸

While acknowledging especially in relation to the latter proposition that such attempts at control occur within 'differing structural conditions' such as 'varying positions of centrality and different types of exchange connections',²⁹ she cannot adequately account for the structure and nature of the relations which form these structural conditions. While she can be seen to be moving towards a depiction of a continuous process of producing and changing such networks, there remains a dualism of structure and action which tends to assume certain structural conditions as immutable.

As with other areas of work, though the basic models are severely limited, a number of potentially useful categories and observations can be extracted from interorganisation theory. Sharpf, for example, notes the need to distinguish two levels of relation: structural relations between organisations, and specific interactions, the former conditioning the latter.³⁰ Marrett suggests dimensions along which interorganisation relations can be analysed - degrees of: formalisation; intensity; reciprocity or symmetry; standardisation; and extensiveness.³¹

2.3 POLICY STUDIES

Introduction

There are several reasons for considering policy studies here. First the area would be expected to be able to deal with political processes of technological choice, and it is necessary to assess that ability. Second, even taking a narrow interpretation of policy, it is likely to be an important category. Third, the critical insights into themes raised in policy studies will be more widely applicable.

Policy studies³² represented an attempt, largely initiated in the US but followed in the UK, to draw together behavioural sciences, political science, management theory, public administration and other areas.³³ The construct intended was viewed variously as a 'guiding metaphor' for 'a broad and diffuse community of scholarly interest';³⁴ an 'integrating supra-discipline';³⁵ and an orientation 'that cuts across existing specialisations'³⁶ but would draw on their methods and ideas. The appeal of collecting these disparate approaches into one field was more to do with the historical problems of the academic disciplines it sought to straddle: the perceived irrelevance of much political science to the increasing scale and intractability of social problems, the failure of public administration theory to improve the functioning of real administration, and so on.³⁷ In practice, though certain approaches dominated the field and much of its establishment was concerned with trying to assert these as an 'encompassing paradigm', the different approaches familiar from different sources continued to remain fairly easily distinguishable, as Heclo observes, by their methods and implicit preconceptions.³⁸

The schema of Gordon et al. makes useful distinctions:³⁹

Analysis for policy

Policy advocacy	Information for policy	Policy monitoring and evaluation
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Analysis of policy

Analysis of policy determination	Analysis of policy content
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The concern here is with the last two categories, except insofar as explanation may incidentally be useful for evaluation and information from certain viewpoints.⁴⁰ The large volume of work that is entirely prescriptive or programmatic - intended to show how policy can be better formulated and implemented, and to provide techniques for doing so - can be left aside.

It cannot, however, be ignored, since its role in political processes may be significant. The idea of value-free instrumental policy science is subject to the general critique of the positivist fact-value and means-ends distinctions on which it relies: that its supposed value neutrality neither stands scrutiny nor indeed is logically possible; and that it further incorporates specific values, inherently tending to support the existing institutional structure and wider social order.⁴¹ While it is claimed to be purely instrumental, able to serve whatever ends a political system decides,⁴² its corollary is that technical approaches encroach on political decisions. Ends are deemed amenable to technical analysis, and political debate over ends is relegated. Policy sciences thus are strongly associated with the broad technocratic end-of-ideology ideology.

Rational Model

Correspondingly in the generic 'rational' model pushed as paradigmatic for descriptive work, the same normative notions and managerial concerns can be found elevated to analytical concepts. It provides a legitimacy depiction of policy processes into which instrumental policy sciences can fit and which thus justifies their utilisation. Here is a clear demonstration that the boundary between description and prescription which positivist methodology should maintain is necessarily untenable; the preoccupations of this model are essentially diagnostic, 'to identify the pathologies of the process and to cure them.'⁴³

The model incorporates the following assumptions about the internal characteristics and external relations of the policy-making system.⁴⁴ It takes the political sphere as consistent and collapses it into an organisation and thence into an autonomous and rational individual.⁴⁵ If any internal structure is acknowledged, it is at best hierarchical with information and competence converging at the top. The individual actor follows a rational

decision-making process based on the classic steps from formulating a problem in response to external stimuli, through evaluation of alternatives to implementation. Usually consensual objectives are assumed - some form of 'public interest'. If any conflict over goals or perceptions is acknowledged at all, the actor is deemed neutral, without interests of its own, reconciling or deciding between those of others. Problems with the outputs of processes then have to be attributed to such categories as myopia, anachronism, mistakes or unforeseen consequences rather than conflicts of interest. Implicitly again these are amenable to correction and amelioration through the education of the policy-maker in better technical means by the policy scientist. At best, the model admits some corruption of the process, some deviation from the common objective, because of 'vested interests'.

The policy-making sphere is on top in society. It is tightly bounded and its interaction with the outside is unproblematic. It is the dominant decision-making agent and its outputs direct other social activities. There are no limits on its power to do so, and no notion of a necessity to produce compliance. Society is looked at from the point of view of the political sphere. It becomes the reference point of analysis, used to justify, for example, the choice of 'key' or important issues to investigate.⁴⁶

As a result, the possibility that another social system may determine politics is ruled out by the method, or to be more specific, the method makes it impossible to seize upon the particular constellation of a capitalist society and to clarify it.⁴⁷

The model is universal. It is assumed to hold for all levels of organisation, all forms of policy and all issues. Indeed it is abstracted from specific issues and largely discussed independently of them. Thus though political science was regarded as having been concerned with institutions and not policy content, the dominant model in policy studies itself was itself unable to tackle the relation between process and content.

Thus, as Gordon et al. characterise the approach: 'Typically the problem is seen as technical, the climate as consensual and the process as controlled.'⁴⁸ The origins of this 'aspirant paradigm' in the disciplines which policy studies attempted to integrate are apparent in its 'tacit elements'; it has, says Dillon,

not only been imbued with the values and techniques of welfare economics, but these influences have also been compounded by those of the goal tradition in organisation theory and by the behaviourist/pluralist tradition in the study of politics.⁴⁹

The model, as Ronge points out, has great appeal; it 'articulates not only the common sense notion of politics and society but the self-image of political and administrative agents, too.'⁵⁰ Gordon et al. concur:

The power and survivability of the 'rational system' model is surprising given that its assumptions have been undermined by empirical studies of the policy process, and that its predictive record is uneven. The main explanation for its continuing existence must lie in its status as a normative model and as a 'dignified' myth which is often shared by the policy-makers themselves.⁵¹

An important variant associated with Easton was based on systems theory,⁵² stressing the character of policy-making as an input/output conversion system and allowing for 'feedback'. While showing many of the assumptions listed, it was better in that it acknowledged the existence of several primary social sub-systems within a functionalist view of the whole. Likewise, however, as Ronge observes,

...systems theory resigns an analysis of society as a whole for methodological reasons, and thus again neglects and underestimates the environmental conditions of the single systems under analysis - which is an important detriment when it comes to the political system.⁵³

The Concept of Policy

Already the discussion has raised the question of what is meant by policy. There is limited purpose in engaging in the debate over a definition, but it will prove useful to make some basic distinctions, first to make clear the limited sense in which the term is used subsequently in this thesis; second to be able to assess and criticise work which deals with policy and avoid invalid comparisons; and third to understand the assumptions which the use of the term can bring with it.⁵⁴

Policy is usually taken as more general than specific decisions. It is some sort of directive, guidelines or accepted approach for the forms of action to be taken or refrained from, against which specific decisions or

actions are referred, with which they are supposed to be consistent, or by which they are at least constrained. Then it seems useful to distinguish policies from goals and objectives. Leaving aside the difficulty of attributing goals and of distinguishing means and ends, it accords with most treatments to take policy as means towards objectives.

A key distinction is between policy as an explicit formulation and as an implicit set of guidelines or accepted approach. The former is accessible in statements issued outside an organisation, or in directives or some other codified form inside. The latter is necessarily derived by the analyst from the outputs of the organisation. As Ham and Hill ask:

Can it be said that a pattern of actions over a period of time constitutes a policy, even if these actions have not been formally sanctioned by a decision?⁵⁵

The question is only resolved by an act of definition; connotations which accompany each option must then be recognised. There are problems with both.⁵⁶ The former may lead to confusion between rhetoric and what is enacted. If this narrow definition is adopted it must be accepted that there will then be no necessary or simple correspondence between 'policy' and the observed pattern of outputs.

The latter conception, however, reinforces the assumptions of purposiveness and consistency already criticised. It may invalidly be assumed, for example, that inaction in a particular event reflected a tacit policy of non-intervention, or that a pattern of outputs was produced by a uniform approach. Rather their existence and connection would have to be demonstrated empirically. Further it requires a careful distinction between outputs as actions by the organisation, and outcomes as observed changes in the affected domain. To confuse the two will reinforce the other assumptions identified as elements of the rational policy model: the centrality and omnipotence of the organisation - that it is responsible for the effects observed. The distinction only holds, however, with reference to clear boundaries between organisations and subunits of them and insofar as those boundaries can be considered to exist. An output at that boundary, as many organisation theorists would accept, is itself the outcome of conflictual processes between groups inside the boundary. This observation is crucial in understanding the policies of state bodies, which it is argued in 4.3 are themselves arenas for conflicting interests.

These problems with policy as a concept mean that its use as a focus for study incorporates assumptions and reinforces tendencies which must be challenged. It elevates the importance of the political sphere as determinant and over-emphasises the purposive nature of political activity. It treats policy as 'the relatively durable element against which other premises and actions are supposed to be tested for consistency.'⁵⁷ Policy analysis becomes 'the study of identifiable things called policies which are produced, or crystallise, at a particular stage in the decision process.'⁵⁸ It promotes the idea that all processes involve policy: that all issues come under the scrutiny of the political sphere and at least a consistent approach is taken even if it is not expressed as explicit policy; and that no change is made nor action taken except under its guidance. It reinforces a linear unidirectional notion of policy and implementation.

Rather than impose this single form on processes and make assumptions about the primacy of policy, analysis must allow for different forms and explain each in context - in other words, establish empirically whether, to what extent, in what form, and to what degree of specificity and consistency explicit policy or patterned approaches actually existed; how they developed and changed; to what extent explicit policy determined a course of action or was a post hoc rationalisation; and the extent to which action was purposive, reactive, routine or evasive.

Policy and Implementation

Consideration of the dominant rational model of policy-making and a focus on policy, leads to its corollary, the policy-implementation dichotomy, and a large literature on implementation.⁵⁹ Objections to the dominant approach are similar: that the descriptive model is inherently normative, derived from administrative concerns, this time over problems with enacting what has been decided - lack of control, degrees of discretion, etc. The assumptions fit with and extend those of the rational policy-making model: that the process is one-directional and one-dimensional, with policy in command; that objectives are consistent and consensual; and that action is entirely purposive. Analysis thus focusses on divergence from the norm and the influences producing it, so as to allow correction. Variants such as introducing a 'programme' stage between

policy and implementation simply elaborate the basic model.⁶⁰ It is of course strongly associated with the division between politics and administration.

Critics point to the variety of actual processes:⁶¹ that actions may precede policy; that the relation may be recursive; that not all actions relate to policy; that hierarchy and compliance cannot be assumed nor even taken as an ideal; that the boundary itself varies according to the detail of policies and the discretion of administrators. Action thus starts with multiple dispositions to act, of which explicit policy is only one. Implementation is performed by agencies with their own interests and objectives and varying relations to the political sphere. Even explicit policy is mediated, interpreted, modified or subverted. Questioning the policy-implementation dichotomy thus leads back to questioning the category of policy itself - its existence, its forms, its specificity. It will be argued that these points can only be taken into account in a dialectical framework which sees policy like other social constructions as both an outcome of social processes and a political and ideological resource used by groups in them.

Forms of Policy

Insofar as explicit policy exists or it is valid to depict a tacit policy from observable outputs, it is apparent that there is a range and hierarchy of forms and statuses of output. It is useful to consider some suggested distinctions.

Lowi, for example, suggests four categories of output: distributive, constituent, regulative and redistributive.⁶² Thence Salisbury derives structural (regulatory or self-regulatory) and allocative (distributive or redistributive) outputs.⁶³ O'Riordan suggests four levels: legislative, executive, regulatory and adjudicatory.⁶⁴ De Man suggests three hierarchical levels of control which could be regarded as levels of policy output: substantive control specifies what must happen; procedural control sets up the process for deciding what must happen; and structural control sets up the structures within which these processes occur.⁶⁵ Gregg identifies different legislative statuses - constitutional, authoritative and authorised - forming a hierarchical legal framework, and four focusses

corresponding to how each affects the next lower level - constitutional, institutional, programme and technical.⁶⁶

In greater detail, a list can be made of various forms of policy instrument available to the state: coercion; incentives; penalties; pricing; subsidies; information; expenditure, including investment; regulation; legislation; research; symbolic action; reorganisation; and so on.

The usefulness of such categories can be cautiously accepted,⁶⁷ but a number of observations are pertinent here. First, the categories may be analytically distinct, but a particular policy may contain elements of more than one type; they are not typologies. Second, though authors may acknowledge 'interdependence' of levels, depictions like O'Riordan's of a hierarchy reinforce assumptions of the primacy of one level over another - the same tendency as the policy-implementation dichotomy and accounts of political, administrative and technical spheres. Third, therefore, the form taken by a particular output needs to be explained: how, for example, an issue came to be channelled through the decision-making arenas responsible for producing a particular status of output.

The specificity of policy - from perfectly detailed preformation down to general principles - is clearly important and needs explanation. Vagueness may be a product of uncertainty, or of compromise and inconsistency arising from a multiplicity of contending interests. It may also represent an unwillingness or inability of policy-makers to intervene - a consequence of their relation to other social spheres.⁶⁸ Corresponding to the specificity of policy, of course, is the degree of discretion available to those who interpret or implement that policy.⁶⁹

2.4 POLITICAL SCIENCE APPROACHES

Introduction

From the dominant rational model of policy-making, the first shift required is from the viewpoint of a supposedly central policy-making actor to one which sees policy as the outcome of interactions between groups. With this shift the policy-maker's assumed goals and concerns are no longer taken as normative. The policy-maker is at least allowed, if not required, to be one of several actors with its own objectives.

In this section, then, are considered accounts of policy-making which acknowledge a variety of interests. They are based more firmly in political science, though they have frequently been claimed for policy studies since they deal explicitly with policy-making. The discussion follows the development of accounts of non-decision-making and agenda-formation. The outcome is a model of a policy process which follows an issue from its origin as a politicised or mediated need through various stages separated by barriers at which groups exert forms of overt or covert power to influence, divert or distort the outcome. At this point some useful categories and other insights will have been obtained, but in this case an essentially individualist problematic limits the usefulness of the approach.

Pluralist Model

The pluralist tradition in political science formed a clear dominant paradigm, particularly in the field of community politics in which the idea of a non-decision was to be formulated. It has to be considered successful in its own terms; it developed operational definitions and turned up consistent evidence.

Pluralist accounts see a variety of groups being able to put demands via parties, etc., to a responsive political leadership which mediates and compromises between demands. A broad consensus of values prevents decision-makers becoming overloaded.

The approach advocates the study of actual behaviour. The focus of power is defined by the individuals or groups who prevail in decision-making in which there is observable conflict; this is an experimental test of actors' capacities to affect outcomes. Power is something which exists only when exercised; groups do not possess power in the abstract. The studies pick 'key' issues; the criteria of significance are not well defined, but a necessary condition is actual disagreement in policy preferences. Interests, then, are subjectively defined, expressed as policy preferences exhibited through participation in political processes. Pluralists are actively opposed to ideas of unobservable, unarticulated and especially unrecognised interests. From their studies, they claim to have demonstrated that power is issue-based. Different groups or individuals exercised power in each conflict. There was no elite which could do so over a range of issues.⁷⁰

The essential criticisms of this 'one-dimensional' view of power, as Lukes terms it, are that 'it inevitably takes over the bias of the political system under observation and is blind to the ways in which the political agenda is controlled.'⁷¹ It sets out to demonstrate that power is exercised pluralistically, that no elite exists, and that the political system can be penetrated by any group with a grievance. It is criticised as 'superficial and restrictive, and as leading to an unjustified celebration of American pluralism, which it portrayed as meeting the requirements of democracy ...'⁷² As Alford points out, it neglects the origins and determinants of 'preferences', the sources of inequalities in the capabilities and resources of groups attempting to assert their demands, and the extent to which groups are created and sustained by other groups and institutions, particularly at the level of the state.⁷³ The approach is generally depicted as precluding, through its concentration on behaviour, observable conflict and decision-making, discovery of anything but an exercise of power within these limits.⁷⁴

In short, the pluralist approach embodies a liberal political ideology and merely confirms its premises. It thus legitimates certain interests and obscures their existence and the ways in which they are secured.

Neo-Elitist Approaches: Non-Decisions

In the elite paradigm of political science, large complex organisations are held to dominate many spheres of society. The elites of these organisations have a monopoly of hierarchical control, expertise and ability to deploy resources. Neo-elitist critics of the decisional focus of pluralist community studies, then, maintained that there are important demands which never reach the decision-making arena; sought an account of power which recognised the ways in which they are excluded; and postulated an elite which consistently benefits from these processes.⁷⁵

Saunders et al., themselves trying to explain a case of continued tranquility and political stability without even manifestations of discontent emerging in non-institutional forms, show the importance of the difference between the picture the pluralists paint, through their concentration solely on overt conflict, and that of their critics. 'Mass political inaction ... is thus for Dahl indicative of a well-integrated and smoothly-functioning system of local representative democracy.' It indicates 'the altruistic use of legitimate power'. For neo-elitists, in contrast, the calm surface is maintained by 'the self-interested use of manipulative power'.⁷⁶

Bachrach and Baratz, mainly in response to Dahl, produced the best-known formulation of this 'second face of power':

Of course power is exercised when A participates in the making of decisions that affect B. Power is also exercised when A devotes his energies to creating or reinforcing social and political values and institutional practices that limit the scope of the political process to public consideration of only those issues which are comparatively innocuous to A.⁷⁷

It is exercised through the 'mobilisation of bias', operating

systematically and consistently to the benefit of certain persons and groups at the expense of others. Those who benefit are placed in a preferred position to defend and promote their vested interests. More often than not, the 'status quo defenders' are a minority or elite group within the population in question.⁷⁸

Bachrach and Baratz thus effectively broadened the scope of politics beyond the limits of the pluralist framework, to include latent issues on which decisions are prevented from being taken, and made an attempt to

deal with the effects of context.

While their initial definitions might have suggested a wider conception of non-decision-making, it is clear from their detailed expositions and illustrations that they were limiting it to conscious suppression of recognised grievances in anticipation of an adverse response from another group. This leads naturally to a reputational methodology in which participants' subjective assessments of the influence of other individuals or groups are used to indicate the locus of power in the development or suppression of political issues. The stress of the approach is still on conflict, covert as well as overt. Non-issues are 'observable in their aborted form to the investigator.'⁷⁹ The conflict is between subjective interests, embodied in sub-political grievances as well as expressed policy preferences.

Two major aspects of early formulations of the idea of non-decisions enabled pluralist critics to attack the new approach and reassert their own analysis and conclusions: their lack of clarity, and epistemological and methodological problems. First, the idea of non-decisions was dismissed as empirically unresearchable - a particularly powerful criticism in view of the straightforward methodology and apparent success of the decisional school.⁸⁰ Second, it was claimed that no convincing identification of community power structures or elites could be made; their supposed existence would probably be introduced by circularity of argument.⁸¹ Third, it was asserted that the outcomes dealt with by exponents of non-decision theory were explicable in terms of actual decisions of various sorts; the idea was redundant.⁸²

Supporters and opponents agreed on the vagueness and inadequacy of the concept of non-decision as defined by Bachrach and Baratz, finding several different notions conflated.⁸³ It was not clear in which stages of the political process a non-decision could be found; whether a non-decision was the result of a conscious strategy on the part of an elite or whether it could be produced by the existing bias in a system in the absence of conscious effort; whether non-decisions were characterised by results or mechanisms or both; whether an unsuccessful attempt qualified; whether non-decisions worked systematically and consistently to the benefit of one group; and whether the potential challenge was to the decision-maker or to

another party with interests in the issue.

The debate established, however, that the importance of the matters raised could not be denied - the neglect of issues had to be researched. Methodological difficulties and initial problems in formulating concepts were not grounds for dismissing the whole idea.⁸⁴ Specifically the notion of a non-decision was neither superfluous nor necessarily methodologically self-justifying.⁸⁵

The value of the neo-elitist approach was firmly established by its application, particularly Crenson's study attempting to explain why the issue of air pollution was raised at different times and with varying effectiveness in US cities.⁸⁶ It used both correlations from a statistical survey and two detailed case studies to show how the treatment of the issue was largely determined by forms of influence exercised 'outside the range of observable political behaviour', and seldom by direct intervention. Crenson carefully tailored his reputational methods to accommodate pluralist criticisms.

Agenda-Formation

Theoretically, van der Eijk and Kok attempted to resolve the questions and ambiguities left in the original formulation of non-decisions by clarifying the stages of a process of agenda-formation.⁸⁷ They defined five stages in the passage of items through the political process: wants, demands, issues, decisions, outputs. These stages are separated by barriers at which items may be stopped or distorted.

Wants are 'opinions, interests, ideologies and similar ideas and attitudes which are cognised in a non-political way'; they include basic human needs, but it is recognised that most wants will themselves be functions of various social determinants. They are converted into demands when a group or individual promotes the idea that those responsible for making binding decisions should act to fulfil a want. This conversion may be prevented by dominant values, beliefs and myths deeming certain demands legitimate and others not, by lack of knowledge, anticipated reactions of others, or by actions of others to prevent conducive organisational arrangements. Certain demands are then accepted as issues for

consideration by decision-makers. They may be taken up only in part, or they may become moderated in exchange for an enhanced chance of getting through. Again, force, confusion and anticipated reactions operate at this barrier.⁸⁸ At the traditional focus of pluralist studies, decisions are made on an agenda of issues; here 'issue-perversion' may occur.⁸⁹ Finally, unless the decision itself, perhaps symbolically, forms a political output, there is an implementation stage, 'in which much can happen to prevent a certain output being realised at all.' 'Output-perversion' is also possible, 'channelling the output away from intended beneficiaries to others.'⁹⁰

The complete process is complex; the analyst must identify not only the determinants of success of a want reaching the agenda, but also at what part of an agenda - and thus at which set of decision-makers - an issue ends up, and the relations between the different sets. For van der Eijk and Kok, then, non-decisions occur at the first and second of their barriers, and are defined and categorised by effect; it is not relevant for the purpose of definition whether they result from a conscious strategy or not. The consistency of benefits and the existence of elites, they maintain, are matters for empirical study.

A 'Third Dimension': Unrecognised Interests

The formulations of agenda-formation theorists suggest the need for a further extension to the conception of power, but ultimately fail to grasp its significance or implications: it is possible for demands, rather than being suppressed, never to be recognised.

Lukes' key critique⁹¹ saw the 'two-dimensional' view of power of Bachrach and Baratz as indicating the need for a study of bias and control but having too narrow a conception of their operation. It was too committed to the study of behaviour. First, conscious manipulation of values by an elite is not necessary; '... the bias of the system can be mobilised, recreated and reinforced in ways that are neither consciously chosen nor the intended result of particular individuals' choices.'⁹² Second, the bias of a system is maintained largely 'by the socially structured and culturally patterned behaviour of groups, which may indeed be manifested in individuals' actions.'⁹³ Bachrach and Baratz adopt too methodologically

individualist a view of power and Crenson's reputational method, as Newton observes, 'leads naturally to this sort of individualistic explanation, which, although it is not unimportant, leaves aside the possibility of more impersonal, structural and systemic explanations.'⁹⁴ The power to control political agendas must be analysed, maintains Lukes, 'in terms of collective forces and social arrangements'. He identifies two separate phenomena of collective action and systemic or organisational effects; while collectivities and organisations are obviously composed of individuals, their power cannot be conceptualised in terms of individuals' decisions or actions.

Not only does the 'two-dimensional' view retain the individualist concepts of the pluralists, but it is also too narrowly concerned with observable conflict. Power is not only exercised when conflict occurs: '... the most effective and insidious use of power is to prevent such conflict from arising in the first place.'⁹⁵ The absence of a grievance need not indicate a consensus.

The theoretical formulation of Bachrach and Baratz and empirical methodology of Crenson, by limiting investigation to at least articulated wants, thus define limits to political studies which Lukes' 'three-dimensional' view does not accept.⁹⁶ The 'three-dimensional' view acknowledges issues, potential issues and the way in which wants may never arise.⁹⁷ The last will most likely occur in the absence of observable conflict. There is, however, a potential conflict between the interests of those exercising power and the real interests of those dominated. There is not just a failure on the part of pluralists and elitists to recognise the possibility of objective interests being different to expressed preferences; most pluralists and several elitist writers explicitly deny that idea.

Gaventa has attempted to show how Lukes' three dimensions could be developed and applied.⁹⁸ In a case study of an Appalachian mining community, he examines the 'generation of acquiescence' among subordinate social groups and 'the processes by which challenge may emerge'. The third dimension for Gaventa requires an analysis of contradictory interests and 'involves specifying the means through which power influences, shapes or determines conceptions of the necessities, possibilities and strategies of challenge in situations of latent conflict.' These means are, he suggests,

social myths, language and symbols; the communication of information - its quantity, identity and media; and other forms of social legitimation - their creation and instilling. His task is to discover how a supposed consensus was arrived at originally; what barriers exist to the development of consciousness of the dominated group; and what the responses of powerholders are to the beginnings of challenge.⁹⁹

Gaventa thus sets out to provide what he finds lacking in previous studies: 'a specific, empirical development of the means and extent to which the multiple faces of power affect the politics of a single area, over time, in a variety of aspects of community life.'¹⁰⁰ He argues that mechanisms can be identified within each of the three dimensions of power. The analyst must take a 'view from below', and compare varying modes of participation in normal and abnormal times. He suggests that the relative importance of each dimension may show a historical pattern and the forms of power may mutually reinforce; thus overt conflict may establish patterns of control and then give way to covert forms of the maintenance of those patterns, though backed if necessary by coercion.

Gaventa takes Lukes' framework as a starting point, then, and gives substance to the framework by identifying forms and mechanisms of power operating in each dimension. But he also goes beyond Lukes' analysis, overcoming some of the points of Lukes' critics and taking on some of their methodological suggestions. Above all, he shows power relations developing historically and in a structured context. Thus his work will actually be seen to fit better with the more radical approaches considered in the next chapter.

Limitations

The account of agenda-formation, though constituting a major advance on pluralist decisional analysis, remains limited by three major elements of its problematic: its individualist action grammar; the linearity of the process depicted; and its abstraction from a social context.¹⁰¹ Even Lukes' contribution ends up uncomfortably half in the old framework. He extends the policy process back to include ideological control of the politicisation of needs; widens the scope of the debate on power beyond the traditional sphere of politics; and indicates the need for analysis in

terms of both structure and action. Yet he ends up framing his discussion within the individualist paradigm carried over from previous approaches. Problems arise, as Clegg notes, when he tries to extend it into areas in which 'it is not at home', to an explanation of structural effects. His analysis remains 'one in which morally responsible agents choose their actions under conditions of more or less relative autonomy.'¹⁰² Bradshaw makes the same criticism of Lukes: that he espouses yet at the same time rejects a structuralist definition of power, and remains firmly individualist. His illustrative methodology is inadequate - 'a series of dynamic tableaux or mind experiments in which two individual actors, A and B, are manipulated through socially barren scenarios' - and cannot validate a leap from diadic examples to a collective exercise of power.¹⁰³ For McEachern, too, comparing Lukes' and earlier approaches, the 'areas of agreement have more significant consequences for the analysis of power relations than the manifest differences in approach.'¹⁰⁴ There is, maintains McEachern, a consensus whose 'core proposition' is 'that power relations are to be understood largely in terms of themselves and that the context and character of the interacting parties is less important than the analysis of the interaction itself.'¹⁰⁵ The consensus covers the use of the heuristic 'A and B' device, a lack of attention to the significance of the outcomes of an interaction, and a reliance on behaviour as the basis of assessment.

The individualist 'A,B' grammar 'invites the substitution of groups or institutions for the symbols'; this, argues McEachern is inappropriate for most collectivities and significant social interactions between them. It is worth quoting in full McEachern's eloquent summary of the need to consider the character of the groups and the context:

In a class-structured society, the major social groupings and institutions at the start of any particular interaction have a given character that derives from a combination of their structural location and the historical developments that lead them into interaction. In the analysis of an interaction, neither the structured context nor the specific characteristics of the interacting parties can be taken for granted, but must be accorded a significant part in the analysis. The analysis cannot just be concerned with the interaction itself, but must include an account of the character of the interacting parties, and the historical trajectory followed by them to produce the interaction. It is in this sense that the analysis of power is not enough; to understand power it is necessary to understand the context in which power operates.¹⁰⁶

Power relations cannot, then, be analysed in the same terms at all levels of social life. A particular interaction cannot be understood in its own terms, but requires reference to other social levels and relations. This fundamental requirement is the central theme of the next chapter.

CHAPTER 3 ELEMENTS OF A NEW FRAMEWORK

3.1 INTRODUCTION

Limitations of Conventional Approaches

Some requirements for a framework for analysis were identified in the discussion of 1.3 on technology. To these can now be added the need to overcome the inadequacies of conventional approaches to explaining social phenomena reviewed in chapter 2. The generic limitations of these bodies of theory reflect their origins and the context of their development, especially in their normative orientation and hence potential role as ideology:

- a separation of action from social structures, with mutually exclusive paradigms;
- reification of specific forms;
- an inability to be critical or reflexive and a tendency to reaffirm existing institutions and the wider social order.

It was argued that the output of these approaches should not be rejected categorically. Their categories and empirical findings, while not universal, may more or less accurately describe phenomena in specific or limiting conditions. Certain contributions have recognised shortcomings of the dominant paradigms and shown ways of at least partially breaking out of them. And debates between vying approaches and concepts stressing opposed elements of dualities indicate a resolution in a corresponding dialectic. In short, much useful material can be reinterpreted and incorporated in a better framework. In doing so, it should be possible to resolve the preoccupations and dilemmas of conventional approaches at the limits of their paradigms.

Principles

The inadequacies of conventional approaches point to the following general principles characteristic of a broadly Marxist approach aiming at a structured, dynamic and historical account:¹

- to view social systems as in a continuous process of construction, maintenance and change, even though specific institutions may be deeply rooted and relatively stable;
- to explore the connections between levels of social structure and areas of activity as parts of a total social formation, even though each has partial autonomy;
- to stress the specificity of social arrangements at all levels;
- to explain the similarities and differences in phenomena by relating the contexts of their production;
- to acknowledge the presence of contradictions - the more or less temporary coexistence of incompatible or inconsistent features of various types - throughout social systems, within and between levels of structure and spheres of activity, and created, recreated, transcended or exacerbated by action;
- to view change as produced by these contradictions, providing incentive, scope and constraints for action against the existing order; and to expect that change rather than forming a smooth process, to be punctuated by crises as fixed patterns and entrenched interests are superseded;
- to eschew the notion of a general theory and instead provide the theoretical tools with which specific social arrangements and phenomena can be analysed;
- to see theory and praxis as fundamentally and dialectically related, with theory not only informing praxis but arising out of and therefore

reflecting practical concerns, mediated through a particular context of social relations in which theorists themselves operate - hence not only the limitations of conventional social theory but also the need for oppositional praxis in constructing critical theory.

Objectives and Scope

This chapter represents an attempt to formulate guidelines for studying specific sets of events and explaining their outcomes in accordance with these principles. Leading on from debates in some of the areas dealt with in chapter 2, the central theme is the relation of detailed action to its context. Some key concepts are reinterpreted, and some attempts at reformulating specific fields of inquiry are reviewed. The discussion necessarily moves out beyond a substantive focus on policy-making to social processes in general and to higher levels of theoretical abstraction. It therefore includes consideration of how to narrow down again: how to delimit a field of enquiry, how to convert the general framework into operational procedures, and what the discussion means for political processes in particular.

The debates dealt with in this chapter are complex, and have involved relatively few authors whose objectives are similar to those of this thesis and all of whose work is valuable, though the degree of theoretical elaboration and empirical application varies. It is not possible here to resolve finally their differences, but in that some of the contributions have not yet properly confronted each other, to compare them here will prove worthwhile.

3.2 LINKING CONTEXT AND ACTION

Structuralist and Individualist Approaches

A central requirement of the form of analysis advocated here is the ability to connect different levels of social arrangements and processes. It needs to show how broad characteristics and changes in social systems affect specific detailed action and outcomes, and thus how a focus on this micro level, abstracted from its context, produces an unsatisfactory explanation and also obscures the possibility of alternatives through changes in the wider social order.

In the review of conventional approaches in chapter 2, a fundamental division has already been encountered: that between grammars of structure and action, linked to philosophical debates over voluntarism and determinism. It appears in theory as the predominance in a field of a problematic which can deal with only one aspect, as, for example, with structural functionalist sociology or pluralist political science, or as competing and irreconcilable schools and corresponding debates over their different conceptions of, say, power.

Action approaches are essentially individualist, seeing social formations and outcomes as produced by individual human agents. And while they entail different theories of the subject, they are mostly voluntarist, seeing these agents as endowed with autonomy, free will and reason, thus leaving motivation as an unexplained independent variable. They are unable to deal with the character and behaviour of collectivities, treating them as interchangeable with individuals. In the pluralist and elitist accounts of policy-making reviewed in 2.4, the former effectively entailed denials of structural effects, and the latter made unsatisfactory attempts to graft structural considerations onto an individualist framework.

Structuralist approaches are best able to deal with large scale features of social systems. In starting at that level they find difficulty in explaining the complexities of limited areas of social activity and tend to exclude human agency. Structural functionalist sociology, for example, implicitly treats human actions as functionally adjusted practices

contributing to the operation of stable subsystems.² It is thus inherently unable adequately to explain change. Althusser's Marxist structuralism explicitly excludes human agency, except insofar as agents are bearers of structurally determined social relations.³

Neither exclusive approach allows the relation of micro and macro levels, in theorising or in particular studies. It has already been indicated, for example, that studies of specific technological sites or issues have understandably produced detailed accounts in action terms, and in the absence of adequate theory to relate this to a context have remained empiricist and implicitly pluralist. On the other hand, if it accepted that social systems are in some sense structures of relations involving human action, an adequate framework must explain the role of action in creating, reproducing or changing these structures.⁴

Dualism and Outlines of Dialectical Approaches

Acknowledgement of the need for both levels of analysis and of the merits and limitations of structuralist and individualist approaches, has led to attempts to combine them dualistically: to take structure as imposing limits within which agents act, still essentially free-willed but with restricted scope.

Lukes at least recognises the need for a treatment of power in terms of both structure and action. He counterposes and rejects the two extreme problematics of individualism and structural determination. Citing Poulantzas as adopting the latter, Lukes rightly states:

It is not a question of sociological research 'leading finally' either to the study of 'objective coordinates' or to that of 'motivations of conduct of the individual actors'. Such research must clearly examine the complex interrelations between the two, and allow for the obvious fact that individuals act together and upon one another within groups and organisations, and that the explanation of their behaviour and interaction is unlikely to be reducible merely to their individual motivations.⁵

Instead, he sees agents having relative autonomy within structurally defined limits; he wishes to combine the problematics of structure and action additively. As Giddens puts it, in 'representing structure as placing limitations or constraints upon the activities of agents ... Lukes tends to repeat the dualism of agency and structure ...'⁶

Besides Althusser it is debatable whether any significant Marxist theorists fit the extreme structuralist model, though some appear to have been strongly influenced by Althusserian theory.⁷ Lukes himself criticises Poulantzas.⁸ Hindess, in condemning the 'two persistent and influential kinds of reductionism', 'theoretical humanism' and structuralism, puts Poulantzas along with Althusser in the latter category, despite Hindess' own earlier attachment to Althusser's theory.⁹ Jessop, by contrast, defends Poulantzas against accusations of 'extreme determinism'.¹⁰

Of radical critics who tackle Lukes directly, most likewise acknowledge the need to transcend the two frameworks and claim to reject dualistic combinations. Hindess, for example, in a wider attack on capacity-outcome conceptions of power, rejects 'any fudging of the issue by some combination of the two'; such combinations 'merely compound the problems of reductionism by introducing distinct and incompatible principles of reduction'.¹¹

A number of critics, in many cases in the course of discussions of power, provide brief general indications of how the dichotomy might be resolved.

Benton proposes a realist conception of power, which he claims 'avoids both structuralism and voluntarism and the metaphysical debate between them'.¹² His account would be a structural one, 'so long as it is recognised that not all structures are extrinsic to agents ...'

The advocated position is systematically determinist, and causal, but at the same time does not reduce agency to the status of mere "bearer" of the activity of extrinsic structures: the exercise of social powers is to be understood as a resultant of the mobilisation of specific intrinsic capabilities under definite extrinsic conditions of possibility.¹³

In an early formulation, Jessop puts the relation between power and structure thus:

... the effective political power of a class is determined through a double delimitation - through the limits imposed as effects of the complex articulation of the various structural levels of a social formation and, within these constraints, the limits involved in the relations between different class practices in the field of economic, political and ideological struggle. Strictly speaking,

power is identical with these limits in the second degree.¹⁴

Jessop thus defines power in terms of its effect within a structural context. It is 'theoretical practice that defines the terms and levels of analysis and thus determines the inclusion or exclusion of specific actions in a given study.' Unfortunately Jessop's elaboration of this practice goes no further at this stage than stating 'it is essential to show how the agents' capabilities and ideological formation combine with structural constraints and other factors to produce a given effect.'¹⁵

For Clegg the problem is

... how to theorise power as a concept of social action, and thus as a possibility of its historical grammar, yet also as a concept of social structure, in order to extend it to the point beyond its grammar where recent critiques would have it go.¹⁶

He seeks to go on from Jessop's start.

The necessary task is to articulate concepts at the structural level, which can explain the emergence and non-emergence of issues and interests, and their relationship at the level of action. What this implies is some theoretical criteria of the significance and rationality of those issues and interests which are evident in both social action and inaction, and some way of specifying how and why these theoretical criteria should be acceded to. This entails three levels of analysis: the levels of structure, mediation and action.¹⁷

Clegg follows Althusser in outlining a structure of the capitalist mode of production and stressing the need for the theoretical elaboration of the specific effectivity of its superstructural levels. Corresponding to his analytical levels of action, mediation and structure, he proposes the concepts of power, rule and hegemonic domination. Power he defines as 'the ability to exercise control over resources which, when subjects engage in practices, produce effects on other subjects.'¹⁸ Individual power practices will display an underlying rule or mode of rationality - to be analysed as a property of structures, not of strategies or actions of subjects.¹⁹ Clegg's work is concerned with power in organisations; here the mode of rationality can be seen as a set of 'sedimented selection rules', the means by which a controlling group steers practice in an organisation towards an objective principle set by its location in a total and primarily economically determined social formation.

Clegg makes an advance on structure-action dualism in attempting to theorise the mediation between them, but seems to remain more firmly structuralist. He concentrates more on the structural determination of action, leaving largely unexplored the indeterminacy or contradictory aspects of action and its effects on structure. The elaboration of his theory remains patchy, however.

The two fullest and most satisfactory expositions of frameworks consistent with the principles outlined at the start of this section are those of Jessop and Giddens. They have different emphases and starting points, and ultimately differ on the determinacy of human action. Giddens focusses more firmly on action, putting effort into developing a model of action appropriate to its role in creating and reproducing structure.²⁰ Jessop by contrast starts from the structuralist end and stresses the complex determinants of action more than its reciprocal effects. Both, however, develop approaches which overcome the major criticisms of voluntarist and structuralist accounts and, it is argued here, give broadly compatible guidelines for study of a detailed area. Both provide a clarification of key concepts and their interrelation, and potential resolutions of many of the dilemmas and preoccupations of limited or dualistic approaches.

Jessop: Articulation

Jessop seeks to develop a 'method of articulation' to be used to reconstruct the 'contingent necessity' of particular social conjunctures and outcomes.²¹ The account should be a complex but coherent and consistent synthesis of different but structured determinations.

This entails both movement from the abstract to the concrete in a single plane of analysis (e.g., from capital in general to particular capitals) and the combination of determinations drawn from different planes of analysis (e.g., popular-democratic antagonisms rooted in the relations of political domination vs. class antagonisms rooted in the relations of economic exploitation).²²

For Jessop 'the real world is stratified into different domains and regions,' with distinctive properties, and requiring different techniques of analysis.

... each domain comprises not only a level of appearances or phenomenal forms but also an underlying level or levels at which are located the mechanisms that generate the surface phenomena of that domain.²³

Each chain of determination must therefore account for the mediations linking the mechanisms and the phenomenal events. The overall account will be adequate to the extent that it exhaustively establishes the conditions necessary to produce an outcome at the level of detail chosen and to which it remains consistent when extended to a level of greater detail.²⁴

While retaining some features of Althusser's approach and utilising his concepts of 'overdetermination', 'conjuncture', etc., Jessop's approach has crucial differences. In contrast to Althusser's refusal to bring empirical evidence to bear on theoretical elaboration, Jessop's approach is predicated on a realist theory of science, acknowledging that its retroductive method produces hypotheses which require formal, substantive and empirical forms of evaluation; he discusses the appropriate nature of each at length.²⁵ Jessop also rejects the depiction - common to Althusser and functionalist sociology - of a static, closed, self-reproducing system.²⁶ But in stressing the structural determinants of action and leaving relatively undeveloped the role of action in reconstituting and changing social systems, it is debatable the extent to which his approach is still subject to Thompson's major criticism of Althusser:

... each moment, each "now" ("conjuncture") should not be seen as a frozen moment of the intersection of multiple subordinate and dominant determinations ("overdetermination") but as a moment of becoming, of alternative possibilities, of ascendant and descendant forces, of opposing (class) definitions and exertions, of "double-tongued" signs.²⁷

Similarly while rejecting the depiction of agents as bearers of relations of self-reproducing systems, it is debatable whether Jessop is still subject to Thompson's criticism of the 'eviction of human agency from history'. He stresses the determinacy of conjunctures, including that of action through the structural constitution of individual or collective actors' subjectivities. The indeterminacy Jessop appears to leave is analytical rather than ontological; the practical impossibility of predicting an outcome, particularly within the limits of external 'structural constraints' and in the

structures intrinsic to agents in constituting their complex and contradictory identities, means that 'actual effects can meaningfully be said to depend in part on their actions and inactions.'²⁸

For the purposes of this thesis it is not necessary to resolve this status of indeterminacy, for the resulting guideline for specific detailed accounts is the same as that which it will be seen comes out of Giddens' framework: that actual objectives, intentions, strategies, tactics and conduct, within and related to specific structural constraints, have to be reconstructed and argued from empirical evidence.

Giddens: Structuration

Giddens rejects dualism of structure and action in favour of the duality of structure: structure and action are conceived dialectically as moments of a totality, separated only for analytical purposes.²⁹

Giddens defines his key terms thus.³⁰ A system is a reproduced pattern of social relations between actors, organised as regular and recurrent social practices - 'a reproduced interdependence of action'. Structure is recursively organised rules and resources, the structural properties of a system. They are drawn on by actors in interaction but are also thereby reconstituted through interaction. They are 'both the medium and the outcome of the practices that constitute those systems.'³¹ Structuration is the way that structures are constituted and changed and therefore that the system is produced and reproduced in interaction. Structure then, is not simply a set of constraints on action; it both constrains and enables, since it is essentially involved in the production of action.

History thus produces a 'deep-layering' of structures, relatively durable in time and extensive in spatial terms; these are institutions. Systems may be well integrated, with a reciprocity of practices and regulated relations of relative autonomy and dependence.³²

Giddens distinguishes three modalities of structuration, 'central dimensions in the duality of structure in the constitution of interaction ... drawn on by actors in the production of interaction, but at the same time

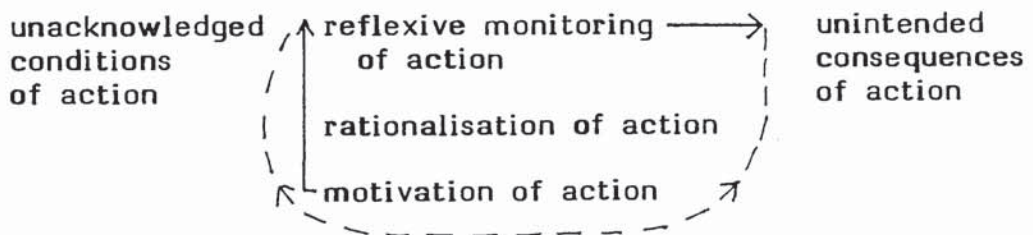
... the media of reproduction of the structural components of systems of interaction.³³

INTERACTION	communication	power	sanction
(MODALITY)	interpretative scheme	facility	norm
STRUCTURE	signification	domination	legitimation

These three aspects are analytically distinct but found combined in different ways. Thus, for example, 'symbol systems and modes of discourse are interwoven with forms of domination and legitimation' and authorisation and allocation 'are only mobilised in conjunction with signifying and normative elements.'³⁴

Giddens further distinguishes between allocation and authorisation as resources involved in structures of domination.³⁵ He then identifies institutions according to their predominant modalities: thus the realm of politics concerns the mobilisation of authority as a resource, and economics that of allocation.³⁶

A crucial link in the theory is a model of action and, within this, notions of motivation and knowledge.³⁷



Giddens argues the need to acknowledge the unconscious, practical consciousness and discursive consciousness, each bounded and influenced in different ways in their formation. Action is seen as a continuous flow of conduct, and most action consists of situated practices exhibiting regularity



and thereby 'chronically reconstituting' the structures of social systems. However, action is always a form of intervention in a potentially malleable context and it is an essential feature of the model that an agent can act differently. Motivation, which may have unconscious and conscious elements, is thus linked to unacknowledged conditions of action, and intentional action thereby produces unintended consequences, which themselves become conditions of action. It is inadequate to discount agents' rationalisation of their action and thereby depict systems as operating 'behind their backs'. While practical knowledge is deployed tacitly in routine practices, discursive knowledge - of the conditions of social reproduction and their contradictory nature - allows for deliberate attempts at change through alternative responses. There is thus in this model indeterminacy; a route to understanding the role of ideology in shaping action; and the potential resolution of some of the dilemmas for action theorists in their attempts to distinguish between conscious and unconscious exercises of power.³⁸

The concept of practices - actions exhibiting regularity, using tacit practical knowledge and, as integrated assemblages, constituting social systems - is crucial to this framework. It allows analysis to link structure and process, and to overcome the problems of action theorists. The concept of practice also forms the basis of a radical reformulation of organisation theory, as outlined in 3.4.

Structure of Explanation and Delimitation of Scope

An explanation of a particular arrangement or outcome should thus treat all levels of abstraction from the level of the major social groups, relations, contradictions and dynamics of social systems down to that in terms of which the problem is posed. It must identify conditions at particular levels and postulate and examine the means by which they could have produced the arrangements or changes observed.

The more concrete and complex the explanandum and hence the more specific the conditions of existence to be examined, the more we must move beyond the invocation of general laws, tendencies, and counter-tendencies and the more detailed we must be about their mediations.³⁹

For general substantive analysis of social systems, their institutions and

their broad historical development - whether as a level of explanation in itself, or as the context within which more detailed areas of activity are situated and as providing the mechanisms generating the more specific arrangements - this study must rely on others' general expositions, and must therefore at least acknowledge debates at that level and be aware of the controversial nature of any depiction. The general substantive model adopted has been indicated in chapter 1 and is developed in chapter 4. It is intended to be broadly acceptable within a radical paradigm but it does not seek to resolve the many points of contention.

At more detailed levels, it is necessary to dissect social conjunctures in terms of different forms of relations and practices which constitute them - loosely as economic, legal-political, and ideological, or more rigorously in terms of Giddens' modalities of structuration. The relations will be structured: there will be, as Jessop puts it, 'relations among social relations'.⁴⁰ Even though the principle of a Marxist model may be accepted, that the relations of material production are in some sense fundamental in shaping the overall social formation, there is no reason to expect a priori any particular hierarchy of relations in a specific limited area of activity.⁴¹

With acknowledgement of - indeed an emphasis on - the totality, complex interconnections and processual nature of a social system, and the duality of structure, study of a particular area requires ways of delimiting the scope and dimensions of enquiry - of suspending or bracketing certain aspects while others are explored - without lapsing into the forms of abstraction criticised in conventional approaches. Benson, Giddens and Jessop each suggest useful devices.

Benson's is a substantive demarcation into policy sectors in the context of a reformulation of interorganisation theory. Each sector is 'a cluster or complex of organisations connected to each other by resource dependencies and distinguished from other clusters and complexes by breaks in the structure of resource dependencies.'⁴² He calls them policy sectors because they 'frequently become the target of public policy and are to a considerable degree created and modified by public policy decisions.'⁴³ These sectors are conventionally defined substantively - health care, manpower, natural resources, etc. - though the correspondence between the

conventional definition and the sector as defined by its network of dependencies cannot be assumed. Benton's demarcation seems reasonable, though the connotations of 'policy' and the inadequacy of 'resource dependency' for describing exhaustively the relation between organisations should be borne in mind. The sector should be treated as including all relevant activities - production, allocation or exchange, consumption and state intervention - so that their interrelations can be explored; a concentration on organisations may lead to the neglect of sections of society involved in the activity of the sector but without coherence or adequate representation. The demarcation of a sector needs to be justified in terms of a general substantive model of a specific social formation, to acknowledge and not obscure the actual structuring and interconnection of sectors and hence the possibility of change in the wider social formation affecting several or all sectors. Benson's analysis of sectors is taken up again shortly.

Giddens proposes a methodological bracketing for studying system properties corresponding to the elements of the duality of structure: to allow analysis of institutions and of strategic conduct. Strategic conduct is the way in which actors draw on structural elements - rules and resources - in their social relations. Institutional analysis treats structural elements as 'chronically reproduced features of social systems'.⁴⁴

Jessop, in considering the detail of a specific conjuncture, distinguishes structural and conjunctural moments.⁴⁵ Structural constraints are 'those elements in a social formation that cannot be altered by a given agent (or set of agents) during a given time period: it may include practices as well as their emergent properties and material preconditions ...' Conjunctural elements are those which can be so altered. Jessop points out several implications. First, the same element may confront one actor as a structural constraint at the same time it appears transformable to another. Thus the potential power of different actors might be identified with the balance of the types of element in a particular situation. Second, alliances may transform situations by converting a structural constraint for one actor into a conjunctural opportunity. And a structural constraint can become a conjunctural element in the longer term through transformation of the terrain on which the interaction takes place.

3.3 KEY CONCEPTS: POWER AND INTERESTS

Introduction

It is now possible to return to two central concepts in social theory, to see how treatments of them have reflected the prevalent division between structure and action, and how they may be reinterpreted for use in this framework in the light of the discussion of the duality of structure. The first is power; the second is interests or objectives.

Power or Domination: Conventional Conceptions

In the action problematic of pluralist and elitist political theorists power is understood as existing only as consciously exercised by individuals in interactions largely abstracted from their context; typically the power of A over B is the ability of A to get B to do something B would not otherwise have done. Lukes likewise implicitly reserves the term for a capability expressed in action, in rejecting, for example, Poulantzas' 'assimilation of power to structural determination'.⁴⁶ For Lukes' agents, with autonomy within structurally defined limits, the exercise of power involves acting differently. Similarly in organisation theory the predominant conception of power has been the ability to change or deviate from the formal structure of the organisation. In such conceptions of power, the prior conditions for the exercise of power are assumed or ignored; it is not seen as a potential or capacity for action and no attention is paid to the prior allocation of that capacity.⁴⁷

The structural property by which certain groups maintain advantages has generally been termed domination, 'an institutional phenomenon, either disregarding power as relating to the active accomplishments of actors, or treating it as in some way determined by institutions'.⁴⁸

Power and Domination: Dialectical Conceptions

McEachern uses the term power to cover both aspects, distinguishing between, but not clearly relating, the exercise of power and the fact of having power. His definition, though, is firmly in terms of structure, not

action:

Power is a property of the structured relations between classes, and the constituent groups within classes, that enable them to secure their various class and sectional interests.⁴⁹

This conception of power, as the ability to secure interests or to have them secured, allows for effects on groups not immediately involved in interactions; they are taken to have power in the sense that the normal operation of the structured system reproduces and defends their conditions of existence. Conversely they may be adversely affected indirectly. It is not necessary, as in pluralist accounts of power, for a group to have taken an active role.

In dialectical form, these two aspects can be related through Giddens' duality of structures of domination: 'the resources which the existence of domination implies and the exercise of power draws upon, are seen to be at the same time structural components of social systems.'⁵⁰ Rather than using power like McEachern for both transformative capacity and domination, Giddens reserves the term for a sub-category of transformative capacity, used in 'actors' attempts to get others to comply with their wants'.⁵¹ Thus for Giddens 'power is a relational concept, but only operates as such through the utilisation of transformative capacity as generated by structures of domination.'⁵² Moreover, power relations, though relations of autonomy and dependence, are always two-way, in a 'dialectic of control' in which 'even the most autonomous agent is in some degree dependent and the most dependent actor or party in a relationship retains some autonomy.'⁵³

Clegg has a similar formulation relating both aspects, though he is hampered by his conflation of the categories which Giddens separates into different modalities.⁵⁴ The exercise of power 'as a particular type of social action is constructed and acted out by individuals as a ruled enactment ... in the context of an economically conditioned structure of domination.' The structure of domination, articulated through different types of rule, thus grants the prior capacity to exercise power. Clegg stresses the point that an overt exercise of power occurs over issues, that is, when a challenge is made to a significant aspect of the system's operation.

... individual power relations are only the visible tip of a structure of control, hegemony, rule and domination which continues to appear to be the natural convention. It is only when control slips, taken-for-grantedness fails, routines lapse and problems appear that overt exercise of power is necessary. And that is exerted in an attempt to re-assert control.⁵⁵

Jessop likewise restricts power for the level of interaction, seeing it not as a property of agents but as 'a complex social relation reflecting the balance of forces in a given situation.'⁵⁶ But for him it is useful only in a 'limited and descriptive role' assigned post hoc to account for the production of effects within the space defined by the analytical device of 'structural constraints'; that is, it is redundant as an explanatory principle except insofar as the complexity of determinations at this detailed level - 'the attributes, capacities and modes of calculations' of agents - cannot be fully accounted for.

At best the concept of 'power' can be retained to identify the production of significant effects ... through the interaction of specific social forces within the limits implied in the prevailing set of structural constraints. The contingency of power in comparison with the determinacy of structure is theoretical rather than actual. All this implies is that the conduct of the agents in question and, a fortiori, its effects in a given set of circumstances cannot be predicted from knowledge of the circumstances themselves In this sense the analysis of power is closely connected with the analysis of the organisation, modes of calculation, resources, strategies, tactics, etc., of different agents ... and the relations among these agents ... which determines the overall balance of forces.⁵⁷

Hindess rejects a notion of power as capacity belonging to an agent so that outcomes are somehow explicable as the 'vector-sum' of such an attribute for interacting parties. Instead he stresses the need for explanations in terms of specific practices in specific conditions.

Arenas of potential or actual struggle ... have to be analysed in terms not of the differential possession of quantities of power but rather in terms of the differential conditions and means of action available to the contending forces, their strategies and objectives, etc.⁵⁸

Hindess's criticism of a capacity-outcome model, his stress on the complex conditions of specific interactions, and his warning against reductionism are all reasonable, but the extent to which authors he criticises actually display these tendencies is exaggerated. His prescription for analysis does not contradict the notion of potential power by virtue of the different

rules and resources available to groups from their structural location and the specific conditions of the interaction, and of its exercise - by no means inevitable, necessarily complete or automatic - by the mobilisation of these facilities.

Moreover, in stressing the need to analyse specific interactions, Hindess does not adequately deal with the explanation of 'conditions and means of action' in terms of structural properties of social systems. His prescription as it stands contains little safeguard against lapsing into a pluralist disconnection of the site of interaction from its context, an associated empiricist methodology, and neglect of the normal reproduction - independent of significant struggle - of structures of domination.

Interests, Goals, Objectives: Conventional Conceptions

Any model of interaction requires a concept for the orientation of action. Different approaches use interests, wants, goals or objectives, and there is little agreement on the meaning and usefulness of each and their relation.

The theme of goals has been central in organisation theory; indeed the existence of a collective goal has often been taken as the defining feature of an organisation, and the main cause of its structure and actions. A long debate has shown lack of agreement on a definition and produced a catalogue of pitfalls with the concept, but has also generated useful distinctions and suggestions which will be used later.⁵⁹

In political science it has been seen that pluralist studies entail a subjective conception of interests, manifested as expressed preferences as to outcome. Elitist studies extend this to include suppressed wants and grievances. Lukes, in acknowledging a prior phase in such processes and the possibility of unrecognised real interests, necessarily takes an objective definition. But Lukes fails to establish an adequate way of identifying real interests, taking them as wants as they would be expressed under hypothetical specific conditions, those of relative autonomy of the actor. Benton has thoroughly exposed the weaknesses of this view.⁶⁰

McEachern likewise illustrates the inadequacy of Lukes' counterfactual

approach, by showing how it breaks down when one considers an interaction between government and private capital in which the latter appeared successfully to be imposing a policy on the government. Lukes' procedure of the 'imaginary reconstruction in the absence of the exercise of power' gives no guidance to the analyst on how to establish what the government would have done. To fall back on stated policy preferences would be to revert to pluralist procedure.⁶¹

Interests: Radical Debates

For McEachern, power is the ability of an actor to secure its interests or to have them secured, and

... interests are structurally located, that is, socially significant groups have their primary interests as a consequence of the place they occupy in the social structure.⁶²

Analysis thus entails the investigation of actual and potential effects of action on a wider set of groups than those immediately involved. It is also necessary to consider a longer time span than decisional studies to allow for the working through of effects; to stop at the decision output will preclude the understanding of wider interests. It is

important to stress that (interests) are objective, in the sense of being located in the structures of social life, rather than subjective, that is, existing only in the perception of that life. There is a link between the objective character of interests and the ways in which they are perceived by individual and collective actors, but this does not affect their objective character.⁶³

Similarly Westergaard and Resler see interests as determined by social location,

as the possibilities and potential objectives of action which are inherent in economic positions regardless of whether the incumbents of those positions in fact so define their objectives at any given time.⁶⁴

Alford and Benson talk of 'structured interests',⁶⁵ 'built into a sector, either positively or negatively, in the sense that the operation of the sector serves or conflicts with their interests.'⁶⁶ The structure of the sector is 'an arrangement typically empowering and defending some interests at the expense of others.'

Benton, however, rejects the idea of objective identification independent of the ascriber,⁶⁸ claiming it is usually accompanied by counterfactuals and thus lapses back into conflation with wants; or else ethically or historically transcendent viewpoints, or universal theories of human needs, are adopted to anchor it, with the concomitant ontological and epistemological problems. Instead he argues for the identification of alternative objectives through the 'effective action' of subordinate groups in abnormal conditions. A conception of power based on objectives as revealed in the symbolic content of practices can sustain Lukes criticisms of pluralist and elitist notions, but does not entail a notion of 'objective interests'. In retaining 'interests' for other purposes, Benton formulates a notion close to that of Giddens and Jessop as considered below.

Giddens, in a brief exploration of the concept, likewise rejects conflation of interests with wants, though sees the two as closely related.⁶⁹

... to say that A has an interest in a given course of action, occurrence or state of affairs, is to say that the course of action, etc. facilitates the possibility of A achieving his or her wants.

Interests and power are closely related, but contingently rather than logically. Interests, in that they concern the modes of realisation of wants in contingent social and material circumstances, can thus be objectively determined. Giddens rejects the notion that interests are structural properties of collectivities as used by McEachern. Rather, actors have interests by virtue of their membership of particular groups.

Jessop produces a similar but more fully developed formulation which indicates a resolution of many of the contentious points in the voluminous debate over interests. The analysis of interests is to

... be undertaken in a relational context concerned with comparative advantage rather than some notion of absolute interests posited in isolation from specific conjunctures. A situation, action, or event can be said to be in an agent's interest if it secures a greater net increase (or smaller net decrease) in the realisation of that agent's conditions of existence than do any feasible alternatives in a given conjuncture. This implies that an agent's interests must be assessed in relation to the structural constraints and conjunctural opportunities obtaining in a given period.⁷⁰

Actors can face conflicts of interest in relation to different conditions of existence, particularly in that actors are involved in different relational systems and have multiple identities or subjectivities. Thus interests can only be assessed in terms of alternative outcomes in particular situations for specific subjects. The balance for a subject changes with a change of conjunctural opportunities, structural constraints or a redefinition or recombination of identities.

There is thus a dialectical relationship between subjective and objective interests.

Objective interests must always be related to a particular subjectivity occupying a particular position in a given conjuncture: a particular subject can nonetheless miscalculate these interests since they are defined in terms of the conditions actually necessary for its reproduction rather than the subject's own views of these conditions.⁷¹

Benton's conception of interests⁷² is similar but ultimately limited to use in political discourse rather than in the analysis of power relations: distinct from wants; ineradicably evaluative; to be assessed by evaluating various evidence and considerations with no privileged place for self-ascription; and closely related to social identities, the formation of which is a contradictory process. Hindess also finds the concept of interests inadequate as a starting point in analysing interactions; it cannot provide a 'general model for explanation for the ways actors are mobilised in struggles.'⁷³ Rather analysis should identify the various distinct and possibly contradictory objectives actually pursued, partly a result of specific conditions, possibly changing as a result of interaction and with no simple relation to what might be ascribed as 'interests'. In both these and Jessop's formulation is a potential resolution of the problem of attribution of interests and the 'paradox of emancipation' in socialist revolutionary practice: the oppositional use of 'interests' must be rooted in at least some aspect of the social experience of the subordinate actor.⁷⁴

However, if with Benton and Hindess the necessity of interests in analysing power relations is rejected and instead 'objectives' are considered - even as extended and complicated by the inclusion of other evidence of aspiration besides stated preferences - there is a danger of missing one of the main points of McEachern's study: that it is possible for certain sections of society to have its 'primary interests' secured through the

structures of domination as mediated by other actors, without their direct participation in interaction and hence any manifestation of 'objectives'. It seems essential, then, to uphold McEachern's derivation of 'primary interests' from social location. They equate with what Jessop terms 'conditions of existence', which are routinely maintained by the reproduction of structures of domination.

Expectation

The problem remaining with the view of interests as derived from structural location and specific conjunctures is the practical difficulty of their identification in analysis. Derivation of basic conditions of existence is relatively straightforward for certain groups and spheres of activity which fit clearly into the fundamental categories of a mode of production: namely classes, class fractions and individual capitals, in production and exchange. The further one gets from these categories the less extensive a prior derivation can be, and the greater the dangers of circularity and reductionism, because of the objective greater degree of articulation and because other levels and spheres have seldom been theorised in sufficient detail.⁷⁵

The pragmatic approach adopted by many researchers uses this a priori analysis of interests at least as a starting point even if they retain doubts about its philosophical foundation.⁷⁶ The analyst is then faced with groups without clearly understood locations, with the complexity of a limited area and specific circumstances, and the multilayered and often conflicting interests of actors. Here most resort to some of the more expedient ways by which non-decision theorists produce what they term 'expectation' of behaviour:⁷⁷

- defining human needs normatively, so that the set of unsatisfied needs requires investigation;⁷⁸
- comparing similar social collectivities or spheres of activity⁷⁹ and taking suggestions from the diversity of circumstances;⁸⁰
- comparing the same group or sphere at different times;

- looking at the actions of a group in abnormal times, the spread of alternative views during crises, and the reactions to changes in conjunctural opportunities;⁸¹
- identifying contradictions between behaviour and some principle already established as accepted by an actor;
- identifying contradictions between the claims of dominant groups to fulfil some function, and empirical evidence;
- identifying codified rules of exclusion;⁸²
- looking for what Offe terms 'misunderstandings' or 'overdeterminations', that is, contradictory depictions of certain objectives or demands;
- studying the actual or potential effects of a change on a group, in terms of actual or expected losses;
- and similarly in the maintenance of an existing arrangement, the absence of any attempt to redress maldistribution of some item of acknowledged value.

The methods all face the obvious problem of justifying the identity of something that does not exist, since only in observable conflict is a counterfactual readily providable.⁸³ They have particular limitations, and particular normative criteria, which they generally fail to establish and to which serious objections can be raised. They are all expedient; each may or may not work, and the whole set may not be exhaustive or adequate. They should be treated with caution as heuristic devices.⁸⁴

Interests and Objectives

If interests, then, must be related to existing arrangements or potential changes at different levels of abstraction, they may be considered to lie on a scale, and those at different points on it are not necessarily compatible. Gunn and Hogwood illustrate the point - though in a discussion on values - with the example of expenditure cuts:

The necessity for, and incidence of, spending cuts might be viewed from the narrow perspective of the self-interested individual officer within a local authority. Or he might take a slightly broader view in terms of what would be best for his particular sub-division of the department. Or he might raise his sights to consider cutbacks in terms of the department as a whole. A more 'corporate' level of reasoning would require him to take into account the scale and balance of spending within the local authority as a whole. A supreme effort might even allow him to take into account national criteria for assessing his authority's expenditure.⁸⁵

The particular objectives pursued by actors can thus usefully be examined in terms of the level of interest to which they correspond: how they were arrived at in negotiation or debate, and how discourse may have conflated or neglected certain levels.

Returning to the notion of organisational goals, then, these should be seen as contingent on internal processes involving diverse interests and arising from different strategies and rationalities. Taking on board some of the distinctions noted by organisation theorists, distinctions can validly be made between stated and unofficial goals, and between overall and partial goals, the latter possibly fragmented and contradictory. Some will be functional, referring to the performance of a role in society - though not necessarily its objective function. Others will be geared to the survival and growth of the organisation itself or of particular parts or arrangements within it. For each of these categories, analysis must distinguish the elements which are stated or otherwise discursively acknowledged within the organisation, and can thus validly be considered a cause of behaviour, and those, like the rationalities which describe their coherence, which are attributed by an observer according to the patterning of practices and outcomes. The treatment of organisational objectives, in short then, is best resolved in an analysis of organisations as assemblages of practices characterised by specific rationalities, as outlined shortly.

To summarise then, the concept of interests, its necessity or usefulness in the analysis of interactions, and its relation to wants, preferences, objectives, etc., remain contentious, though formulations such as Jessop's point beyond most of the disagreements in the voluminous debate. It is not possible here to try to resolve the matter, but a provisional conception of interests may be outlined: having subjective and objective elements; derived from the structural location of actors and the

specific circumstances of the interaction, though the extent of derivation is limited by inadequate theorisation and analysis needs to resort to more expedient methods; referred to potential outcomes and identities and therefore contradictory. They are related to, but not the same as, wants or objectives: the actual objectives pursued must be reconstructed.

3.4 REFORMULATING FIELDS

Introduction

The treatment of context and action, and the related reinterpretations of power and interests, indicate resolutions of the dilemmas and preoccupations of conventional organisation and political theories at the limits of their paradigms. Pluralist and elitist approaches, for example, acknowledge the importance of social structures and institutions but do not have the conceptual basis to follow this through and are unable to graft satisfactory ways of dealing with them onto essentially individualist accounts. Here a voluntarist concentration on intentional action produces problems concerning the supposed exercise of power through inaction, conscious and unconscious exercise of power, and the attribution of responsibility. Likewise in organisation and policy studies, focusses on policy, bargaining, negotiation and so on, can thus be seen to capture only that small part of social processes involving purposive action. The problems are transcended in a framework acknowledging the maintenance of interests by the normal reproduction of an institution through its routine practices, with associated concepts of practical consciousness, unacknowledged conditions and unintended consequences.

Radical critiques based on essentially the same principles and concepts used here, have tackled specific fields of study with different points of departure and separate disciplinary influences. Not surprisingly they have produced similar criticisms of orthodox theories and convergent guidelines for reformulating those fields. Chapter 2 made use of such critiques, and the general substantive discussion of chapter 4 draws, for example, on Dunleavy's suggestions for a radical reworking of local political studies and public administration.⁸⁶

Here some outlines are considered which are on the lines advocated here and at levels which will prove useful for this study: reformulations of organisation and interorganisation theory, and a discussion of struggles as a particular class of social actions. A suggested reformulation of agenda-formation models for the treatment of political issues is left till 3.6.

Organisation Theory

In reconsidering organisation theory, a useful starting point is Reed's conception of organisations, based on the concept of practices and on Harris's distinction between primary and secondary practices: 'integrative and regulative mechanisms which are developed out of secondary social practices aimed at assembling primary productive practices into coherent social formations.'⁸⁷ Organisation not only facilitates the integration of primary practices but at the same time constrains and orientates them to certain interests and fundamental principles of the wider social formation. A fundamental dialectic exists, then, between the needs to generate commitment and to exert control. Echoing Child's work, Reed warns against a monolithic view of organisations and stresses the different strategies adopted for assembling practices, even as responses to the same constraints and pressures.

This conception, it is suggested here, is consistent with the general analysis so far in this chapter, allows the integration of much that is useful from conventional organisation theory, and accords with other more specific insights from radical theorists, such as Offe's discussion of bureaucratic and functional rationalities as different organising principles, and Benson's similar analysis of bureaucratic and professional conflict.⁸⁸

Benson's more comprehensive outline for a reformulation of organisation theory follows similar lines.⁸⁹ It would analyse the way specific organisations were established, maintained and changed in a continuous process. The morphological categories of conventional organisation theories - goals, formal structures, informal relations, links to environment, etc. - would be seen as giving a useful but limited and static description of surface 'outcroppings' of this process related through it rather than by determinate causal mechanisms. It would study the organisation as a whole, with components interconnected in complex ways besides those formally rationalised. It would not assume the organisation to be rationally articulated or functionally adjusted. It would question not only taken-for-granted distinctions of internal features but also the assumed boundaries of the organisation in its environment, and explain the extent to which they were valid. It would seek the basis of organisational

control and other features in external relations. It would seek contradictions within the organisation; some, like that between labour and management, would be versions of contradictions in the wider social formation, while others would be specific, such as divisions between relatively distinct semi-autonomous subunits charged with different tasks - the theme of task discontinuous organisations developed by Offe and Clegg. It would also look for contradictions affecting the organisation from outside, such as a mandate of contradictory functions, or subjection to conflicting pressures. Much organisational activity would then be understood as attempts to manage, contain or manipulate contradictions.

Organisation theory itself then appears as 'produced by particular groups of people acting within a limited context on the basis of their practical concerns.' Much of it can then be understood as 'formalized solutions of certain actors ... to the technical, practical problems posed by the organisation's dialectical character (and providing) sets of procedures, movements, routines, which may be employed to pursue an objective by cancelling, controlling or capitalising upon the contradictory complexity of organisational life.'⁹⁰

Interorganisation Theories

As observed in chapter 2, the requirements of intraorganisation theory in this study are limited. Of greater importance, then, is Benson's outline of a new interorganisation theory.⁹¹ Again he sees the primary objective as being 'to explain the emergence, maintenance and transformation of interorganisational patterns.' These patterns 'would be explained at the level of the total social formation ... conceived as a multileveled structure of social relations containing contradictions and undergoing periodic crises of development.'⁹² Benson focusses on 'policy sectors', and distinguishes for each a surface level of administrative arrangements, policy paradigms and interorganisational dependencies, and a deeper level of interest and power structures and rules of structure formation. The surface level forms a hegemonic model which the power structure tends to maintain. The elements of the deeper level are generated by the requirements of the larger social formation.⁹³

Benson suggests that groups within a sector are identifiable as: demand

groups; support groups; administrative groups, provider groups, and groups coordinating activities within and between sectors.⁹⁴ Each of these has different interests in the operation of the sector which are fulfilled or denied to varying extents. He suggests specific forms of sectoral arrangement, in part explicable within the sector and in part requiring relation to the wider context. These include subgovernment, a coalition of legislative and external support groups and administrative elites; pluralistic interest representation; and hierarchical bureaucracy.⁹⁵ It is at this level of analysis that corporatism as a specific form can be situated.⁹⁶ To each arrangement, it is suggested later, would correspond a characteristic ideology.

Contradictions may be identified within and between levels, and affect the sector from outside. Thus, for example, the policy commitments of a sector may drift through struggle between groups in the sector; though such responses may be essential to the legitimation of a system and movement to and fro within certain limits acceptable and absorbable in terms of the underlying interests, unchecked drift may challenge the deeper structure. Or changes may come up from a more fundamental level, occasioned by the internally contradictory structure of the sector or the changing demands of capital accumulation affecting the sector from outside.

As well as more or less routine practices and stable relations, there is also continuous 'organising activity'. Most observable conflict remains at a superficial level. Some contradictions may be managed within the existing arrangements; some require changes in policy commitments or reorganisation. Occasionally a crisis in the sector requires its substantial restructuring or even leads to its disappearance as a distinct entity. The analysis of each rearrangement requires the identification of its origins in specific contradictions, the means by which it is pursued, and the consequences for the groups involved.⁹⁷

Benson's rules of structure formation likewise embody contradictions, between those representing different pressures or requirements, between parts of the sector organised on different principles, and from new sets of rules developing within old. Again these may be managed or contained for relatively long periods.⁹⁸

Struggles

Urry usefully develops an analysis of struggles as a particular class of social acts, in the general sense of interactions in which one collective actor seeks to change existing arrangements, in opposition to the interests of another.⁹⁹ Besides the possible straightforward achievement of the actor's objective, which as observed need not represent in any simple way its primary interests, he suggests a range of possible unintended consequences - diverse and often contradictory - because of the structured context:

- reproduction of social systems;
- institutionalisation, in which social conflict is regularised and stabilised;
- innovation;
- increased repression in reaction to conflict;
- heightened struggle, where gains permit and encourage further actions of dissent;
- and heightened contradiction, where consequent structural changes exacerbate the conditions of a group;

In that reproduction of basic social relations in a system requires periodic restructuring of its organisation, social struggle may well be functional for the maintenance of the system; it provides the motor of change but its structured context channels that change towards an unintended outcome. Thus struggles intended to produce change favouring subordinate interests may paradoxically be as important in reproducing a social order as the practices tending to maintain it. This theme is taken up again in chapter 4 in a discussion of the state.

3.5 KNOWLEDGE AND IDEOLOGY

Knowledge and Power

If for the moment a common distinction is accepted between the exercise of power and the application of knowledge as the two facets of social action, it is clear that they have been treated largely separately. On the one hand, social science has studied how outcomes are produced in terms of power relations, but has ignored the content of arguments. At best it has considered information as a resource. On the other hand, much discussion of specific issues, especially technical and scientific debates, and indeed to a great extent the assumptions made by participants in those debates, treat outcomes positivistically as determined exclusively by the merits of the contending arguments.

As Dunleavy argues for policy-making:

... all policy decisions involve two rather different kinds of influences, namely power influences, and ideology influences. To win a policy decision it may be necessary to mobilise power, to organise politically, to invoke sanctions or rewards in an effort to structure the terms of decision, to deploy 'power resources', to seek allies, to isolate opponents, etc. But it may be equally important to win a rational argument, to undermine a policy 'paradigm' intellectually, to solve specific 'technical' problems, to demonstrate a shift in the 'intellectual technology' of the policy area. Current political science and sociology tell us a great deal about the former activities, but precious little about the latter.¹⁰⁰

The two facets are obviously closely interwoven. It is clear, for example, that debate is a significant component of struggle; that knowledge in some form informs all practices and actions; that the dominance of certain views cannot be explained by the 'facts'; that knowledge is an important resource in interactions; and that its possession, deployment or withholding is significant in determining outcomes. In disputes over scientific and technological issues in particular, ostensibly technical arguments are widely recognised to be aligned to institutional interests in terms of optimism, interpretation of evidence, and so on, though protagonists generally deny such a connection. Thus the problem in explanation is: what status should be attributed to technical arguments and their resolution in explaining

outcomes, and what should the disposition of the analysis be towards the content of contending positions?

Knowledge Forms as Social Constructs

'Knowledge' for the purposes of argument here is taken as a general category with no connotations intended of its status or validity. It is meant to cover Giddens' categories of practical and discursive consciousness, as well as rationality, ideology and similar concepts, though the discussion here concentrates on the constitution and deployment of discursive knowledge.

As a starting point it is assumed here that all knowledge is socially influenced: that its forms and content are products of the social process and context of its formation as mediated by the practices of those involved in forming and disseminating that knowledge. This assumption is a more general and stronger form of the vague notion acknowledged in much discussion that knowledge is value-dependent.

The relation between sets of ideas and social structures has formed the subject matter of the sociology of knowledge - and of similar fields of study under different titles - and again it is impracticable to embark here on a full discussion of its debates and findings.¹⁰¹ The intention is rather to outline the principles accepted; indicate some points which the treatment of knowledge aspects of social interactions should take into account; and try to arrive at some general guidelines and questions with which issues in a particular area can be explored.

It is useful to map out two conceptual dimensions within knowledge. First at least provisionally a distinction may be made between cognitive and normative components, corresponding to the requirements placed on knowledge of providing information and understanding on which to act, and of legitimating social actions and patterns. Second, levels of knowledge can be depicted according to the scope of their object. The most general is usually termed 'world-view', or 'universe of meaning', or similar. Being furthest removed from day-to-day experience, it contains strong normative components. At the other end, specific arguments, beliefs, interpretations, 'facts', etc., have a stronger cognitive component, having limited and more

pragmatic concerns. There is no necessary consistency between levels, and indeed arguably a necessary contradiction between the ideological world-view and specific elements rooted in experience. Moreover subjects or spheres at more specific levels form to varying extents separate subuniverses of meaning, developing in particular ways and often with rival bodies of knowledge.

Ideology

Conventional political theory is characterised by a poor conception and almost total neglect of ideology; hence Lukes's recognition of the need for a prior stage of ideological influence in agenda-formation. The treatment of ideology in radical theory, in most conceptions broadly concerning what was termed above the normative elements of knowledge, has remained largely at the general level of the constitution and differences of views of the overall social order, as related to classes and the maintenance of class domination.¹⁰² Ideology is taken to form a relatively coherent ensemble of representations, values, and beliefs, originating in experience of a contradictory reality, to some extent corresponding to it and reconciled with it, and indeed incorporated in practical conduct as well as in discourse. A dominant ideology conceals or distorts relations of domination, abstracting and fixing superficial relations or appearances as natural or normal, and elevating its values to the status of self-evident imperatives. It is not only a product of a social system but also a condition for its reproduction; the importance of ideology in the maintenance of domination in advanced capitalist societies - by consent rather than coercion - has been stressed by many radical theorists. A critical notion of the social determination of all social knowledge precludes a view of ideology as a 'false consciousness' as opposed to somehow objective scientific knowledge of social life. But it is neither necessary to accept another significant tendency in Marxist thought, the notion of ideology as a determined epiphenomenon of economic and political structures. Rather ideology is a site of struggle in itself: analysis must allow for diverse mechanisms whereby individual and collective social actors are brought to particular positions, and expect contradictory elements in them.¹⁰³

The analysis here must be able to deal with more specific levels -

with the sets and flows of ideas within or across the broad class boundaries with which most treatments of ideology have dealt. It is at such levels that, for example, Benson has suggested the concept of a 'policy paradigm' in a sector,¹⁰⁴ and Dunleavy has identified overlapping managerial, professional and partisan ideologies in public administration and argued the importance of professions as carriers of ideas across organisational boundaries.¹⁰⁵ These more specific ideologies perform the same but smaller-scale function of establishing or maintaining cohesion across differing interests. It is suggested here that the notion of a hegemonic project, developed for the level of social cohesion in a nation state,¹⁰⁶ can be usefully translated to a lower level: to attempts to establish particular views of more specific domains, to try to induce other parties to see issues in terms which advantage one party. It may operate across divisions within organisations in the construction of a corporate 'ethos', and between organisations as pursued through public and professional debate, publicity, and so on. Attempts to establish hegemony will involve some or all the main ideological forms identified by Giddens:

- the representation of sectional interests as universal ones;
- the denial or transmutation of contradictions;
- reification, or the naturalisation of the present.¹⁰⁷

To the extent that sectors and other institutional structures are isolated, and as Cawson and Saunders suggest, develop different forms of politics, sharply differing ideologies may develop.¹⁰⁸ Corporatist forms, with isolated bargaining between organisations and simultaneous formation and implementation of policy, are likely to be characterised by a pragmatist, reformist ideology.

Epistemology

Treatment of the cognitive or rational element of knowledge depends on the epistemology which is taken to govern knowledge of the social and natural worlds. Briefly, a need is accepted here for reference to empirical observations as tests of validity, even allowing for the theory-laden nature of such observation and the rejection of notions of objective facts.

Knowledge of both worlds is obviously mediated by human practice and is therefore subject to social influence in selection, form and content. Theory-dependency, however, is not equivalent to theory-determinacy, and a substantive relativist position towards disputed knowledge must be rejected.¹⁰⁹ While the conception of ideology and science as antithetical is rejected too, it is maintained that science has two ideological aspects. First, there is a powerful ideology about science - in the self-image and pronouncements of practitioners, in the conception of science outside, and in the use of science to legitimate actions. Second, scientific theory, as a product of human practice in a social context, can itself be penetrated by ideology. There are and must be differences in social and natural sciences and knowledge of the physical and social worlds; in particular, the degree of penetration by ideology, and the potential ideological function, is greater for social sciences.¹¹⁰

Determinants: Knowledge as Historically Specific

A view of social knowledge as a social product implies that the level of demand for it, the particular areas investigated, and the constitution of that knowledge in certain forms, are historically specific. They are strongly related to increasing state activity: cognitively to the complexity of problems of maintaining social stability and managing contradictions shifted into the political sphere; and normatively to a need to legitimate its actions as natural, necessary and based on acceptable principles. Thus the state has acted increasingly to structure and direct the development of social knowledge in appropriate forms, and that knowledge comes to reflect the characteristics of its approach.¹¹¹ The more the state is required to intervene to maintain a system in specific interests, entailing the securing of the hegemony of one interpretation of its operation, the more the state must disguise its class interest in an appeal to supposedly objective social knowledge. This leads, as critical theorists have argued, to the rise of rational planning and quantitative methods, and of a technocratic ideology; policy-making becomes 'depoliticised' or 'scientised'.¹¹²

The construction of technical knowledge is particularly important here. It depends on the relation of technical experts to political arenas, and the process of negotiation between them over the objectives of their work, affecting not only the adaptation or transformation of knowledge but its

very content.¹¹³ The importance of paradigms in technical groups has already been suggested: practices are maintained by assumptions, styles, exemplars, models, etc., and activities are thus directed along certain paths without explicit decision points.¹¹⁴ These objectives need to be related to those of outside social groups.

Similarly in debate it is necessary to dissect the components and levels of arguments, and consider the social influences they contain and the interests furthered by their deployment and acceptance. The channels through which specific interests are effectively embodied will be at several levels: from the general correspondence of a form of rationality to a particular social formation - incorporated in practical consciousness but probably not discursively acknowledged - down to the conscious manipulation of information to suit an argument. Thus assumptions may be identified, for example, about the domain to which the debate should be restricted, the features of the issue deemed significant or relevant, and the methods considered appropriate for analysis.¹¹⁵ The degree of 'factual' character of knowledge items, and the credibility of challenges to them, are themselves social constructs. Formal procedures for assessing technologies were considered in these terms in 1.3.

The nature of the arguments, and of the knowledge deployed in them and resulting from their resolution, requires specific examination. An evaluation may be, at the one extreme, an entirely legitimatory exercise, assuming artificial consensus, obscuring social divisions and power structures, and arriving at a predetermined and desired result through the careful selection of initial assumptions and methods. It may present a choice of a restricted number of options between which dominant interests are disinterested. It may at the other extreme represent a genuine attempt to explore alternatives without constraint and assess them according to agreed definitions and a logical calculus without bias towards one result. It depends on the context and the constitution of the arena in which the debate is conducted; such characterisations must be justified empirically.¹¹⁶

As to the relation between levels of knowledge, specific arguments and interpretations vary in their consistency with higher level notions. The normative elements are effectively drawn on implicitly or explicitly as a

resource in interaction. Thus particular views of issues will be advantaged to the extent that their assumptions and methods fit with prevalent rationalities and thus remain implicit, and that they can adduce appealing general norms for explicit support. Arguments against existing arrangements are thus disadvantaged. Not only can the sanction of explicit general norms be brought to bear on them, but they also require justification through challenges to deeply embedded normative elements; that is, critical arguments must take on the harder task of extending the terms of reference of the debate to allow questioning of underlying assumptions.

Technical Rationality and Technocratic Ideology

The concept of rationality, as a pattern of rules which direct practices towards some objective, has already been introduced. It applies equally to intellectual practices, that is, routine elements of what might otherwise be considered discursive knowledge formation - in the paradigms suggested as operating in any field of theory. In criticising conventional social theory a relation was indicated between intellectual practices and the activities they theorise. The importance of economic rationalities, for example, and their reification of specific social relations in formal techniques, has been analysed elsewhere.¹¹⁷

Advanced industrial societies have been depicted as dominated by a technical rationality, and its nature and significance form another large topic of debate.¹¹⁸ Most conceptions of it depict an instrumental mode of thought which separates means and ends and is concerned obsessively with choice between means, leaving ends to be set by default. It contributes to the separation and disaggregation of issues which hinder both a comprehensive grasp of structures of domination and a strategic response to problems.

What is of more concern here is the associated technocratic ideology which upholds that rationality as the model for all knowledge and action, and which therefore legitimates certain criteria and procedures for decision-making. Sanderson has attempted to identify the important elements in this ideology.¹¹⁹ It contains conceptions of

- an appropriate mode of development of social knowledge;
- the nature of the social world;
- and the appropriate mode of utilisation of social knowledge.

It embodies three strong normative themes:

- a liberal economic model of human activity, based on the maximising self-interested individual;
- a rationalism, as outlined above, and related notions of progress, efficiency and economy;
- and a materialism which asserts the primary importance of economic growth.

For critical theorists in particular, domination thus appears as a submission to the fulfilment of technical imperatives which bring the material benefits of 'progress'. Disputes are seen as resulting from ignorance of facts, and it is assumed that a consensus can be achieved by the discovery and assertion of such. The replacement of politics by technocratic guidance from experts is seen as desirable and inevitable. Expertise is elevated as a source of authority. Dunleavy points out some important consequences of technocratic ideology.

Since a policy system ostensibly based on rational arguments places no special virtue on compromises, stressing instead the 'one best solution', situations of ideological disequilibrium tend to produce a polarisation of professionals around rival solutions. Policy conflicts are universalised and intensified, not least because staff move between agencies seeking niches appropriate for their standpoint and thus concentrating into centres of knowledge production or technique development which become highly differentiated from each other.¹²⁰

Status of Arguments

What status, then, should be accorded to the content of, say, technical or economic arguments in an explanation of outcomes? That is, in what sense do arguments decide the result of debate? A positivist notion of objective facts, and the corollary that these do and should decide the

outcome, is obviously unsatisfactory; it is, itself, part of the technocratic ideology which characterises conventional argument, and of the self-image of the role of technocrats. But also rejected here is a relativist position which asserts that analysis should not and need not judge the validity of such arguments. An argument has already been made against the introduction of relativism into the sociology of technology of the sort which has formed the basis of recent developments in the sociology of science. If it is accepted that arguments are socially constructed then it follows that a relativist approach leads into relativism with respect to social interests, that is, political neutrality. It denies an understanding of the content of such argument as embodying social influence and thus leaves the outcome of debate underdetermined in analysis.¹²¹

Rather, the role of an argument is to be analysed specifically and with reference to its content, on the lines indicated above, showing in particular how elements of knowledge - scope, form and substance - are drawn on as resources in the process of formation and deployment. Insofar as knowledge is penetrated and shaped by ideology, it can be further argued that its deconstruction requires practical opposition as well as intellectual critique - that there are limits to analysis by an outside observer.¹²²

While the provisional distinction between cognitive and normative elements of knowledge may be acceptable analytically, it is clear that it is misleading to assume any particular division. If a positivistic notion of objective facts is rejected, with either values as a separate realm or ideology as a distortion of scientific knowledge, then social influence with arguably normative elements enters into all knowledge. Given the ideological potential of the presentation of knowledge as objective, the practical implication of this discussion for the analyst is in any case that a critique of the knowledge aspects of social actions requires detailed engagement with the form and content of arguments in order to account for its role in furthering certain interests, whether or not it is deliberately deployed to do so. In other words, analysis must always attempt to push the division back to a minimum of what is taken as objective or factual.

3.6 TERRAIN AND ISSUE

Treatment of Issues

So far this chapter has dealt with, first, the constitution of actions and interactions, and, second, the formation and use of knowledge in a broad sense. It should now be possible to combine the two aspects and return to the problem of understanding the formation and passage of an issue as developed in theories of agenda-formation, to see how they may be reinterpreted and their insights retained. A framework better able to deal with structural effects should allow analysis of the relation between the issue and the institutional terrain, drawing together the often separately treated matters of structure, process and content. In particular the intention here is to clarify the forms of influence likely to operate at each stage of that development. These are no longer limited to deliberate exercises of power, so that the effect of structural constraints, routine practices, unintended consequences, and in particular ideology, can be taken into account without the confusion of the individualist paradigm when treating other than purposive rational action.

Offe: Selection Mechanisms

Offe has presented a structural counterpart to the agenda-formation model, starting from the question of the class character of the capitalist state: how it operates with relative autonomy from individual capitals and yet serves the interests of capital as a whole. Offe attempts to explain how the class character of the modern state resides in its internal structure, by conceptualising its system of governance as a set of filters or selection mechanisms. These allow qualitatively discrete interpretations of needs through, while denying others expression; they systematically exclude certain types of event.¹²³

There are two forms of selectivity, claims Offe. The first must distil a class interest out of 'narrow, short-term, conflicting, incompletely formulated interests of pluralist influence politics',¹²⁴ that is, must select only those items which coincide with the long-term collective interests of capital.¹²⁵ The second complementary form must filter out challenges to

that dominant interest and conflicts which might disrupt or threaten it otherwise. Offe stresses, however, that the contradictory location and nature of the capitalist state means that its internal processes cannot be adequate to the task of generating policies guaranteeing the interests of capital.

Offe identifies four levels through which selection operates: structure, ideology, process and repression. They are sequential, each operating as limits within the limits set by the prior level. Structural restrictions include a limit to the radius of state policies, availability of information or resources, and the absence of appropriate bureaucratic organisations. A set of premises and barriers define the scope of possible policy outcomes. Ideology then promotes a selective perception and articulation of the problem. Further mechanisms then operate in the institutionalised process of policy formation and implementation.

Formal rule-structures determining the processes of parliamentary consultation, "collective bargaining", bureaucratic planning and administration, policy-discussion by academic experts, election campaigns, and political mass-communication are never mere procedural formalisations but they predetermine as such the possible content and possible outcome of the process. They do so by investing certain policy-contents with increased chances of being implemented, by providing certain interests with a head start, and by granting them chronological priority, relatively more favourable coalition chances or the opportunity to employ specific power resources. Every procedural rule creates conditions of being favoured, or conversely of being excluded, for certain issues, groups or interests.¹²⁶

The last stage is repression, or the threat of it. Offe acknowledges that this categorisation only indicates a general selectiveness. Specificity and class character must be established by empirical study.

The distinctness of the categories and their nested relations are questionable. For example, 'structure' is limited to material, organisational and informational conditions, and ideology would seem implicated in both these 'structures' and in 'process'. In place of repression, the more general category of sanctions as Giddens uses it, covering both coercion and inducement, would be an improvement.¹²⁷ Nevertheless the schema is a useful starting point insofar as the terrain can be considered static.

Structure of Influences

There is no simple correspondence between Offe's levels and the barriers of der Eijk and Kok's model of agenda-formation,¹²⁸ though they would ultimately have to produce the same end result. Moreover, the pattern of development in detail will, of course, be specific to each issue and set of circumstances. But it is possible to suggest a likely structure of influences on an issue, and how the different elements of the processes described by Giddens and Jessop are likely to predominate at each stage.

In accord with Lukes' account, as elaborated and illustrated by Gaventa,¹²⁹ influence at the early stages is predominantly ideological, tending to maintain routine responses and practices reproducing the existing order and to suppress the acknowledgement of contradictions. Their continued suppression relies on inadequate discourse. This is therefore the field of ideological struggle, to create an awareness of interests in change. The analysis should be able to deal with groups continuing to suffer the effects of a central and entrenched contradiction - such as the continued exploitation of wage labour - or one which requires change in order to preserve its conditions of existence - say, by a section of capital seeking government intervention against the relative decline of its sector.

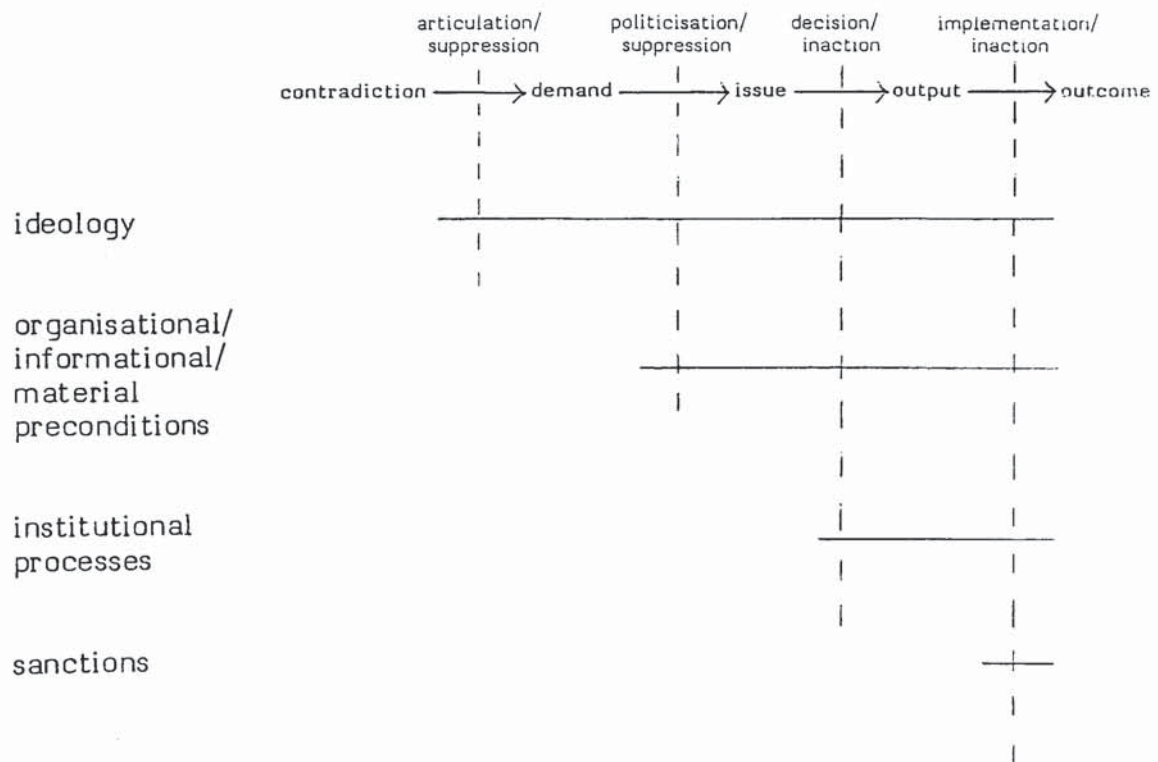
Structural conditions in Offe's sense - including the existence of organisations with authoritative or allocative power to act on an issue - then become important. Ideology is again implicated here in the selective perception and articulation of problems. It should be recognised that organisations may not simply be responding to wants or grievances articulated outside, but may be articulating issues themselves through their interpretation of their own needs or those of groups on whose behalf they act in some sense.

In the subsequent institutionalised processes - the realm of pluralist and elitist accounts - the issue is shaped more by direct interaction between groups, involving the exercise of power in the limited sense arrived at in 3.3. More active and deliberate mobilisation of resources, and greater importance of discursive consciousness in the motivation of action, can be expected. Organisational structure and ideology are still

implicated in these stages, however, as depicted in Giddens' account of the constitution of action - as in, for example, the nature of political arenas dealing with the issue, and the selection of criteria and possible solutions in decision-making.

It is here, where policy content may often legitimately be seen as embodied in central policy-makers' conceptions and practices, that many insights from decision theory could be situated and utilised. Suggested cultural or psychological patterns in their behaviour must not be left unexplained; they should be seen in the light of the discussion on the constitution of agents' subjectivities. The interest here in notions of, for example, satisficing or incrementalist strategies is not to judge their rationality in their own terms, but to be aware of their existence and possible importance and to explain their origins, their reproduction as practices, and the wider significance and functionality of the outputs they produce.¹³⁰

It is suggested, then, that a suitable blending of Offe's model and the agenda-formation account could be represented thus:



Terrain and Issue

The main criticisms of the agenda-formation accounts reviewed in 2.4, arising from their confinement within an individualist paradigm, have already been made. But cursory observation of actual political processes suggest additional criticisms, this time similar to those levelled at the rational model of policy processes considered in 2.3. They imply, though possibly not necessarily, a single decisional arena through which issues are channelled. They tend to assume that issues pass along a single channel in a linear and sequential process towards it.¹³¹ Van der Eijk and Kok themselves recognise this as the 'fallacy of inputism'. Government is reduced to a black box which 'channels, reflects and expresses commands and instructions that come from elsewhere.'¹³² This leads to a neglect of output and its consequences, particularly on subsequent rounds of the policy process dealing with the same or related issues - that is, some sort of feedback;¹³³ and of possible interaction between the terrain and the content of issues passing through it.

Actual institutional terrains are far more complex. The origins of issues in social contradictions may be multiple or diffuse. The agenda-formation approach implies a single definable need or want which may or may not become politicised, and is then dealt with by a particular policy formulation or blocked. In reality a particular outcome may address a number of needs or interests. It may turn out to serve an entirely different purpose to that originally intended; take, for example, the source of the original demands for nationalisation in McEachern's study and the effect of the final outcome.¹³⁴

The distribution of action and interaction between different sites must be explained.¹³⁵ The extent of legitimately political aspects of any activity will vary, and the role of the political sphere will take varying forms only one of which, in exceptional circumstances, will be that of full political power to authorise and allocate, that is, with no restriction on the courses of action it can consider.¹³⁶ The opposite extreme of effectivity is that in which the allocation of resources is decided completely outside the political sphere - as in many private investment

decisions with large social effects - and in which any political function which exists is entirely legitimacy. Beyond the assumptions of much policy studies work, analysis must account for the role of political arenas as sites not just of allocative and authoritative decision-making, but also of legitimation; hence the view of public inquiries, for example, as rituals involved in consensus-formation.¹³⁷

Even state responsibility is usually fragmented. An issue may be shifted between sections of the state, split between them with subsequent contradictory outcomes, or neglected altogether because it is not catered for by existing arenas. The division of responsibility between representative political and bureaucratic spheres will be one of the most basic features of the terrain. As Smith and Wood argue, this division must not be taken as given.¹³⁸ Historical and contemporary variation show that it is a product of several factors, especially the organisational and procedural legacies of previous forms of state intervention. Nor can it be assumed to correspond to a simple division between policy-making and implementation. It is inadequate simply to judge these as anachronistic; the structure may be the means by which particular interests are defended from challenge. Sometimes the shift of an issue between these spheres may be more deliberate and less a matter of routine. A contentious item may be moved out of a representative political arena in order to defuse dissent. Conversely, to force an administrative issue into political debate may represent a significant exercise of power itself.

Similarly the processes by which problems are defined in technical terms and consigned to an expert sphere, and the effects this has on options and outcomes, must be observed and questioned. As with the bureaucratisation of issues, there may conversely be a need to repoliticise an issue - to broaden the terms of reference of a technical treatment to reintroduce their social basis.

The issue itself, then, is an equally important focus of study. Its progress is related to the constraints and actions at each stage of its passage. Its form and content are shaped by various independent and interactive processes of knowledge formation and dissemination, characterised by specific rationalities and imprinted with specific ideologies. The form it takes at a particular stage to a large extent

determines its subsequent routine institutional route, the scope of debate and negotiation, the legitimate and authorised forms of policy output, and so on. Conversely, the terrain itself may be affected by the passage of the issue. For example, the issue may reflect on the organisational inadequacies of the responsible bodies, so that organisational reform itself becomes a potential output of the process. Or alliances may be formed around a specific issue and may be crucial to its resolution. In short, policy processes cannot be studied in isolation from the substantive issues they are dealing with.

3.7 APPROACH

Guidelines

From the discussions in this chapter, it should now be possible to draw together procedural guidelines for the study of a particular sector or more specific activities within it, which both retain the principles espoused in 3.1 and can accommodate the specific character of processes associated with technological change which were identified in 1.3.

For general analysis of a sector, the tasks are to:

- identify, locate and characterise the collective actors in the sector, trace the network of relations between them and their connections outside, and situate the sector, all with reference to a general substantive model of the whole social formation;
- trace the historical development of the sector up to and during the period in question, in terms of internal dynamics and effects of change in the wider society.

Hence for a specific interaction:

- trace the historical trajectory leading the parties to interaction, consider the interests of the parties as derived from their location and in relation to potential outcomes;
- consider how these interests are represented in objectives and policies, and trace the internal and interorganisational procedures by which they are generated;
- identify the structural elements drawn on by actors in the process of interaction, looking for economic, political and ideological components and considering the different modes of their mobilisation: in devising conscious strategies and tactics, in following accepted procedures, in acting within existing constraints, in attempting to challenge them, etc.

And for an issue:

- trace its origins as the manifestation of a contradiction, its passage through institutional arenas, the changing form and content of the issue as a result of interactions and the effects of the issue on the terrain.

Warnings

It is not claimed that these guidelines provide an operational prescription for analysis which can be mechanically applied; nor that they rigorously follow any one of others' approaches reviewed in this chapter. They should, however, at least allow analysis to follow their broad direction, not to conflict with their more specific contentions which have been accepted in the discussion, and to incorporate their improvements over conventional treatments.

Two additional points must be stressed. First, whatever forms of delimitation of scope, bracketing of moments, units of analysis or other simplifying devices are adopted, it must be remembered that these are to varying extents expedient. They are more or less artificially imposed on complex reality and their suitability must be argued for a specific focus. They must not be transferred without justification nor allowed to obscure outcomes which undermine their validity. Referring back to the criticisms of conventional organisation theory, for example, justification is needed of the extent to which organisations or groups can be considered consistent and therefore having a uniform collective identity and interests, or themselves need to be seen as sites in which externally presented positions are produced by internal struggle.

Second, particular connections between power, interests, objectives, etc., have been proposed, some logical and some contingent. The discussion stressed the complexity of articulation of even a small area of social activity - in Jessop's terms, the multiple and contradictory chains of determination needed to specify a conjuncture - and the indeterminacy at the level of interaction, whether this is seen as inherent, as in Giddens' model of action in the context of structuration, or in the practical

impossibility of an exhaustive analysis through Jessop's method of articulation. Together these mean that there is no simple correspondence between interests, objectives, strategies, actions and outcomes. Each process whereby outcomes are produced in interaction needs to be reconstructed and argued. There can be no 'reading off' and comparison of capabilities and resources from social structure to arrive at a predictable outcome.

The argument of this chapter has been almost entirely concerned with procedure and concepts for analysis, though it has touched on more concrete depictions of the state and policy-making. In the next chapter, the discussion moves to a general substantive analysis of the energy sector and its key actors.

CHAPTER 4 ENERGY SECTOR AND MAJOR ACTORS

4.1 INTRODUCTION

The last chapter was almost entirely concerned with procedure and concepts for analysis, though it touched on more concrete depictions of the state and policy-making. This chapter is intended to give a general substantive account first of the energy sector in Britain, and second of the key institutional actors involved in CHP and DH: central government, the nationalised industries and in particular the electricity supply industry, and local authorities.

The discussion of the sector broadly follows Benson's approach as described in 3.4, looking at:

- the functions and significance of energy provision in the social formation, and the relations between organisations in the sector and outside;
- the structure and development of production, consumption and state intervention;
- at the policy commitments, administrative arrangements, interorganisational relations which have characterised the sector.

Because of the specific topic, it concentrates on the national political economy of energy, particularly of electricity supply and heat use. It leaves aside, for example, the geopolitics of oil supply, except insofar as major changes have affected the sector and the wider economy.

An attempt is made to relate the observations on the sector and the major actors to the character of British society as a specific advanced capitalist economy and wider social formation, and especially since the energy sector is to a large extent nominally under public control, to an account of the state as developed in Marxist work. A review of such theory and the debates on it is beyond the scope of this thesis; instead what is intended to be a broadly acceptable characterisation is presented

in 4.3.

This general substantive discussion, following the arguments of chapter 3, has three purposes. It is first intended as a contribution to a more adequate understanding of the energy sector, and should thus be useful for analyses of other energy issues and technologies. Second, it can be treated as a level of explanation in itself for the neglect of CHP and DH in this country, in that the structure, broad development and programmes of the sector set preconditions for its exclusion. This explanation is pursued further in 9.1. Third, it provides the context for the detailed accounts of activity on CHP and DH in chapters 5 to 8. For this purpose the discussion here must be more than just background: as argued in chapter 3 and elaborated for this study in chapter 10, the context sets the possibilities and constraints of this action.

The discussion in this chapter has a wide scope and thus relies heavily, though selectively and critically, on other work. Its observations must often be regarded as assertions or suggestions which in themselves need investigation and evaluation. At this level of analysis, of course, comparative studies between different countries would be appropriate and invaluable. The aim here is to show the extent to which a consistent picture of the sector and its context can be constructed based on the approach developed so far.

4.2 ENERGY PROVISION

Introduction

It seems reasonable to take the social activity of the provision of energy - its production, allocation and use - as forming a relatively distinct unit of analysis or 'policy sector', broadly as proposed by Benson.¹ The specific topic makes possible some further delimitation of scope, in that it is not necessary to venture here into the international political economy of fuel supply, or into other distinct areas of energy use such as transport.² This demarcation, of course, then implies consideration of the relations between this sector and others: through the wider activities of key actors involved in the sector, like central government; in the wider social determinants of the level and nature of the activities of the sector - such as the demand for its commodities, or the restrictions imposed by planning or environmental policy outputs; and in the use and effects of its outputs.

Discussion of energy, especially in the vast literature since the mid-70s, shows particular preoccupations and emphases.³ Much has been concerned with technical merits or problems of technological options, often with implicit technocratic assumptions as to the political neutrality of the subject area and the role of such contributions. Much has had a normative concern with energy policy, in the sense of the action that governments should take, with many of the paradigmatic assumptions identified with general discussion of 'policy', such as the supposed centrality and omnipotence of governments in decision-making and implementation. Most political scientists have concentrated on international aspects.⁴ A few have suggested that organisational structure affects policy outcomes, technological choices or the more general development of energy provision.⁵ Very few have taken this as a starting point and explored the ways in which this occurs.⁶

That British society is based on a capitalist mode of production, with its particular logic and requirements, means that its energy sector is structured and operates in a way which both reflects the character of the system and is a basic condition for its functioning and continuation. In

part the features of the sector come from the energy supply industries being organised themselves on essentially capitalist lines, though it will be seen that increasing state control and restructuring of the industries has been necessary to guarantee the adequate performance of their essential role in the economy. The sector's historical development, outlined shortly, has interwoven with these principles and with the country's particular physical and resource characteristics the important peculiarities of the British economy, state and society.⁷

Energy in Society

Energy is basic to all social activity and crucially so in industrialised societies because of the size of energy use sustaining production, distribution and communication.⁸ It is only one of several inputs to most productive activity and quite large price fluctuations can be and have been absorbed. Nonetheless, with a high inelasticity of demand and the difficulty of substitution between fuels in the short term, disruptions to supply threaten the whole economy and hence assume great political importance. General political and media attention thus tends to be spasmodic and at times of shortage. At other times energy is simply expected to be available for its various uses in the economy.⁹

The pervasiveness of energy use has important implications for its political treatment - that is, as a distinct policy area. The pattern of energy provision and thus policies explicitly intended to affect some aspect of that pattern, have effects on other sectors and specific issues, such as welfare, employment and environment. Conversely the pattern of energy use in a multitude of activities affects, primarily via the composition and totals of demand, the energy industries. Many events or policies with a major impact on energy provision originate outside the sector, and many decisions made within it are forced by the dictates of other sectors. Hence the difficulties, albeit varying according to the political acceptability of different mechanisms, of intervention to influence demand. The balance - the relative importance attached to the energy aspects of a particular issue, or conversely the extent to which other aspects are explicitly acknowledged in energy decisions - can be seen as historically specific. Thus, for example, in spite of the exhortations of advisory groups in the 70s that energy implications be dealt with explicitly in local

government planning procedures, that has seldom been done and often discouraged.¹⁰ Employment implications of energy decisions have on occasions been significant concerns, notably in the contraction of the coal industry, the maintenance of the power engineering industry, and as described in chapter 8, in recent debate on conservation and CHP/DH.¹¹

Production and Distribution Chains

The production and distribution of energy can be conceptualised as a set of chains, involving extraction or procurement of initial form, conversion processes at any number of points, transmission, distribution and end use.¹² Certain energy forms are in competition for conversion processes and end uses; others have an effective monopoly. The significance of different fuels and sources, and of intermediate and end conversion processes, has varied enormously through this century. At the turn of the century energy provision in Britain was almost entirely based on coal, used directly for heat and steam raising, and via conversion to coke, electricity and gas. The significant chains now are:¹³

coal - electricity - light, motive power, heat, communications

nuclear fission - electricity - ditto

natural gas - direct use - heat

oil - heat, motive power, electricity

Within, between and around these chains of physical processes are the relations of ownership, control, allocation, regulation, etc., which have established, maintained and changed the activities.¹⁴ Feeding into the chains are the processes of technological development, adoption and production of the equipment used at the various stages; again a particular structure of organisations, of relations with other groups in the sector, and hence of influences shaping the technological character of the developing systems, needs to be analysed.¹⁵ The general character of the sector's social structure and its historical development are explored shortly.

State Policy Instruments

A wide variety of policy instruments are available to the state for influencing activities in the sector and have been used for such:¹⁶

- organisational restructuring, including nationalisation, privatisation and liberalisation;
- cooperative or indicative planning;
- investment control: approval, loan sanction, ceilings;
- financial control: pricing directives, financial targets, setting interest and discount rates;
- control of imports;
- grants, subsidies, loans;
- technical standards;
- shareholding and other control of private enterprise;
- regulatory measures: licences or franchises with various conditions;
- prescription or proscription of practices;
- miscellaneous directives and specific powers;
- taxation;
- inquiries or legal action;
- informal negotiation, persuasion;
- state energy use and equipment purchasing;

- research and development, demonstration;
- publicity, information, exhortation, education, structuring of or intervention in debates.

To list them as here says nothing about their legitimacy, efficacy, consistency, unintended effects, the determinants of the choice of measures or how they might relate to overall objectives. Certainly the analysis in this chapter entails the rejection of the common picture of government deciding policy and then directing the sector to suit. Some measures will be affected by economic or political forces outside state control. The use of one may entail or depend on others. One may tend to contradict another. The legal status and political acceptability of each depends on specific conditions, in particular whether the relevant body is in state or private ownership. Removal of a standing measure also constitutes an intervention. The measures here do not include those affecting all sectors of the economy nor those incidentally affecting energy through intervention in another sector, such as industrial policies affecting demand or planning controls affecting facility siting.¹⁷

The British Energy Sector in the Twentieth Century

For the first half of the century, energy production in Britain was based on coal, used directly for heating and steam raising, and via conversion to electricity, gas and coke. Total primary energy use increased by around 45% in that period, accounted for almost entirely by increased coal output (App. 9); in 1946, coal still formed 93% of TPE.¹⁸ Mines were privately owned, and besides bulk supply to other industries, most was distributed via merchants. Gas and electricity undertakings were municipally or privately owned.¹⁹

Besides regulation of gas and electricity utilities, state energy policy such as it was in the early decades of the century centred naturally on coal: limited intervention followed the pattern of price rises, shortages and general health of the industry.²⁰ There was considerable direction of energy use in industry by the Ministry of Munitions in WW1, but then a reversion to non-intervention, despite the problems created by coal

shortages and price rises for several years afterwards.²¹ Efficiency of use was still the major concern of the only really comprehensive official review of energy matters in the interwar years, by the Board of Trade's National Fuel and Power Committee in the late 20s.²² Probably the most significant measure taken by government to influence industry's coal use was the reorganisation and centralisation of electricity generation, encouraging industries to take a public power supply rather than generate their own.²³ Intervention in the domestic sphere was limited to the actions of the Ministries of Reconstruction and Health on heating for local authority housing.²⁴

There was widespread recognition in the 30s of the need for a thorough restructuring of the energy industries. Following tight state control in WW2 and the acknowledgement of the importance of energy with the establishment of a separate ministry, the coal, gas and electricity industries - except for coal distribution - were taken into state ownership in the late 40s, for reasons and with results considered in 4.4. The working out of relations between government and the new nationalised industries was crucial in establishing the postwar pattern of energy provision and policy. The findings of the Ridley Committee on National Fuel Policy in 1952 and the avoidance of even its modest proposals showed the retreat from intentions to coordinate the energy industries or plan the development of the sector comprehensively.²⁵

The chief concerns of the first postwar decade were the inadequacy of coal supplies for increasing demand, the need to expand electricity generation, and security of supplies of oil as it grew in importance. The 1950 Plan for Coal stressed maximising production and investment in new pits and mechanisation.²⁶ Much hope was placed on the first nuclear power programme announced in 1955.²⁷

As fears of a continuing energy gap diminished, so did interest in end use efficiency. Emphasis shifted to securing ample supplies of cheap energy to sustain economic growth, and designing the mix of primary energy forms.²⁸ In spite of events at Suez, political uncertainty over oil supplies diminished and prices fell from 1958 onwards. Uncertainty in other areas of supply were increasingly displaced onto a stable and adjustable supply of oil. Coal markets were eroded for several reasons:

competition in the domestic sector with gas and electricity; concern over air pollution, and the Clean Air Act; the conversion of railways to diesel and electric locomotion; the albeit short-lived switch to oil-based gas production; and increased efficiency in most conversion processes. Thus despite early government commitments to expand the industry and continued protection measures, the 60s saw a massive retreat from coal, with much reduced output targets and contraction of the industry.²⁹

Two major programmes were initiated by government rather than the supply industries. The first was the massive and sudden influx of cheap natural gas, and the second, a second nuclear programme based on AGRs. White Papers in 1965 and 1967 formed the first comprehensive discussion of energy issues since Ridley, and the closest any government had come to a coherent policy.³⁰ They were concerned with the consolidation of a four-fuel economy to provide continued cheap energy: coal production would be contracted; the competing industries would adhere to commercial behaviour; and oil supply was assumed to provide the flexibility to make up total requirements.

Events of the early 70s showed the confidence of Fuel Policy to have been grossly in error. The oil price rises of 1973-4 brought energy issues back into central political arenas, and stimulated wide public and professional debate. They revived concern over efficiency and conservation, and made displacement of oil imports a priority.³¹ The 1974 Plan for Coal attempted to stop the drop in coal production, though markets continued to decline.³² The impact of the 70s energy price rises was softer in Britain than elsewhere, however, and the response low key.³³ By 1979 when the second large price increase occurred, Britain was approaching self-sufficiency in energy with rapid exploitation of its North Sea oil and gas finds. The economic recession, particularly through its effect on heavy industry in Britain, led to a decline in demand; primary energy consumption decreased by 11% in the decade up to 1983.³⁴ Electricity and gas price rises, after the anti-inflation restraint of the early 1970s, reinforced this. Attempts otherwise to influence end use and induce conservation remained weak, and, as will be described later, the same basic structure and policy paradigm were preserved in the sector.

Structure

The sector has become increasingly vertically integrated as industries have sought control upstream and downstream in each chain.³⁵ Control has become highly concentrated, with larger plant and centralised organisation. Local and regional organisation in the industries has lost many of its functions. Additionally, political control at these levels has been lost; regional energy organisations are linked to the centre. Coordination and cooperation between the chains is minimal. The industries have competed over common intermediate or end uses. At the boundaries along chains, and especially at that with end users, energy has been allocated as commodities, albeit in markets and at prices which have been far from the theoretical ideals of liberal economics.

Producer interests have sought to maintain this structure and defend commercial terms of investment and operation. Government actions, for reasons to be explored later, have generally supported it. Reorganisation of the industries, though sometimes as at nationalisation associated with demands for greater public accountability and intended to benefit users, has preserved and indeed consolidated these basic relations.

Production of fuels and consumption within the energy industries have been determined primarily by resource availability and comparative costs, but influenced also by strategic and expedient political considerations of international relations, security of supply, balance of payments, etc.³⁶ The actual balance has depended on the degree of autonomy of the industries and the scope of state powers to affect it. Outside of wartime, government control of fuel mix was most evident in the 60s: the nuclear power programme had been adopted by an initially reluctant electricity supply industry; the rate and terms of North Sea gas production had been decided essentially by government; coal was being contracted, albeit as much in response to declining sales; and oil imports were manipulated to make up the balance.³⁷

The physical structure of the supply systems imposes a number of potential constraints on change.³⁸ Particularly important is inertia in the form of partly depreciated investments, much of which takes several years

to construct and has a physical life of decades. The scope for new investment thus depends on existing plant, the need for expansion if it exists, or the balance of advantages and costs in replacement if not. An inelasticity of demand in the short term, partly because of investment in end use equipment, also contributes to inflexibility.

An understanding of choices of plant for the energy industries requires consideration of the suppliers of plant, their relation to the energy supply industries, the sources and stimuli of innovation and the stages of the process.³⁹ These aspects will be considered more specifically for the electricity supply industry and the particular case of CHP/DH, but some general observations can be made here. Technical innovation has become increasingly integrated into the supply industries or other state bodies. As virtually monopoly customers, the industries have increasingly defined their requirements to outside suppliers, and established and retained much control over research, development, design and construction. Thus most development work has been aligned to the industries' own conception of their role. The result has been growing dependency of indigenous supplier industries, with few export opportunities, on the policies and ordering programmes of the main industries.⁴⁰ In the case of the ESI, however, this dominance has been reversed since the 70s, with the increasing alignment of its investment programmes to suit the US-based international nuclear plant industry and its changing market conditions.⁴¹

Different technologies have had different degrees of state effort and subsidy reflecting their perceived strategic importance and their perceived centrality or marginality to the industries' programmes. The extreme case again is nuclear power, for which research and development has been vested in the UKAEA, with massive public funding and minimal accountability.⁴² In terms of a development process, demonstration appears to be as important as basic research, given the scale of plant required, the lack of scope for experimental adoption, the risk associated with long lead times, and the integrated systems into which a new supply technology has to fit. Increasingly, national and international consortia are required for development and construction - first of nuclear stations, now of fluidised bed combustion, SNG, etc.

Policy

Derived from and reinforcing the structure of the sector is a strong policy paradigm, concerned with upholding these key features of competition, commercial operation and commodity allocation, and almost exclusively concerned with ensuring supply. Its embodiment in organisation can be traced,⁴³ and its ideological elements are important in justifying the actions of the industries outside. Demand has at most times been sacrosanct - to be met at whatever level, and treated and upheld ideologically as an independent variable, though in reality stimulated by producer industry marketing practices.⁴⁴

During crises of supply, with shortages or sudden price rises, there has been pressure on the state to influence patterns and levels of energy end use. But despite a consensus in wider debate at these times on the need for improved efficiency in conversion processes and especially in end use, and enormous potential identified for energy savings, pursuit of conservation and demand management has been weak. Conservation as an alternative investment has rarely been assessed seriously in national terms alongside investment in new supply projects,⁴⁵ and the institutional base and hence political force of conservation interests has been fragmented.⁴⁶

Thus in both the early postwar years and in the late 70s, supply-based responses to the energy crises prevailed: action to secure continued supplies and thereby to pass on costs to consumers.⁴⁷ The opportunities for such - increased coal output and imported oil in the 50s, and the displacement of imported by indigenous oil in the 70s - reduced the incentive for demand-side actions.

A relatively small and closed group of central actors has determined the development of the sector, deciding and implementing policy effectively in one process in the form of programmes. They have been insulated from wider debate by lack of accountability, secrecy and a near monopoly of expertise. Outside interest in any case has been fragmented and sporadic. Usually energy has been expected to be readily available as required by the economy, and it has been the focus of attention only when supply has been disrupted. What wider debate there has been has had

limited impact. The dominant policy paradigm has thus been rigid, both impermeable to alternative ideas on technology and organisation and slow to adapt to changing external conditions. Internal hierarchies and organisational responsibilities, and centralised and technocratic decision-making - especially more recently in the development of computer models of the operation of the physical systems of the industries, formalised procedures of forecasting, and so on - all constrain responses and allow only incremental decisions within the bounds of an accepted and limited rationality. The coherence of the approach has been reinforced by a technocratic ideology, some key elements of which will be identified shortly, and by the close identification of certain technical professionals with the industries in which most of them are employed.⁴⁸

General objectives for government energy policy can be and have been fairly readily formulated. Thus in 1978 the Labour government's Green Paper depicted the traditional overall aim as the provision of adequate and secure supplies of energy, the efficient use of available supplies, and the attainment of these aims at the lowest practicable cost to the nation.⁴⁹ Even these have selective and debatable emphases. But it is impossible to derive clear operational objectives from such formulae, and it would be mistaken to assume that such a process in some way determines subsidiary policies. The pervasiveness of energy in society, the different interests of groups involved directly in the sector, the diverse and often contradictory objectives of the state whose pursuit affects the operation of the sector, mean inevitable conflict over means towards a general end, even supposing the state is able to influence actions in the sector towards such. Questions remain of definition, intergenerational distribution, the determination of costs, the distribution of costs, the interaction of energy provision with other sectors, and of interfaces between organisations within the sector. Thus there can be considerable disparity between such stated general objectives and the actual direction of specific programmes and operation of the sector.⁵⁰

Delivered Forms, End Use and Users

Besides the increased use of energy as the economy has grown, there is a clear trend in delivered forms.⁵¹ In an economy characterised by a multitude of independent decisions by individual firms, and a lack of

planning, there has been a steady move towards high quality and flexibility, so as to reduce constraints on the type of end use and changes in it. This demand for high grade delivered forms produces thermodynamic inefficiency in overall conversion sequences, encouraging inappropriate end use conversions, particularly where only low temperature heating is required.⁵² Hence there is resistance not only to intervention to influence demand levels, but also to the objective of matching end use to the most appropriate conversion sequence. Studies of future energy needs which instead of extrapolating present supply trends have attempted to analyse energy use and design the mix of conversion processes to suit, have demonstrated enormous primary energy savings.⁵³

In this century the main effect of this tendency on energy mix has been an increasing proportion of electricity. With electricity generation only now of the order of 30% efficient, this growth has resulted in a decreasing overall efficiency of primary energy use, even though generation efficiency alone has increased steadily.⁵⁴ There are additional pressures exacerbating this trend; besides having an interest in expanded electricity use in general because of its commercial and competitive terms of operation, the ESI has further sought to encourage its use for off-peak space heating to smooth its diurnal demand pattern, regardless of the suitability of such use in terms of overall thermodynamic efficiency.⁵⁵

The correspondence of the development and operation of energy production to the needs of industrial users, acts in several ways to subordinate the demands of other, particularly domestic, users, despite their significance in terms of total consumption. First, the relative importance of each conversion chain and of delivered forms is predominantly fixed by the needs of production. Second, the commodity nexus between the energy industries and users, coupled with inadequate direct representation and tenuous political accountability, leaves the latter in a weak position.⁵⁶ Not only is pricing considered the most appropriate means of influencing consumer behaviour to the extent this is deemed necessary, but the level of demand is considered an adequate expression of consumer interest. Third, industrial users have exerted strong influence through government. Prewar, the key demand was to restructure the energy industries to allow adequate, continuous and expanded supplies, a general requirement for the economy which government took an active role

in pursuing.⁵⁷ With the energy industries nationalised, industrial energy users have lobbied directly for reduced prices, in effect at the expense of domestic consumers, making a dubious case during the recession that high energy costs are contributing to unprofitability.⁵⁸

A focus on the end uses of energy and its use-values allows a conception of the interests of users in different arrangements in the sector which is broader than the usual equation of 'consumer interest' with the lowest price of each separate commodity. This wider view might well include elements which the energy industries already stress in competition - convenience, physical control and low cost. It could also include concern for adequacy and for collective benefits such as pollution control and energy saving - that is, some attempted integration both of the diverse interests of users, and of these with production objectives. Expression of such interests necessarily takes a political form, beyond the limitations of the role of consumers and their limited 'freedom of choice' - hence, as suggested later, the importance of local political arenas.

Heating

An adequate social analysis or history of heating as a particular set of end uses has yet to be undertaken.⁵⁹ It is beyond the scope of this thesis, but it is useful to indicate what it should entail and draw together some key points.

Heating as an end use can be divided into space and water heating, in domestic, commercial and industrial buildings; cooking; and industrial process heating. It uses the five forms of energy which reach consumers, namely electricity (as resistance or induction heating or via heat pumps), gas (burned directly or via heat pumps), solid fuel (wood, coal, coke or other smokeless fuel, refuse or peat), oils, and heat produced in a central plant and distributed as hot water or steam. A large proportion of final energy requirements is for heat, much of it at low temperatures.⁶⁰ As indicated, this pattern could allow better matching of conversion sequences to end uses and hence greater overall thermodynamic efficiency, but at the expense of the flexibility of use given by higher grade delivered forms.

The important elements in the form of use are the delivered energy

form; the end use appliance; the costs and mode of allocation of these elements; the physical characteristics of the building; and the control of the user over their selection and use. A systematic analysis would need to explore the influences on the alternative energy forms and end use systems available, their prices or other form of allocation, the installation and operation of the systems, the standards of heating required or deemed normal or necessary, and the labour processes involved in end use. It would thus be based on analysis of the relations between the consumer, the producer and distributor of fuel or energy form and of appliances, whomever controls the building, and the state as mediator. As argued for all energy forms and uses, the economic and political power of different groups of users varies. These direct relations would need to be set in a broader social context, including for domestic heating, for example, the structure of incomes, domestic labour, the housing sector and planning.⁶¹

The whole of the analysis of the energy sector outlined above is relevant in determining the prices of energy forms as commodities, including the influence of consumers on energy production through demand patterns and through political channels. The initial choice of heating system from available technical options depends in particular on the structure of its installation, operation and maintenance costs; there are, for example, pressures in both public and private sector housing to install systems with lowest capital costs, and changes in energy prices have left occupants with prohibitive running costs. State intervention has been important in research and development of systems, standards, information and publicity, pricing policies, directives on end use, regulation of competition, welfare subsidies and legislation on air pollution. State action in other areas has effects, particularly in housing provision and planning.⁶²

Local authorities have had a central role in heating: as major energy consumers themselves; as housing providers and managers; as administrators of welfare services and benefits; and as a political focus for consumption issues: for the grievances of tenants with inadequate heating and of campaigns on these and related issues. The pattern of local authority action in these areas and the influences on it, traced later, are important for understanding heating provision.⁶³

The basic need for domestic heating and the continued widespread

inadequacy in its provision in low income groups - resulting in death, illness and discomfort, and deterioration of housing stock - have made heating a welfare issue in administrative and political terms.⁶⁴

Through much of the century domestic heating levels have been poor and appliance efficiencies low. The Simon and Egerton Committees, established in anticipation of postwar reconstruction and housing programmes, were the first comprehensive records of these and other problems - of cost, convenience, air pollution and national fuel economy.⁶⁵ At the time inefficient open coal fires predominated - often only one in each house. Britain had 'acquired an international reputation for having the coldest houses in the civilised world, which in effective living space were confined in winter to small circles round the fires.'⁶⁶ Their cultural significance and psychologistic explanations of their dominance were to be important ideological arguments in debates on policy, often reinforcing arguments for continued low standards and perpetuating 'the interwar attitude ... that central heating was either too expensive or much too good for the Council tenant'.⁶⁷ The Simon Committee recommended various forms of government action, on appliances, building standards, information and smoke abatement. It accepted competition between the energy industries, but expected prices to be related to costs and thought solid fuel should account for the bulk of domestic consumption. It concluded that adequate standards of heating - background and supplementary - would typically require doubling the useful heat in smaller dwellings. This it argued could be achieved for no extra cost and with no increase in coal consumption.⁶⁸ Many private developers and local authorities adopted the Egerton standards and later the Parker Morris standards of 1961 for heating and insulation; a mixture of mandatory standards and departmental directives has superseded them though the insulation standards are still widely regarded as unsatisfactory.⁶⁹

Gas and electric heating appliances were developed in the interwar years and supplied about 5% and 10% respectively of useful domestic heat by the late 30s.⁷⁰ Since then, they have steadily eroded coal's share of the market, though the balance of use has varied with shifts in relative price, as with the artificially low prices of electricity in the late 40s and of natural gas in the 60s. Electric fires were used widely in the early postwar years particularly because they avoided coal rationing and the

price of electricity had halved; some three quarters of consumers had them by 1948 compared to a quarter before the war.⁷¹ Smoke abatement measures - under the Clean Air Act 1956 and the Local Acts which preceded it - were important in changing domestic systems and likewise contributed to the decline of coal.⁷² Much new local authority housing used either gas or electric ducted air systems - until changes in fire regulations in 1969 precluded its use - or oil or solid fuel block heating.⁷³ Low capital cost underfloor electric heating was installed in many local authority flats but rising electricity prices made it unpopular. Electric background heating is now limited to off-peak storage systems. Group and district heating based on coal, oil or gas was built into some local authority estates in the 60s and 70s; these have also had problems of performance and from rising fuel prices.⁷⁴ Gas fires and central heating have increased since the introduction of cheap natural gas (App. 13).⁷⁵

Ideology

The existing pattern of energy provision generates and is legitimated by a distinct ideological view of the role of energy. It includes arguments for a necessary relation between economic growth and energy consumption, and hence the ultimate danger of an energy gap; an assertion of the risk that demand-side intervention entails; and a dismissal of the potential of renewable resources. It entails the assumptions about future social development characteristic of technocratic ideology discussed in 3.5, and its associated notions of progress and efficiency. It is strongest and clearest in the arguments of advocates of the expansion of nuclear power.⁷⁶ A concentration on technical issues and a projection of the subject area as politically neutral permeates the energy literature, even much of that produced by critics.⁷⁷

A number of concepts recur in the justification of government and industry policies and actions. Their importance stems from two structural features. First is a general characteristic of the capitalist mode of production: the mediation of social demands and objectives by market mechanisms and commercial criteria means that their fulfilment is to some extent partial, contingent and incidental to the main dynamics of production, and moreover takes a specific form in the predominantly commodified provision of material needs. Ideologically this partial

correspondence supports the idea that the existing order based on market allocation necessarily satisfies needs, and that it is the best and only way of doing so; continued disparities and inadequacies, in this case primarily in domestic energy provision, require its assertion. Second is the associated political division between production and consumption. With little direct representation of user interests, needs and preferences are interpreted by the producer industries and allied sections of the state, which as argued leads to a disparity in the treatment of the needs of different groups of users.

The first concept is the 'public interest'.⁷⁸ In general use it is associated with a conception of a uniform 'public' without divisions, and a pluralist notion of the role of government. It may be taken to mean unhindered market mechanisms as providing optimum resource allocation. Probably more often it equates to the objectives of the state or particular government overriding a sectional interest. It remains, however, important and not entirely reactionary in the defence by professionals and bureaucrats of public sector activities against the sectional interests of political parties or particular capitals and sections of capital. Frequently the term indicates even narrower sectional interests, asserting that they are common. The assumption that what is economic for a nationalised industry is automatically in the national interest has been drawn on frequently, though usually denied if challenged explicitly.⁷⁹ Acknowledgement of the need to coordinate the nationalised industries, to regulate their actions or override their objectives, and more generally the need for state regulation of capitalist markets, contradicts these conflations of interest. That attempts at coordination or regulation are resisted confirms that conflicts of interest are involved rather than simply administrative problems.

A more limited form is 'the consumer interest', invariably to have the commodity in question as cheap as possible, and therefore not to have the cost of its production increased by non-commercial actions. It legitimates the division of production into competing organisations and ignores the likelihood that an individual's interest with respect to one commodity may conflict with and be overridden by other interests. Moreover it implies an uniformity of interest and treatment across classes of consumer which does not hold. As discussed earlier, it denies a broader formulation of user

interests based on use-values which does not accept the limitations of the present structure and form of allocation.⁸⁰

'Freedom of choice' for the consumer is frequently invoked when a distributor of one energy form is faced with exclusion or discrimination in a market. Appeals to the notion, common to the competing industries, are selective; the same distributor elsewhere may seek the exclusion of competitors or use discretionary pricing practices, say, to gain advantage. It is subject to the critique of revealed preferences; choice is assumed to exist and channels for its expression are assumed to operate.⁸¹ It is sometimes acknowledged that information is required for informed choices, but the nature of that information is then limited to what is seen as neutral, that is, unlikely to change currently revealed preferences.⁸²

The Specific Character of the Sector

A common view that the failings of energy provision are caused by irrationality and short-sightedness implies that such errors can be corrected by technical arguments for alternative systems. This general account of the energy sector, by contrast, has demonstrated the specificity of its arrangements, and in relating them to the mode of production, has stressed their correspondence to, and support for, certain interests - though pervasive contradictions and unintended consequences ensure that this is by no means simple and consistent. It has indicated ways in which existing relations are maintained. That conflict in the sector is often channelled through technical arguments underlines the need for an understanding of how such knowledge is constructed and deployed, as outlined in 3.5. From the analysis of the state to be developed in 4.3, it will further be argued that the inadequacies of government energy policy and interventions are likewise derived from its location, character and inherent limitations rather than incompetence and mistakes.

The view developed here implies that certain courses of action and technological options may be more or less systematically excluded or actively resisted because of the challenges their introduction would represent to established interests within the sector and more widely, because of the political demands with which they are associated, or because of the economic and organisational conditions which their

introduction would require. It indicates in particular that, despite incentives operating on individual end users, structural features of the sector act systematically against energy savings, supporting the general contention that capitalist social organisation is intrinsically incapable of promoting the rational use of resources.⁸³

4.3 THE STATE

Introduction

A corollary of the acceptance of the principles outlined in section 3 is the need to relate the analysis of the energy sector and the key organisations in it to an adequate theory of the state, or rather to a general substantive characterisation of the British state derived from that theory. The intention here is not to review or enter the debates in Marxist and other radical theory on the capitalist state, but to outline a broadly acceptable view, and emphasise aspects of it and draw out insights from it which are pertinent here.⁸⁴ The development of public sector industries is dealt with in 4.4, and more detail on government organisation and policies for energy is given for the four periods of the account in chapters 5 to 8.

State Forms

The state is a set of institutions: it can be analysed as related forms of representation, of internal organisation, and of intervention in the economy and the wider social formation.⁸⁵ The forms of a capitalist state are determined in large part by the character of the process of capital accumulation and its concomitant class conflict, and thus change as that mode of production develops.⁸⁶ In more detail, the characteristics of a state are determined by the particular accumulation strategy adopted by capital, under the dominance of particular fractions, to organise the process and tackle its problems. These characteristics include a specific set of policies and actions, social bases of support for and resistance to the state, and often a 'hegemonic project' by which it legitimates the privileging of certain interests and mobilises support.⁸⁷

The state has a partial autonomy both derived from the nature of capital accumulation and limited by it.⁸⁸ The state is neither an instrument of a particular class or other social group, nor is it neutral between them, as it is depicted in pluralist theory. Its key concern is the health of the economy; it responds primarily to manifestations of trends and crises in it. Its independence from particular capitals is necessary for

it actively to develop and implement strategies in the interests of capital as a whole and if necessary to act against the interests of individual capitals or sections - that is, because of the economic weakness of capital in its inability to provide its own preconditions, and its political weakness in its lack of unity. There is no guarantee, however, that its actions will be adequate to the task; indeed arguably the inherent contradictions of the mode of production and the limitations on its own action mean they cannot be so. Rather, its own responses to problems of the system, as attempts to contain and manage particular contradictions, create or exacerbate others.⁸⁹

The class character of the state resides increasingly in its internal structures and procedures. In policy-making it acts as set of negative excluding mechanisms, rather than relying on the institutionalised positive rights of particular groups. It must first distil a strategy for capital as a whole out of the incoherent and incompletely formulated demands of its sections; that is, selecting elements which correspond to the long term interests of capital. Second it must filter out political challenges to that dominant interest.⁹⁰

The nature of the state is by no means determined exclusively by the capitalist mode of production and its inherent class conflict. It is also a product of determinants on other dimensions not reducible to class: in for example, race, gender and popular-democratic issues. It thus manifests other social contradictions and is a site of struggle over these.⁹¹

While the state tends to maintain these various forms of dominance, there exists the possibility of significant gains for working class and other subordinate social groups through the expression of their needs through political processes. The institutions of social welfare, though also serving capital's needs in reproducing adequate and compliant labour, are at the same time examples of such gains.⁹²

The main advantage of the state as an analytical focus is in stressing its overall character and coherence of function in relation to a particular stage of capitalism.⁹³ However, the organisational structure of the state does result in large part from fragmented responses to specific problems, and its political unity cannot be assumed but has to be constructed and

maintained. This fragmentation helps maintain the separation of issues which together might create overwhelming problems of legitimacy, but it also creates separate sites of struggle in which different balances of political forces may prevail, and hence divisions and contradictions between sections of the state in principles, objectives and actions.

Identifiably different forms of politics may thus operate over different types of issue. A corporatist mode, fusing interest representation and intervention through bargaining between the state and representatives of capital and labour, might be expected in the sphere of production, leading itself to accentuated divisions and possible conflict between sectors. For consumption issues, and thus particularly at a local level, a more pluralist or competitive mode is likely, with divisions not simply related to class.⁹⁴

State organisation is at any time also a response to past problems and a result of past political struggles. Inertia, and a disparity between organisation or procedures and the content of issues, may thus provide a further complicating determinant of political outcomes.⁹⁵

State Intervention

The state is increasingly involved in providing preconditions for the continued operation of the mode of production and the reproduction of the social relations in it and in the wider society - that is, as a system of economic exploitation and political domination. Its intervention has extended to all spheres of social activity: production, distribution, exchange, and individual and collective consumption. It has long provided legal, administrative and money systems, helped sustain a supportive ideology, and backed these with coercion, thereby facilitating and protecting the social relations necessary for continued operation of the system. In response to the periodic crises inherent in accumulation, the state has increasingly undertaken direct intervention in the economic sphere, actively restructuring production and latterly consumption.⁹⁶ It has long provided infrastructure of use-values which are inherently impossible to allocate as commodities because they are common to many activities and costs cannot be attributed. It has increasingly been required to take over provision of other resources basic to production, such as research and development. And it has had to intervene to supervise, restructure or take

over activities which have failed as capitalist enterprises but are deemed essential to a national economy. In areas of intervention in production exists the possibility of other forms of resource allocation besides a market; a mix of forms is established by political processes and requires specific analysis.

As state activities have increased enormously in scope and scale so has state expenditure. A primary contradiction of state action - that the state must provide the preconditions for accumulation but relies on it for the revenues to pay for such - has resulted in fiscal crisis.⁹⁷

Ideologically, extended state provision demonstrates the feasibility and advantages of other means of allocation besides the market. For both these reasons, in periods of recession there is strong pressure from capital to cut public expenditure or shift it from social consumption to social investment.

Far more economic and other social relations have been drawn into the realm of the state. It has become increasingly responsible for the conduct and condition of the economy and most other areas of social life and has been required to devise programmes of intervention to cope with them. A corollary of this expansion is an increased need to understand political forces operating within the state supporting or resisting specific objectives. The argument in chapter 3 has already indicated a need to problematise and explain, rather than to take as given, the distribution of functions between different types of state body, and especially between representative, administrative/bureaucratic and expert/technical spheres, and to consider the effects of this distribution and changes in it. In general, there has been a steady shift away from elected to functional representation, and from the rule of law to more ad hoc intervention through executive and bureaucratic action. In Britain the importance of the Cabinet as a central coordinator of an increasingly complex and fragmented state organisation has continued and increased.⁹⁸ With the declining significance of representative channels and increasing inadequacy of their legitimatory functions, has come the 'politicisation of administration'. Social groups have increasingly challenged state agencies outside representative arenas.⁹⁹

Moreover, rather than increasing the size of government departments

and giving new administrative roles to civil servants, much of this increased state activity has come to reside in a large array of quasi-governmental organisations.¹⁰⁰ They are involved in policy-making, administering, advising and arbitrating, and in some cases production and services. They effectively institutionalise relations between central government and capital, labour and other social groups like professions, and thus between these groups themselves. They have served to remove much political activity from representative arenas, particularly local government, and hence accountability. They have often legitimated the depoliticising of this activity with a technocratic conception of their role. As with the separation of issues between sections of government helping to diffuse discontent, and with other incremental and conservative characteristics of government actions described by decision theorists, the difficulty of coordinating action between QGAs is not simply an administrative feature or problem; it is characteristic of specific state forms. Among the general results are that action often requires consultation with several bodies, and that professions have become much more important sources of influence on policy.¹⁰¹ But these bodies have been set up largely ad hoc with different forms, statuses, social composition, organisation and procedures. Their characteristics depend on a variety of factors: forms of representation; professional divisions; legal or executive powers or traditions; prevalent views of a problem, of possible solutions and legitimate actors; and so on. Thus general characterisations and even classification is difficult; the specific results of interposing such agencies need to be analysed.¹⁰²

Government

The analysis of the state as an institutional ensemble allows us to remove the primacy as an explanatory factor of changes of party in government - with the assumptions that the bureaucracy simply implements its policies and thus that the whole government apparatus is controlled by the wishes of the electorate - without trivialising their role or denying their significance.¹⁰³ It must certainly take into account the characteristics of parties, their internal divisions and shifts in their balance, their relations to specific social classes, and hence real differences in policies and programmes. It must at the same time acknowledge the continuity of state action across changes of government,

and changes in policy during a party's period in office.¹⁰⁴ While the differences are important, it is necessary in this perspective to explain also the functionality of conflict in the development and continuity of strategy: it allows strategies for capital to be devised effectively by trial and error. As McEachern puts it:

... where the consequences of policies cannot be assured, certain and deliberate conflict between political parties and conflict between sections of capital and governments are the only ways in which general policies can be adjusted to serve, more effectively, the needs of capital.¹⁰⁵

This analysis of the state as ensemble, while indicating its functionality in reproducing the social order, stresses that the adequacy or functionality of its actions cannot be assumed teleologically. Even more with specific actions or specific sections of government, mechanisms and effects must be demonstrated.

The characteristics general to government departments depend on the stage of development of the state; on the party in government and its strategies; on the character and practices of the permanent bureaucracy.¹⁰⁶ Characteristics specific to each department depend on

- the function in the social formation of the sector for which it has responsibility;
- the structure and activities of political forces in that sector and their means of influence on government;
- its origins and historical development;
- its relation to other government departments, and its position in a ministerial hierarchy, which may reflect the dominance of sections of capital in the economy or the significance of the sector and its problems;
- the organisation of other state bodies around it, with their diverse functions effectively as delegated by government, but particularly as sources of advice.

The official mandate of a department is thus only one determinant of its actual objectives and actions, one that is likely to overstate for legitimisation a positive active role in solving perceived problems; and its ability to pursue this mandate depends on the specific constraints on its actions.

The variety of influences on the character and actions of each department, and their operation as partially separate sites of political struggle, means that their subordination to government policies or the unity or consistency of these policies, is constructed politically and cannot be assumed analytically. Thus there may be competition over policy affecting several departments; disputes over territory and in obtaining resources; perceptions of issues, indeed identifiable cultures, strongly shared within departments but differing between them; and hence contradictions within the Cabinet and other central policy bodies between the pursuit of sectional objectives and the imposition of consistent priorities.¹⁰⁷

British State since WW2

It remains to make some further general observations on the British state and its wider social context in the postwar period.¹⁰⁸ The actions of early postwar British governments constituted the establishment of a mixed economy and welfare state, aimed at capitalist expansion with full employment. The economy was stimulated and controlled through Keynesian macro-level management rather than structural intervention, and paradoxically this involved a dismantling of planning functions accreted during WW2. There was a broad acceptance of the need for state intervention to stabilise economic fluctuations, and considerable continuity of policy between governments. The economic and political settlement between capital and labour based on this programme lasted for some two decades; it was a period of growing economic prosperity, political stability, optimism, and faith in technology-based progress. Yet there were chronic profitability, industrial relations and fiscal problems, which pointed to the limits of Keynesian techniques in their inability to resolve fundamental structural problems. In this case, argues Jessop, the combination of factors included a dominance of finance capital, and a competitive weakness of industrial capital; a continued dependence on foreign trade; an attempt to maintain a world financial and economic role; and the defensive

strength of labour in maintaining the gains of the postwar settlement.¹⁰⁹ These problems, coupled with the growing international dominance of the United States, led to some abrupt changes in the Labour government's policies in the late 40s, such as the diversion of resources into first exports and then rearmament, with effects on the reconstruction programme.¹¹⁰

There was a move from the economic liberalism which had reasserted itself through the 50s towards state economic planning from the early 60s.¹¹¹ Measures to promote competition, rationalisation and modernisation were started this time by a Conservative government in legal and monetary policies and with the establishment of the NEDC. They were consolidated by Labour, with more direct intervention aimed at industrial reorganisation, and a National Plan.¹¹² This transformation of state forms continued in the early 70s under both parties, with efforts to consolidate corporatist representation and direct intervention in production. The period was accompanied by a crisis of hegemony with trade union militancy and a wide range of other forms of dissent. From the mid-70s on, there were increasing attempts to shift conditions back to favouring capital, involving measures such as imposed wage restraint and public expenditure cuts.¹¹³ With the Conservative government in 1979 came a more radical attempt to resolve the economic crisis on capital's terms.¹¹⁴ Important elements of this programme for this study are the reorganisation and contraction of the public sector, local government, welfare state institutions and other QGAs, to cut expenditure and shift production and service provision back into the private sector. Plans for the privatisation of infrastructure and energy provision were being implemented by the mid-80s.¹¹⁵

4.4 THE NATIONALISED INDUSTRIES

Introduction

This study requires an understanding of the character of the nationalised industries which dominate the energy sector, and of the electricity supply industry in particular as one of the key actors in the history of CHP and DH in Britain.¹¹⁶ Despite the significance of the nationalised industries in the economy in terms of assets, employment and the reliance of other industry and indeed the whole range of social activity on their products, most of the vast literature on the subject has narrow, pragmatic and often normative concerns, such as the framework or detail of ministerial and financial control.¹¹⁷ Radical analysis is particularly underdeveloped, again considering the historical centrality of nationalisation to Labour Party policy and, more recently, the dismantling of state ownership and the beginnings of a debate on alternative forms of public ownership and control.¹¹⁸

The aim here is to draw together some general observations, insofar as that is possible from existing analyses. It will be clear that a general characterisation of the nationalised industries must be limited since there are few institutional features in common and the mode of integration of each into the economy and society is different.¹¹⁹ Only the early postwar nationalisations are treated, as distinct from the interwar public corporations and the state takeover of ailing firms from the 1960s onwards.¹²⁰

For an understanding of their interests, strategies and power, the industries need to be considered not in isolation - this would lead to acceptance of their self-image as operating in the 'public interest' - but in the context of a mixed economy, with particular relations to the state, to industrial capital, and between themselves.¹²¹

Nationalisation

Nationalisation as a policy had origins in a long-standing commitment of the Labour Party, often maintained against a reluctant leadership by the demands of unions in the industries and anti-capitalist sentiment in the wider labour movement.¹²² As implemented, it was part of an accumulation strategy based on the creation of a mixed economy and a welfare state, for the revival and expansion of a capitalist economy and in particular to avoid the recurrence of a slump and mass unemployment. The industries to form the state-owned base of the mixed economy had in a way failed as capitalist enterprises, not in the case of the energy industries because of individual unprofitability but in that even under long periods of state supervision they had not harmonised their sectional interests with the requirements of the economy as a whole, and specifically had failed to rationalise and modernise their structure and technical processes. Ironically as it turned out, the argument that all three fuel and power industries should be nationalised to allow coordination won out over a tendency to justify and hence limit nationalisation on technical and organisational grounds case by case.¹²³

The industries were effectively abandoned by the private sector, then, in return for compensation and the expectation that they would be rationalised and operated adequately for their essential role in the economy.¹²⁴ The costs of rationalisation would thus be socialised, and the interface between these and other industries in terms of prices, supply and finance, would be facilitated and regulated. The public sector would be operated to enhance the smooth operation and profitability of the private sector. The 'mixed economy' was a mixture only of two different forms of capitalist domination of production. As McEachern summarises it:

The interests of the class (of capital) as a whole were advanced through all the proposals that sought to harmonise relations (with) the rest of industrial capital, to make the publicly owned base of the mixed economy comprehensive, and to make explicit the ways in which the publicly owned industries would be operated to serve the needs of private capital without challenging either its profitability or the basic opposition between labour and capital.¹²⁵

Politically the passage of nationalisation legislation for the energy industries was not seriously opposed except over the issue of compensation.

Moreover they were not returned to private ownership by the incoming Conservative government in 1951. Their retention under state ownership was widely accepted.¹²⁶

Nationalisation was not advanced with these objectives in mind. The programme was implemented by a social democratic government aiming at democratic control of the economy, and the major motivation of ensuring full employment was shared much more widely. But the operation of the mixed economy was poorly theorised. Its construction was done in an ad hoc manner and the limits of the public sector were fought out over the steel and transport industries over a long period.¹²⁷ The function of the public sector in supporting a revived capitalist economy thus emerged from the process of negotiating and implementing a form for these industries, not from any blueprint.

The form of nationalisation, despite earlier debates over alternatives and considerable opposition to Morrison's plans,¹²⁸ was quite specific: the public corporation at 'arms' length' from government, that is, outside its normal machinery. Ownership was transferred to the state, planning for each industry was centralised, and rationalisation of the physical systems started. But the commodity status of labour, and capitalist management practices, were not altered; indeed the industries were noted for tough industrial relations practices, set as an example to others.¹²⁹ Workers' participation and representation of wider social interests such as local authorities were resisted by both the industry and the Labour leadership. Rather the Boards were appointed on criteria of expertise and drawn largely from within the industries.¹³⁰

The statutes were vague, with only a general directive as to duties and a rudimentary financial framework to replace market forms of control. Objectives were assumed to be self-evident and consensual, or at least controversial only in technical terms. The constitutional form thus embodied the assumption that political direction was unnecessary and undesirable. It effectively precluded the coordination for national planning which had featured in policy and rhetoric. Although at the time the view of each industry's problems as specific and internal made this fragmentation more logical, the need for coordination was soon to become evident.¹³¹

No distinctive public purpose was defined; if it existed it was assumed to be embodied in the unity, loyalty and ethos of 'public service' of the management. This assumption rested on an ideology of professionalism and the 'common good', common to the industry and the Labour leadership.¹³² These commitments were certainly strong but they involved a notion of 'moral restraint' rather than anti-capitalist views,¹³³ reinforced by a sense of frustration that the technical advances perceived as necessary in the industries had been thwarted by sectional interests. They also entailed a strong resistance to what was seen as political or lay interference. Left ill-defined in practice, there was nothing to prevent professionalism merging into commercialism: internal structures and objectives were largely modelled on private industry and increasingly so from the early 1960s.¹³⁴

The Role of the Industries

The act of nationalisation, then, really only set in motion changes with unspecified objectives and unforeseen results.¹³⁵ The need to negotiate relations with the government and the operation of the industries as suppliers of essential commodities within a capitalist economy, and the context of a broad strategy of Keynesian demand management without planning and without an energy policy, allowed the integration of the industries into the economy and gradually a reassertion of commercial objectives. Indeed it would in the long term have been impracticable for the industries to pursue investment, pricing or pay policies, for example, too far outside the norms of the private sector. The vagueness of their mandate further allowed flexibility and adaptation to the needs of the economy, as interpreted by the state. The industries have operated as a means of subsidising inputs to the private sector, of boosting and stabilising the economy, and of underpinning massive public and private investment programmes. Their pricing policies have been used expediently, in ways which often contradicted their general financial aims, for countering inflation and recently to cut the PSBR and through negative EFLs as a form of indirect taxation. The erratic pattern of the postwar economy has caused large swings in the direction and result of these directives.¹³⁶

The industries separated economic from social objectives and retained

commodity allocation for their products. In selected cases, like rural electrification in which strategic objectives not justifiable in commercial terms accorded with an industry's current view of its role, social objectives were taken on board and justified.¹³⁷ Generally, however, social obligations which might have been imposed on the industries, as a central definition of their role or as incidental duties, were resisted from the start. There was indeed little discussion of what strategic social roles might be, though the government retained the option of more expedient use of the industries for management of the economy.¹³⁸ With increasingly commercial terms of investment and operation being adopted, an attempt was made to formalise the position in a 1967 White Paper.¹³⁹ It indicated that ministerial direction should only be on strategic matters, and further established that the externalities of programmes should be the government's responsibility. The former principle hardly changed actual government practices, but the latter allowed the industries to claim allowance for the financial consequences of non-commercial actions.

Fine and O'Donnell have, then, a strong argument that the development of the nationalised industries should be seen as the state-led restoration of capitalist social relations to industries which had failed as capitalist enterprises.¹⁴⁰ The latest phase of this process, the return of these activities to private ownership through liberalisation and privatisation, is considered in 8.1.

Ideologically the continuity of capitalist domination was concealed in the transfer of ownership to the state.¹⁴¹ Nationalisation placated demands for democratic control by fostering an illusion of political control of the economy and thus weakened opposition to basic capital-labour relations. The contradictory costs for capital, besides the contraction of its sphere of action, were the appearance of an alternative to private ownership; reinforcement of the assumption that the overall conduct of the economy was a proper political issue so that wider state intervention had enhanced legitimacy; the possibility at least of actual political control in some forms; and scope for progressive elements in the albeit ambiguous ideology of the industries' management. The limited or non-existent wider social functions and achievements of the nationalised industries as envisaged in popular demand for nationalisation, and their bureaucratic unresponsiveness to consumers and outside intervention, have in turn been

emphasised by the Right to denigrate socialised ownership in general.¹⁴²

Framework of Control

In contrast to the common assumption that the nationalised industries operate unproblematically according to a mandate given by parliament and in the 'public interest', it is readily apparent that a complex set of factors determines even their general programmes and policies, let alone more detailed objectives and actions. It is useful to identify them but the question of their structure or hierarchy of explanatory significance must be left for investigation.

The set of political, legal and financial constraints operating on the nationalised industries, and the continuing problems with them, even after attempts in three White Papers at rationalisation, are well documented.¹⁴³ First, the statutory duties of the industries are vague, and certainly do not indicate even in broad outline a corporate plan.¹⁴⁴ This partly reflects the haste with which the nationalisation programme was instituted. It also corresponds to the idea of entrusting the future development of the industries in expert boards. The only strong feature of the energy industries' mandates was that a supply side bias was enshrined in the legislation. The assumption was that energy supplies should be dictated by the demand of consumers; it was not acknowledged that demand was not an independent variable but could and would be stimulated by the industries themselves.

Second, a framework of financial control, albeit developed pragmatically and susceptible to expedient use for wider economic objectives, substituted for the control of profitability to which a capitalist firm would be subject.¹⁴⁵ It has consisted of quantitative rules and targets, and performance assessments. For the first decade of operation the expansion of the industries' technical systems was dictated by a strategic judgement of the economy's needs shared by government and the industries. Thus the main requirement initially was merely to break even. As the industries shifted to more commercial terms of operation, target returns on overall investment and then for project appraisal were introduced.¹⁴⁶ In the 80s the industries had target overall rates of return, EFLs, and programme targets for cost reduction.¹⁴⁷ The precise form and

level of these requirements will be seen to have been crucial in the fate of marginal projects. Another important constraint was a prohibition on private sector borrowing so as to avoid competition with private capital; funds have come from internally generated surpluses which of course depend largely on pricing policy, and loans and subsidies from the government.¹⁴⁸

The general tendency towards commercial operation was always complicated not only by the deliberate use of the industries for wider economic management but by conflicts with their public sector role: between, for example, expansion based on planning to meet forecast demand with its inherent uncertainties and that based on investment criteria; by the electoral unpopularity of the price rises needed to shift towards commercial rates of return, and by pressure from within the industry to avoid the political embarrassment of showing large surpluses; and by the technical problems of non-market pricing, such as establishing marginal costs. There have remained considerable political influences on actual economic practices.¹⁴⁹

Third is nominal accountability to a sponsoring department and Minister. The character of this relationship will be illustrated for the electricity supply industry. The Minister's powers have been a continued subject of controversy.¹⁵⁰ In theory the Minister should have given general policy directives and not have interfered in operational management. The opposite has been the case, with intervention on numerous points of detailed management and little influence in some strategic policy areas.¹⁵¹ The department responsible for the energy industries has had relatively few personnel and little expertise.¹⁵² The sections of the department dealing with each industry have tended to act as mediators on its behalf, particularly against the Treasury, rather than as an effective counterweight. Ministerial direction appeared to revert to the ideal course in 1983, with strong directives on objectives issued to industry chairs, but paradoxically it was aimed at the steady withdrawal of state involvement from the industries.¹⁵³

Finally various official external bodies have monitored the industries collectively or separately - Select Committees, Royal Commissions, Consumer Councils and, since the Competition Act 1980, the Monopolies

and Mergers Commission.¹⁵⁴ Their impact has been limited. Both the Select Committee on Nationalised Industries in 1968 and NEDO in 1976, for example, identified a need for clearer strategic policy, the former suggesting a ministry for the industries, and the latter, policy councils separate from what should be administrative boards. Both ideas were rejected.¹⁵⁵ The terms of inquiry of other bodies have been relatively narrow. With this external scrutiny, as with Ministerial intervention, the industries have objected to what they have depicted as political interference.

One key aspect of the control of the nationalised energy industries remains little analysed in the literature - that of their scope and activities as an ensemble: their coordination rather than the control of each; the question of activities for which none of the industries has responsibility; and the possibility of new organisations. The difficulty of coordination produced by having inadequate accountability and control, is compounded by competitive relations between the industries and a statutory insistence on their individual financial self-sufficiency.

Objectives

This framework of control only defines constraints; within these the actual objectives pursued must be identified. It follows from the vagueness of the mandates that an explanation must be sought also in terms of relations to the outside other than formal state control - particularly in the establishment and adjustment of each industry's role in the economy, whether mediated through political or economic mechanisms - and of processes internal to each industry. As Tivey observes, the vagueness of the mandate means that the industries have had to act politically in order to provide for and defend their own interpretation and plans against government and critics. Their power in doing so contrasts markedly with the common assumption that they are arms of public administration serving government.¹⁵⁶ It is argued in 4.5 for the ESI - though the analysis could be expected to hold for the other industries - that there is no guarantee of the functionality of the industry's practices for the economy, in large part because of this institutional power.

In the analysis of determinants of industry policies, first it is to be

expected that certain objectives common to commercial or quasi-commercial organisations would operate, intended to reduce uncertainty in securing their conditions of existence and continued operation:¹⁵⁷

- to increase their autonomy and resist outside interference;
- to seek to control inputs into their productive processes, particularly finance and material means of production;
- and to seek to influence the form and pattern of consumption of their products.

Second, policy commitments and technological paradigms can be identified, which become entrenched in organisational forms as well as ideologically. These vary for each of the energy industries, though with the common characteristics noted in 4.2.

Following the arguments of 3.4, insofar as these objectives are consciously pursued strategies, they are the outcomes of internal policy-making processes. They are also the ends towards which the rationalities of different sets of practices within the industries are directed. Both aspects thus require analysis of the internal structure of the industries, as much as external influences. This is a matter for specific analysis, however; there is little uniformity between them.

4.5 ELECTRICITY SUPPLY INDUSTRY

Introduction

The development of the electricity supply industry is obviously crucial to understanding the history of CHP/DH, in two respects: that the actual course of development of the industry provided the physical and organisational context within which CHP/DH would be raised inside the industry and thus could or could not develop; and that from this development derives the effects that it would have if imposed from outside and the attitude of the industry to it. A comprehensive history of the ESI and a detailed analysis of its current policies are beyond the scope of this thesis.¹⁵⁸ The intention here is to sketch the broad historical development of public supply - the pattern of production, consumption and state intervention - make some general observations on the character of the industry, and draw out some general factors influencing its objectives and actions. More detail appears for each of the specific periods in chapters 5 to 8.

History: Early

The history of the British electricity supply industry to the 1940s¹⁵⁹ can be summarised as the outcome of two forces: the attempts of sections of the state to construct and rationalise a system adequate to the growing needs of industry and the economy for cheap, reliable and versatile energy, along lines advocated by technical visionaries; versus sectional interests with varied motivations for preserving fragmented localised supply. The conflict of these interests occurred within a framework set by successive Acts of Parliament, and technical development of the system depended on the balance of power in large part thus established.¹⁶⁰ The powers in the Acts were the outcome of recommendations of numerous reports - usually agreeing on the technical requirements of the development of the industry as a whole but differing in organisational ideas - as modified by a Parliament in which sectional interests were well represented.

Public electricity supply was undertaken from the 1880s by municipalities and private companies. Through statutory instruments issued

by the Board of Trade under the 1882 Act, each was empowered to supply within a defined area, and obliged to supply as demanded. The effect of the early legislation on the development of the industry - unlike other public utilities the initial legislation for electricity preceded its development¹⁶¹ - is controversial, particularly as to whether, as was often argued, the powers of the local authorities to purchase private undertakings after a given period stifled the setting up of new companies.¹⁶² Though the 1882 Act was intended 'to put the new industry under the wing of the Local Authorities',¹⁶³ they appear to have been reluctant to undertake themselves what were seen as risky ventures. Often they took out enabling Parliamentary Orders without acting on them, to protect their gas undertakings. By the turn of the century, however, municipal investment in electricity was increasing rapidly, and several large cities did establish their undertakings by buying out companies.¹⁶⁴ Aside from an alleged bias towards municipal undertakings, the 1882 Act is generally held to have allowed and promoted a proliferation of small power stations and to have established and preserved small supply areas when potential economies of scale and benefits of interconnection were becoming obvious. A series of amending Acts over the next two decades did little to help development; indeed POs issued under the 1880s Acts prohibited association between undertakings. Prohibition was relaxed and eventually removed in the 1909 Act, which envisaged Joint Boards of local authorities, but rivalry and suspicion between municipalities meant that few were established. The private-municipal division was at the root of most of the national political debate over electricity. A broad pattern was established of municipal undertakings in the cities and private companies in towns. Outside these, private power companies became important, supplying in bulk to industrial users and to small undertakings, and able to establish larger stations. They were established by Private Acts and not subject to reversion clauses. Their coverage, however, was patchy.¹⁶⁵

Several reports during and immediately after World War One agreed on the problems and on the need for rationalisation through recasting of the legislation, but differed in the organisational solution - from inducement to voluntary restructuring through to outright nationalisation.¹⁶⁶ The 1919 Bill aimed at a national system of coordinating generation and transmission, initially through regional restructuring by District Electricity Boards with extensive powers. In its passage through Parliament, however,

sectional interests in the industry removed nearly all elements of compulsion.¹⁶⁷ The Electricity Commission which it set up, with the duty of 'promoting, regulating and supervising the supply of electricity',¹⁶⁸ was left to rely largely on inducing voluntary cooperation. The Commission worked out schemes for eight of the fifteen provisionally designated Districts but it could only encourage the setting up of JEAs. Only four were nominally established in the next seven years and in only two of these did undertakings agree transfer of their stations to the Authority. Ironically though private undertakings argued their sectional interests, backed by their political representatives and the Right, and this hampered technical rationalisation, ownership as a financial investment was becoming increasingly concentrated through shares and common directorships; the holdings were often geographically fragmented.¹⁶⁹ Using its vestigial powers of sanction over construction and extension of power stations, the Electricity Commission in the same period sanctioned several large stations, 11 over 30MW_e, and forced the closure of over 100 small stations.¹⁷⁰ But lack of interconnection arrangements meant it had to sanction many more small stations to supply new areas. There was limited piecemeal reorganisation by undertakings, notably in the chaotic supply system in London, but it was slow and difficult. By 1926 there remained some 490 authorised stations, most still suited only to local supply, with low load factors and an enormous combined excess capacity.¹⁷¹

There was widespread recognition among industrialists, the state and independent professionals, of a need to rationalise the industry on a national scale, and of the failure of voluntary measures and the limited powers of the Electricity Commission.¹⁷² Moves were started during the brief period of minority Labour government, leading to the Weir Committee report and another Act in 1926.¹⁷³ This set up a Central Electricity Board and consolidated the powers of the Electricity Commissioners as a supervisory and quasi-judicial body. Again opposition came from private electricity interests and the Right, arguing against what they depicted as encroaching nationalisation, but this time the Bill was little modified in its passage.¹⁷⁴

The Central Electricity Board was set up to be 'commercially-minded and efficient';¹⁷⁵ its members were chosen for their experience of business rather than their technical expertise. It was free from both obligations to

shareholders and Ministerial control, and established the tradition of a lack of scrutiny and accountability which was to continue beyond nationalisation. The Board controlled generation and bulk transmission from a set of selected stations, though these remained under independent ownership, and provided networks to interconnect areas and balance supply within and increasingly between them. It completed a 132kV national transmission grid by the mid-30s and established a national control centre in London in 1938, though until World War Two most transfers were within regions rather than nationally.¹⁷⁶ As well as advancing interconnection and standardisation of technical parameters, the Electricity Commission and the CEB enforced considerable further centralisation of generation, though not as fast as they wanted, through powers to close non-selected stations with production costs greater than those of electricity purchased from the Board.¹⁷⁷ Many stations were built or extended to serve needs beyond their localities. Some major stations were conceived and built for integration with the Grid. Many undertakings became distributors only. By 1938 there were 136 selected stations and 35 non-selected. By 1947, the totals had risen again as supply was widened: 142 selected stations on the grid, plus 53 others, of a total of around 350 public supply stations.¹⁷⁸ The advantages of the grid as foreseen by the Weir Committee were thus substantially realised: classic economies of scale in capital and operating costs through the concentration of generation at the most efficient generation stations, and a massive reduction of necessary idle capacity. As early as 1935, only 28 of the selected stations were running on baseload and 15 of these supplied half the public supply electricity generated. The CEB achieved considerable reduction in cost and increased demand.¹⁷⁹

The significant yet limited achievements of public coordination of an industry that showed continued reluctance to reorganise, were widely acknowledged. The Labour Party had accepted proposals to nationalise the supply industry in the early 30s, and planned to do so if returned to power in 1935.¹⁸⁰ There was support for the move among technical opinion in the industry. The McGowan report of 1936 on distribution, however, rejected public boards and proposed reorganisation based on large companies or groups of local authority undertakings.¹⁸¹ The incoming Conservative government accepted the McGowan formula in a White Paper in 1937, but by July 1938 had dropped the idea of legislation altogether

after resistance was mobilised yet again within the industry.¹⁸²

History: Postwar

The industry emerged from the war with a massive shortage of capacity and problems of coal supply. By 1947 there were over 500 undertakings, some 280 of which were distribution only.¹⁸³ The private companies were still largely profitable and paid shareholders what were often seen as unnecessarily high dividends. Local authority undertakings were judged equally sound and competent; they generally had lower prices but retained the principle of self-financing without subsidy and frequently contributed to rate funds.¹⁸⁴

The industry was nationalised by the Electricity Act of 1947, with little serious opposition.¹⁸⁵ The choice of formal structure drew on the years of hitherto fruitless discussion on reorganisation: a central British Electricity Authority and 14 Area Boards. However, the mandate for the industry in the 1947 Act was vague - as Hannah puts it, 'a set of declaratory phrases' which were 'meaningless as a guide on any serious policy issue'.¹⁸⁶ Its financial obligations were to break even. Ministerial control was limited to general policy and occasional specific directives; operational management was to be left to the Boards.

The vagueness of the legislation on both the industry's tasks and its relations to the government meant that they had to be fleshed out in negotiations between the Ministry and the Central Authority. Both sides were keen to set precedents and establish relations to suit their own objectives.¹⁸⁷ The direction the industry took thus depended largely on the objectives of the Authority itself and its ability to establish them in these negotiations.¹⁸⁸

The industry's organisation consisted of a Central Authority responsible for generation and transmission, with 14 Area Boards for distribution.¹⁸⁹ Beyond the statutory outline, internal organisation was left to the industry. The BEA was dominated by CEB engineers, but relied heavily for both construction and operation on a regional structure with personnel transferred from local undertakings. It sought to exercise central control over design and steadily to centralise other functions. Centrally it

operated through a series of permanent and ad hoc committees rather than functional divisions.¹⁹⁰ The Area Boards pressed for greater devolution of responsibility; while formal direction was rare, the BEA used informal persuasion and in any case had overall responsibility for their finance and performance. Among Area Board staff from generating undertakings there was resentment at the separation of generation and distribution. The BEA Regions themselves in turn sought greater control, envious of the status of the Area Boards.¹⁹¹

There was a general acceptance that the prime objective was to spread cheap electricity and its benefits. The industry's strong ethos had an element of public service which broadly tallied with government objectives for the nationalised industries, and a technocratic element in that the objectives were defined in technical terms, as matters exclusively for technical professionals. Thus detailed supervision by government was seen as unnecessary and undesirable.¹⁹² While in general terms the industry was to be run as a business, strict capitalist market constraints did not apply and statutory duties could to some extent be interpreted as expedient or were at least negotiable. There was a consensus on the need for thorough reorganisation of physical structure and management; CEB engineers had increasingly been frustrated by lack of powers to consolidate the national system. The acceptance of planning for the industry did not, however, extend to planning for energy as a whole, and the industry was relieved not to be incorporated in a National Fuel and Power Board as the Labour Party had suggested during the War.¹⁹³ It likewise successfully resisted the Ridley Committee's recommendations on coordination in 1952.¹⁹⁴

A clear picture of the industry's approach is obtained from the BEA submissions to that Committee.¹⁹⁵ The Authority advocated 'freedom of choice' for the consumer and freedom from state interference in the running of the industry. 'Freedom of choice' was a principle 'agreed since vesting day' which had resulted in increased efficiency: 'This freedom, by enabling the consumer to use the fuel best suited to his requirements, has in the past resulted in a steady improvement in coal conservation.'¹⁹⁶ It neither presented evidence for the claim nor elaborated on the mechanism by which this was supposed to have come about. The free market would 'establish a true pattern of demand for the several forms of fuel and

power, producing the best balance of economic advantage in the use of all national resources.¹⁹⁷ Its programme was based on 'planning to meet demands' and making up the shortage of generating plant which inconvenienced consumers and handicapped industry. National policy 'should be for each fuel and power industry to manage its own affairs on a sound commercial and economic basis.'¹⁹⁸

In immediate practical terms, then, the accepted priority was a rapid building programme to meet the anticipated shortage of capacity as demand rose and to strengthen and integrate the distribution system. The first few years were to be dominated by the coal and capacity shortages. A fuel crisis in the winter of 1946-47 emphasised the vulnerability of the system; load was shed in January 1947 when potential maximum demand greatly exceeded capacity, and again in February when coal stocks gave out.¹⁹⁹ The crisis and its severe economic disruption made a deep impression on the industry. The deficit of capacity on nationalisation had been put at over 1GW_e.²⁰⁰ Although the Minister wanted capacity up to requirements by 1951 and the events of the winter speeded up construction, there was actually a shortage for ten years after nationalisation. Physical rationalisation took second place to maximising output, and the average thermal efficiency achieved in 1938 was not reattained until 1948.²⁰¹ Plant manufacture was standardised on 30 and 60MW_e turbines from November 1947 to July 1950 to allow the power engineering industries to cope with production.²⁰² Many small stations were kept in operation to cope with peak demand. Much of the new plant was scattered between extensions to existing stations rather than concentrated on new sites, which proved difficult to find. Moreover the industry was criticised for its poor management of construction.²⁰³ Meanwhile the grid was already being used for moving energy nationally to cope with major geographical shifts in demand.²⁰⁴

With distribution and thus marketing separated organisationally from generation, major problems were created by increasing demand. Electric fires were in widespread use to beat coal rationing, and domestic demand had increased by 50% in the three years up to vesting. Prices had been kept down by wartime controls and by pre-vesting undertakings as nationalisation approached, and were acknowledged to be too low. And the Boards were ambivalent about the problem and opposed action to restrict

the increase in demand through exhortation or price rises. The domestic space heating load had an inordinate effect on peak demand and hence the need for plant, and it could scarcely be considered economic to fulfil. The industry failed to analyse its impact and take it into account in tariffs. It was slow to develop off-peak storage heating when it could have exploited the changes in domestic fuel mix following the establishment of smokeless zones.²⁰⁵

The Herbert Committee in 1956²⁰⁶ confirmed, indeed assumed, the industry's view of itself as 'a strictly commercial undertaking'. It should not be used 'for implementing national policies' or welfare functions and should avoid a course of action in a 'supposed national interest' if not 'purely economic', unless so directed by the Minister. In this case, direction should be precise. The Committee saw only a limited role for the Minister; 'the less the principle of commercial operation is invaded the better it will be for the efficiency of the industry.'²⁰⁷ It depicted, however, a potential conflict between detailed public accountability and efficiency.²⁰⁸

The Herbert Committee report did criticise the centralisation of the industry; it had 'not yet solved the problem of the right degree of delegation within the formal framework.'²⁰⁹ The Committee's findings and the perceived requirements of the nuclear power programme proposed by the government led to the reorganisation of the industry by the 1957 Act.²¹⁰ A central consultative body, the Electricity Council, was formed, and generation and transmission became the responsibility of a Central Electricity Generating Board. The Council ended up with a limited role, with little planning, policy or supervisory function; instead it acted mainly as a marketing and public relations agency, a finance channel and in providing forms of support for the Area Boards.²¹¹ The CEGB was composed of technical functional specialists, rather than the generalists envisaged by Herbert and the Ministry. The CEGB maintained the BEA attitude that central control of design and construction was essential for efficiency. The CEGB Divisions' responsibilities for construction finally finished in the 60s and its new Regions were responsible for operation and maintenance only. The ABs were given powers to generate themselves, but it was made clear - as envisaged in the Herbert Committee report which had endorsed the overall separation of generation and distribution - that

the powers would only be used in exceptional circumstances.²¹² Despite technical incentives such as the reduced need for reinforcement of local lines, and despite continued friction between the CEGB and the ABs, the ABs with a few exceptions showed no inclination to generate.²¹³ The ABs essential business remained 'buying electricity from the CEGB, getting paid for it, and handing the money back to the CEGB.'²¹⁴ The main nexus thus remained the economic one of the BST, though the ABs increasingly used the EC as a political forum for pursuing their interests against the CEGB.

The CEA was reluctant at first to accept the nuclear programme mooted in the early 50s, against Ministry and UKAEA pressure.²¹⁵ There was prolonged conflict over the size of the programme. That announced in 1955 was of 1.5 - 2GW_e over 10 years. This was revised upwards by some three times after Suez. Each of the Magnox stations was expected at the time of ordering to be uneconomic, and actual losses were greater than expected.²¹⁶ After hesitant starts in the 40s, and aggravating switches to and from oil in the 50s under Ministry pressure, the CEGB increasingly favoured oil in the 60s, this time against Ministry directives to maintain the coal burn.²¹⁷

There was 'an aura of increased commercialism' after reorganisation.²¹⁸ The nationalised industries together came under increased pressure from the Treasury to increase their rates of return and self-financing in the late 50s and early 60s.²¹⁹ Other sections of the government were reluctant to introduce electricity price rises and favoured 'competition' through greater regional autonomy as an alternative spur to efficiency. New financial obligations were set in the 1961 White Paper, including a target rate of return on overall investment.²²⁰ The 1967 White Paper formalised what had been increasingly industry practice: DCF appraisal of individual projects.²²¹ But as Hannah points out, with distribution investment considered obligatory under the statutes, nuclear power exempted for strategic reasons, and ordering of large fossil stations often done for their effects on the power engineering industries, few individual projects were judged rigorously on their return.²²² Those which were, were largely optional investments and optional extra features of main projects, assessed initially at 10%, later 15%, and this was often overruled to gain technical experience.²²³ The rural electrification

mandated under the 1947 Act and pressed for by Parliament despite the obvious losses to the ESI, was largely complete by the mid-60s. The industry subsequently pressed for subsidies direct to remaining remote properties to finance supply.²²⁴ Though the industry pressed hard to be freed of social obligations, it did continue to spend much on amenity - an estimated £10m/y in the mid 60s.²²⁵

The size of baseload stations increased. After leaps from 60 through 100 and 300MW_e sets, the 500MW_e set was fixed as standard in 1960 and large orders were placed for it from 1963 onwards.²²⁶ Several authors have argued that the economies of scale claimed for the larger sets are not proven, particularly as technical improvements incorporated in them were not applied to and tested on smaller sets.²²⁷ The relative economics of fuel transport and transmission, with the construction of 275 and later 400kV grids, and increasingly stringent planning controls,²²⁸ led the CEGB generally to abandon plans to site stations near load. The rational integrated operation of the generation system, begun in the 20s with the first attempts to concentrate generation in efficient stations, was effectively completed in the early 70s with the adoption of a merit order based on system marginal operating costs, and hence a BST energy charge on the same basis rather than average operating costs.

Private Generation

A significant fraction of electricity has been generated by privately owned plant outside the public supply system - in industry, mines and transport undertakings - but it has steadily decreased. About three-quarters of electricity used in British industry was self-generated in 1907, about a half in 1935, a third in 1948, and less than a fifth in 1974.²²⁹ As industry turned to electric power in the first three decades of the century, the supply undertakings had to fight to capture the new market with technical knowledge of end use and attractive tariffs, competing with plant manufacturers.²³⁰ A single manufacturer might constitute a large fraction of the load of a pre-vesting undertaking. The relative advantages of public supply improved but the balance depended on several factors, chief among them: the size of plant needed compared to that being installed in the public supply system; whether there was a need for process heat which could be supplied by CHP plant, or a source of

waste heat for generation; and the different economic conditions of private and public installation and operation. In the interwar years, it was worth installing private sets of a few megawatts; after nationalisation most were 10 - 30MW_e; large numbers of standby generating sets were installed in the early 70s; and small scale CHP looked increasingly popular in the early 80s.²³¹ For industry, generation would be a secondary activity, capital could be more expensive than for a public undertaking and a better return might be sought; on the other hand, incidentals like tax relief might make a difference and the security of self-generation was valued. With the prohibition of generation as a main activity under the 1909 Act and the absorption of virtually all public supply stations into the nationalised industry, there have been few examples of industries providing utility services to other industries.²³²

With the interconnection of the supply system, the possibility and advantages of parallel operation developed, with a standby supply from the public system and interchange of energy as required to balance an industrial user's demand pattern. Overall economic savings were identified which could be split to the advantage of both parties, but the interface between the two systems and in particular the conduct of the supply industry in negotiating terms have remained contentious.²³³ Complaints have seldom been upheld and largely because of the complexity and ambiguities the problem has been put down to misunderstandings. But the perceived attitude of the supply industry and the length and complexity of negotiations have been seen as an obstacle to arriving at the most efficient arrangement, and it has repeatedly been encouraged to cooperate more fully and clarify the terms and tariffs for interchange in advance. It has however successfully defended its right to refuse supplies which it can undercut and to fix its own tariffs to cover adequately its costs as it sees them. Moreover reluctance to lose the commercial advantage of discretion and secrecy has meant that terms have remained controversial despite attempts such as the 1983 Energy Act to resolve the problem. The significance of these developments and disputes are considered further in 8.6.

Recent Developments

The industry increasingly aligned itself to a substantial shift to nuclear power.²³⁴ A second programme, of 5GW_e of AGRs, was announced in 1964. Since Drax B the CEEGB's generation investment programme has been almost entirely for nuclear stations. This orientation has been behind its internal reorganisation, in which nuclear power work has become dominant in terms of resources and prestige. It has dictated much of its research activity, on for example, pumped storage to level effective demand. In the early 1980s the CEEGB with government backing committed itself to a programme of PWRs, thus finally aligning itself to the US-based international nuclear industry after years of pressure and of conflict over reactor choice.²³⁵ The first planned station, Sizewell B, was the subject of a public inquiry in 1982 and 1983.²³⁶ Unlike the Magnox stations, the second and third programmes have been justified by their economics, though this became contentious in the mid-70s and has remained so.²³⁷ As presented by the industry using NPV calculations, the accounting has led to an accelerated closing of small older stations before their operational life had finished, especially in the mid 70s.²³⁸

Up to the mid-60s the industry consistently underestimated demand in its projections; from then on it produced large overestimates.²³⁹ It was widely suggested that this overforecasting was not produced by an inability to foresee conditions, but to justify further construction especially of nuclear plant and a move to larger stations - namely multiple 660MW_e sets.²⁴⁰ Simple extrapolations were criticised as entailing untenable assumptions about continued growth in certain end uses of electricity. The margin of spare capacity deemed necessary rose from 14% through 21% to 28% in 1979, and again this was seen as a rationalisation of actual and expected overcapacity.²⁴¹

A massive drop in home orders after the major construction programme of the early 60s - from a total of about 7GW_e down to sporadic ordering of one major station every two or three years - coupled with the increasing unit size, produced serious problems for the power engineering industries.²⁴² By the mid-70s boiler and turbine manufacturers had merged into two large firms in each field, and even these had to be

sustained by the advance ordering of a major station.

The industry, hitherto seen as exemplary on most criteria²⁴³ - apart perhaps from its management of construction programmes - came under increased criticism during the 70s, for its overforecasting and resultant overcapacity, its pricing, its exclusive commitment to nuclear power, its closure to alternative ideas on generation technologies, its organisational structure, and environmental issues.²⁴⁴ Critics had widely differing analyses and motives, from sections of private industry and the political Right which see its status as a state monopoly as the root problem, through those chiefly concerned with technical or environmental issues, to sections of the Left concerned with its lack of accountability and fulfilment of social objectives. It gained a reputation for refusal to accept criticism: it appears to have tried to insulate itself, asserting more strongly its wish to be free of government and other outside interference,²⁴⁵ and to have defended itself dismissively.

The industry's organisation in outline has remained essentially unchanged into the 80s, despite repeated inquiries and two Bills. An investigation by a committee of civil servants and industry representatives led to a Bill introduced by the Labour government in March 1970.²⁴⁶ It proposed a central body with 'powers to plan and control the policy of the industry as a whole'; the boards would retain their statutory functions as before, but would operate within the framework of broad policy for the industry as a whole. The Bill became controversial largely because of proposed powers for the industry to manufacture and supply equipment, and it lapsed when Parliament was dissolved in May 1970.

A Committee of Inquiry under Plowden was set up in 1974 and reported in 1976.²⁴⁷ It recommended a unified single statutory body for the industry but with managerial devolution. It confirmed most of the premisses of commercial operation and opposed the use of the industry as an instrument of economic policy. The government response and proposed legislation accepted the need for a central body but would have retained the ABs with considerable autonomy.²⁴⁸ The Bill contained several clauses, indeed a notable shift under Labour influence, with which the industry felt uncomfortable: a duty to have due regard to 'requirements of national energy policy' as expressed by the Minister; to 'promote industrial

democracy in a strong and organic form'; to have 'due regard for the needs of consumers for heat, light and power'; and strengthened obligations and powers to pursue CHP which are considered in 8.6.²⁴⁹ The Bill was shelved during the Lib-Lab pact because of Liberal opposition to increased centralisation.

The new Conservative government declined to introduce legislation for the comprehensive reorganisation of the industry, expressing the hope instead for the development of better internal relations.²⁵⁰ The Energy Act of 1983 enabled limited forms of private sector involvement in electricity supply by removing the statutory prohibition on supply as a main business and giving private generators guaranteed access to the grid and hence to markets.²⁵¹ The government started looking at further privatisation of the industry as part of a programme of disposal of public sector concerns to the private sector.²⁵² In the absence of externally imposed reorganisation, the CEGB's own proposed changes appeared further to concentrate most functions.²⁵³

These various challenges over the past decade to the industry's organisation and policies, and its responses, are taken up again in 8.6 where their connections with CHP are explored.

Structure and Policies

The analysis of 4.2 and 4.4 indicated general characteristics of the energy industries and their derivation from the technical and social structure of the sector. This provided a starting point for considering the electricity supply industry specifically. It also suggested the increasing importance of electricity because of the requirements of the economy, leading to an increased share of delivered energy, the subordination of coal production to the ESI's needs, and the drive towards nuclear power, albeit with limited results. This significance of electricity is reflected in the industry's exceptional resources and autonomy. There is a contradiction between the function of nationalisation in subordinating energy provision to the needs of the rest of the economy, and the institutional power of the industry to secure the objectives it defines for itself. With no necessary correspondence between the needs of industry for energy, the strategy of government for the general management of the economy and its mediation

of more specific demands, and the programmes pursued by the ESI, there can be significant conflict among these interests, let alone with more specific sectional interests and with those which are excluded from policy-making in the sector.

Thus, for example, while an overall tendency can be seen in the industry towards commercial terms of investment and operation, which might be interpreted as functional for a capitalist economy as a whole, a number of complicating factors are involved: the pursuit and defence of these ideal terms is selective and its attitude, say, to subsidy is ambivalent; government has continued to use its pricing and investment expediently for other economic purposes; there have been frequent disputes over the fairness of supposedly commercial dealings because of the industry's monopoly position; and so on. Conflicts over specific government directives on fuel use, prices and station ordering, over purchase terms for privately generated electricity, and recently over the tenacity of the industry's pursuit of the PWR, would need to be analysed in terms of this structure of relations.²⁵⁴

The distinct policy paradigm of the industry has much in common with the dominant paradigm for energy policy identified in 4.2., deriving its character and strength from the same sources, such as a resonance with more general ideological precepts, and limited political accountability. But it is linked with the particular technological trajectory of centralised supply from large remote condensing power stations, and associated for at least the last two decades with the dominant role intended for nuclear power. The pursuit of this trajectory then creates objective technical and economic constraints on subsequent action and possibilities for change; but the commitment to it also influences the arguments and appraisals of the industry in ways suggested in 1.3 and 3.5, particularly through the overstatement of constraints which actually operate on alternative courses of action.

The coherence and resilience of this paradigm as a set of intellectual assumptions and practices, and following Benson's suggestion, the way it became embedded in organisational arrangements, would need much more thorough analysis than is possible here. They are recognised by some critics, but have seldom been addressed by official inquiries, which have

concentrated almost exclusively on the influence of formal financial, legal and political relations.

A set of mutually reinforcing factors can be suggested. The industry has a virtual monopoly on expertise on electricity. Most professional electrical engineers have been incorporated within it, and closely identify professional interests with those of the industry. Whatever dissent may exist within the industry on technological matters has seldom surfaced. Increasingly centralised internal organisation undoubtedly contributes to the coherence of its policies. The effects of the organisational separation of generation and distribution in England and Wales, versus their integration as in Scotland, are not clear. The limited role of the Area Boards does not appear to have allowed or encouraged significant diversity in approach; some of the notable exceptions are considered in 7.2 and 8.6, and even these can be attributed in large part to anomalies in economic relations between the two sections of the industry.

Criticism from outside has had limited impact, and the responsible ministry has provided a channel for its views rather than independent appraisal of them.²⁵⁵ Consumer influence over industry policies has been weak, legitimated by the unproblematic notion of the interest of the electricity consumer. Its consumer representative body has recently produced useful and thorough criticism of certain aspects of the industry but again with apparently little effect.²⁵⁶ The industry trade unions, dominated by the political Right of the labour movement, have been notably uncritical of industry strategies and have effectively neutralised criticism from that movement.²⁵⁷

The industry's unresponsiveness to criticism is frequently depicted as an inability to change.²⁵⁸ It may in part be inertia, but this assumption ignores both the likelihood that inside the industry there seems little need for a basic change of direction in terms of its own interpretation of its role, and the wider influences on its actual development and function as an essential and integral part of the economy.

4.6 LOCAL AUTHORITIES

Introduction

Much of the activity on CHP and DH has had a local focus and local authorities have been key actors in it. An understanding of the urban political economy and the local state within it is thus essential for this analysis. The remarkable matter is how much of the politics of energy can exclude a local dimension. This exclusion is a result of the specific features of the energy sector discussed in 4.2: that production is organised centrally even though facilities are scattered and it continues to have local impacts; that users of energy relate to production and distribution largely as consumers of a commodity, rather than through local political arenas; and because of the dominance of supply-side considerations in policy-making. The specificity of this arrangement becomes clear when it is compared with energy provision in the first half of the century.

Local Political Studies

Dunleavy, among others, has reviewed and criticised thoroughly the dominant approaches to explaining local politics.²⁵⁹ British studies have typically been descriptive and uninformed by explicit theory, and fragmented in focus. They have dealt almost exclusively with institutions of local government and often their scope and normative orientation have been limited to practitioners' concerns. They display empiricist epistemology, pluralist assumptions and often technocratic ideology. Explicit theoretical bases, as applications of more general political science approaches, display their same shortcomings; the pluralist and neo-elitist approaches to 'community politics' in the States have already been encountered.²⁶⁰ They have to varying extents left basic questions about the object of study unexplored; rested on individualist accounts of social action; ignored the structured context in which local politics operates - not only the constraints and influences of the local economy but the national structures which affect local activities; accorded too great a significance to electoral competition and representation in determining policies; and ignored ideological influences.

Local State

The approach to which the theoretical discussion of chapter 3 points would by contrast emphasise the structured social context around the local state, and its relation to national social processes and patterns. The local state can again be depicted as specific related forms of representation, organisation and intervention, as both sites and outcomes of political struggle. It must be recognised that the local state includes local agencies of central state organisations, especially of the extended welfare state apparatus. The division of functions between these and local government, central government and private capital cannot be assumed; they have changed significantly throughout the century. It is clear that the local state cannot be regarded simply as an arm of the central state, and though amenable to the same form of analysis advocated in 4.3, can be expected to be very different in character.²⁶¹

Though the local state has increasingly become involved in providing conditions for production, the urban focus is probably more important as a site of struggles over reproduction: in housing, in welfare services, in education, in the family, etc. Following Cockburn three points of action can be identified: the point of collective reproduction; that of privatised reproduction; and that of employment in reproduction.²⁶² A different set of responsibilities for the local state produces not only a different form of politics to the more corporatist mode adopted by central government around production issues, but also different ideological concerns and emphases.²⁶³ It indicates the importance of local political arenas for radical changes to integrate production and consumption objectives, a theme developed further in chapter 9, and therefore at the same time the contradictions involved in local government intervention in local production.

Local authorities are providers both of individually consumed goods and services, under various forms of allocation, and also of means of collective consumption.²⁶⁴ The level and pattern of these forms of consumption and allocation are politically determined. With local authorities acting as bulk purchasers from private and public sector industries, different producers have differing interests in each form of consumption, and can thus be expected to try to influence political choices between them.

The forms of distribution and consumption of goods and services have significant effects on the forms of political struggle over them, and more generally in creating urban patterns. As Dunleavy argues, the coexistence in various sectors such as housing and transport of private (and usually individualised and commodity) and public (and usually collective and service) modes of consumption, have created significant social cleavages. These divisions, though strongly dependent on personal income, to varying extents cut across those based on production relations. The importance of such divisions, and their effect on ideological differentiation and electoral alignment, depends on the balance of those different forms of provision.²⁶⁵

An analysis of determinants of local state policy and actions must be prepared to take into account influences - economic, political and ideological - at all levels: local characteristics and relations, either common to urban areas or specific to that studied; processes and contradictions internal to the local state; and a variety of non-local influences. In contrast to common assumptions, Dunleavy argues that local authority policy-making is greatly insulated from electoral influence; representative inputs are fragmented and attenuated; and actions are only in small part responses to specific local problems or demands.²⁶⁶ Of much greater importance are ideologies expressing general institutional interests and orientations. Dunleavy identifies the main ideological forms as managerial, professional and partisan, and suggests a strong corporate ideology where elements of the three overlap in party leaderships, senior officers and general policy groupings.²⁶⁷ Localism - an orientation to the particularities of an area - varies in importance but is generally a subsidiary influence. Its specific content depends on the local political economy and often on traditional perceptions of its character. In any case, local concerns are shaped much more by informal and unacknowledged networks channelling the influence of particular sections of local society outside electoral mechanisms, than by popular demands.²⁶⁸

Central government control over local authorities is important, directly via statutes, financial conditions and executive decisions, and indirectly via circulars, informal advice and pressure, etc. But relations are complex and can by no means be reduced to implementation of central policy by local agency. Central power is limited, for example, by its very dependence on local authorities for implementation or production of outputs, and for their

local knowledge and operational expertise.²⁶⁹ Moreover local authority actions and outputs collectively shape the terms of much central policy debate, and local authorities have often taken a lead in regulating private sector activity.²⁷⁰

Other important non-local influences are national local government organisation, including the various associations and ad hoc groupings and the influence of larger and higher level authorities on smaller ones; professions occupying various positions in the local state and across its boundaries; the direct involvement of private capital in urban development and services; and, on specific projects and issues, national quasi-governmental bodies. A complex and changing network of relations between any number of these organisations may surround a particular local issue.²⁷¹

Developments

Local state intervention in all aspects of social life has increased enormously in this century, and a number of general developments can be outlined which have had a significant impact on the character of urban life. First, there has been an enormous growth in urban public services, in part a result of the physical growth of cities and towns - the process of urbanisation rooted in the requirements of the developing capitalist mode of production²⁷² - and in part the gains of political struggle by the urban population. With this increased responsibility for the provision and management of urban resources and facilities, has come a massively increased expenditure and organisational size, and an increasingly complex set of rules for allocating access.²⁷³

The development of public housing is especially important in this study. Up to 1914, housing provision by a local authority was an adjunct of its public health function: it could replace slums.²⁷⁴ Serious shortages of accommodation after WW1 led to government inquiries and legislation, and large building programmes for working class housing. While the absolute shortage had largely been rectified by the mid-30s, substantial areas of slums remained. The scale of local authority construction of housing and public buildings after WW2 was larger still (App. 14).²⁷⁵

Second, this socialisation of consumption has produced greater conflict in the political arena. These sectoral conflicts, over housing, transport, health, education, etc., have themselves influenced the character of consumption and the responses of the local state.

Third, the local state is also involved in production and distribution: in the last century and less so in the first half of this century, in municipal trading, substituting for or competing with private firms; providing infrastructure and other preconditions for capital; and recently through investment in private enterprise, direct involvement of personnel, purchase and development of land, profit-sharing schemes, etc.²⁷⁶ Increasingly local government is concerned with the health of the local economy and hence with the performance and needs of major private employers. From the relatively uncontentious industrial development policies of the 70s, the character of these more comprehensive local economic policies has diverged along party lines as outlined shortly.

Fourth, local government has accrued greater powers and obligations to plan and manage physical urban development.²⁷⁷ Through land-use, building and transport, the exercise of these has been a major determinant of urban social patterns. The first limited powers for local authorities to regulate urban development were given in 1909.²⁷⁸ In 1932 this control was greatly extended, with powers to adopt and enforce planning schemes.²⁷⁹ However, having to pay compensation where development was refused, remained a major drawback in their application. The Town and Country Planning Act 1944 gave compulsory purchase powers for war damaged areas and other areas in need of comprehensive redevelopment.²⁸⁰ The New Towns Act 1946 gave similar comprehensive powers to development agencies.²⁸¹ The postwar Labour government stopped short of nationalising land, but the T&CP Act 1947 extended powers to plan and control development to the whole country. It required local authorities to draw up land use plans for their entire areas within three years, and finally removed the burden of compensation.²⁸² Subsequent Acts have extended and rationalised these duties, powers and procedures, but continuing to represent a balance between positive planning and regulation of development by landowners.²⁸³

Fifth, the increasing responsibilities and expenditure of local

government has led to changes in organisation and management. The major period of reform in this century was in the 60s and early 70s.²⁸⁴ Pressure mounted for increased efficiency in the use of resources by tighter control over workforce and finance; central government required increased responsiveness at the local level to its own economic and political priorities; and there were demands for action to tackle newly rediscovered urban poverty. There was major geographical reorganisation: the London Government Act 1963 formed the GLC and the 32 London Boroughs, and the 1972 Local Government Act similarly reduced and standardised the 1300 councils outside London into 400 in a two-tier system of counties and districts.²⁸⁵ There was also a concerted attempt to introduce management practices similar to those which had developed in industry.²⁸⁶ A series of official reports criticised the fragmented and functionally specialised internal organisation of local authorities, which had evolved through pragmatic responses to specific demands.²⁸⁷ The key needs were seen as integration, control from the top, efficiency and forward planning. Problems were to be treated as interrelated, and individual services as means to better defined ends.

Thus a concerted effort of the new DoE, the authorities, professional associations, political parties, universities and research institutes, and management consultants, aimed at extensive change: fewer committees; a central policy committee and management team; horizontal or interdepartmental groups for problems, projects or areas; specialist corporate planning staff; and a closer relationship between key members and officers.²⁸⁸ The speed and extent of the shift varied greatly, with metropolitan counties and larger city and borough authorities far in advance of the shires and smaller districts. But despite the absence of compulsion in the implementation of these managerial reforms, most authorities adopted the basic ideas if not the full package prescribed. The late 70s and early 80s, however, saw some disillusionment with corporate approaches and dismantling of associated internal structures. In part this derived from the increased politicisation and polarisation of local policy-making to be discussed shortly, and the desire of elected members to reduce the influence of officers on key policy issues.

As local government 'geared up to govern more assertively',²⁸⁹ however, the emphasis throughout was on management. The approach,

techniques and ideology produced profoundly anti-democratic tendencies. It reinforced the role, and hence the weak economic and political position, of people as consumers of services, and involved attempts as in private corporate strategy to structure patterns of consumption to suit its administrative needs.²⁹⁰

Sixth, there have been shifts throughout the century in the tier of local government at which various functions have been dealt with, but more importantly in the division of these functions between councils, other regional and local state agencies, central government, and the private sector.²⁹¹ These divisions are crucial in determining the nature and pattern of allocation of goods and services, and it will be argued have been important in the shape and fate of CHP and DH. While local authorities' responsibility for education, planning and housing have greatly increased in importance, other functions have been transferred to central or regional bodies, as part of a general shift towards vertically integrated, functionally specific forms of government. Trading functions have declined, especially with the nationalisation of energy undertakings in the late 40s, and are now limited largely to transport and recreation.²⁹² In the 1980s local authorities have come under increased pressure financially and politically to place contracts for services and other work with private firms. In general these changes represent an ever stronger separation of production and consumption responsibilities.²⁹³

The effects of the transfer of certain functions, particularly energy production and distribution, were thus to remove them from the arena of local politics to the growing technocratic administrative apparatus; to retain and reinforce the relation of domestic users to energy production as consumers with little power to influence industry decisions; and thus to defend the commodity form, commercial allocation and the autonomy of producers. The direct relations between local authorities and these agencies are now episodic and specific, generally with limited powers and related to peripheral issues concerning individual projects.²⁹⁴

The reaction, through local authorities or by direct challenges to administrative bodies, has been local and regional demands for greater decentralisation. The importance of energy and particularly heating to the urban population following the price rises of the 1970s has led to a revival

of energy as a political issue at local level, with demands often directed at or through local government, where user interests can be treated in a less fragmented way.²⁹⁵ The weakness and difficulties of these political actions can be seen to derive from the structure of production and allocation.

Central Local Relations

The developments outlined so far, and particularly the organisational and management reforms of the 60s and 70s, thus produced significant differences in the local context over the time span covered in chapters 5 to 8, and in particular between the two periods of concerted attempts to introduce large scale CHP/DH in the early postwar years and the 80s. But in addition there have been profound changes in political and ideological relations between central and local government, arising from the general social and political context outlined earlier and accelerated over the last decade.²⁹⁶

The period from the mid-40s to the early 60s is characterised by Rhodes as one of 'quiescent territorial politics'.²⁹⁷ Economic prosperity and a widely shared ideology allowed reconstruction of urban areas and the introduction of welfare state services, relying heavily on the local authorities for implementation of these programmes. There was a consensual 'apolitisme' with party political differences in local government less marked than at national level.

The centrally initiated reform of the 60s and 70s still involved consultation and an ideology of central-local partnership. However, continued economic decline led from containment of local authority finance to contraction from the mid-70s onwards. The interests of national economic management as defined by central government have increasingly dominated central-local relations. Under the Conservative government the emphasis in both administration and overt ideology has turned from cooperation to control. There has been continued confrontation and a stream of legislation, with mixed results, as it has attempted to exert control. In terms of finance, the government has reduced grants; introduced ceilings on local authority expenditure and penalties for overspenders; and set maximum rates for high spending authorities. It has

attempted to force a reduction in welfare spending and the privatisation of services, and in 1986 abolished the GLC and MCCs as the chief centres of resistance to these policies.

Reaction has come both from the networks of organisations or 'policy communities' in functional sectors, defending their control and resources,²⁹⁸ and in a resurgence of party politics in local government. Challenge has come in particular from Labour controlled authorities, notably the GLC and MCCs, which have to varying extents been focusses of attempts at 'recomposing a political culture of radical labourism'.²⁹⁹ Several have developed, among other programmes, more ambitious experimental local economic policies, albeit with severe financial and political constraints, and for the GLC and MCCs with impending abolition. These have been explicitly aimed at:

- identifying strategic sectors for support and intervention in terms of local skills and needs;
- encouraging alternatives to market criteria, such as production for social need;
- defending or strengthening the position of workers;
- increasing the influence of the local authority in the development and management of the local economy.

As Duncan and Goodwin suggest, the ideological and demonstration effect of these programmes is probably much more significant than their economic impact.³⁰⁰ By contrast, centrally led attempts at inner city regeneration through more compliant local authorities have been based on deregulation and public subsidy of private activity through schemes such as Enterprise Zones.³⁰¹

Legal Framework and Capital Finance

The details of two aspects of local authority operation at any time were crucial to projects such as DH schemes: their legal framework, and finance for major projects. It remains to consider these and changes in

them over the time span covered.

Though local authorities have accumulated wide responsibilities in both providing services and regulating activities, strictly they have been limited to discharging duties and exercising powers conferred on them by parliament.³⁰² In addition, central government has had powers to supervise through inspections, inquiries, appeals, approvals, and threat of action on default. The legislation has been complex, frequently amended and occasionally overhauled. It has, however, formed a 'constitutive structure in which the interests of central government, local government and private interests were mediated.'³⁰³ The law, in other words, has - until its use to the full by the Conservative government in the 1980s in controlling local authorities after the breakdown of administrative arrangements - been less important than administrative negotiation, and the courts little used. Threat of ultra vires actions, suggests Loughlin, have seldom restricted action, and where likely to have been circumvented.³⁰⁴

Enabling powers were given:

- in Public Acts, usually promoted by the department responsible for local government, consisting of a basic Local Government Act and additions and amendments to it;³⁰⁵
- in Local Acts promoted by individual corporations themselves or by county authorities for their constituent boroughs or districts;
- or by Clauses Acts which consolidated groups of clauses for specific purposes.³⁰⁶

Usually powers from Public Acts also required the issue of a Statutory Instrument by the responsible Minister for specific application. In addition much activity has been subject to specific sanction or control by central government as it was carried out, some by routine procedures, others with measures devised ad hoc.

A major attempt at rationalising the large volume of local legislation was started with the Local Government Act 1972, so that redundant

powers could be eliminated, useful ones consolidated and made available to all appropriate authorities, and the need for subsequent legislation reduced.³⁰⁷

As in all local authority activities, the structure of the finance of major projects has been important: in the assessment of projects and in their progress once started, but also in the disposition of the authority towards undertaking a venture.³⁰⁸ Local authorities have only been able to obtain capital for major projects producing permanent assets by borrowing.³⁰⁹ Permission to borrow - loan sanction - had to be sought separately for each project, which would be subject to detailed scrutiny. For each loan sanctioned, local authorities had to set aside a sum each year from revenue so that the loan could be repayed within a prescribed maximum period, supposedly related to the physical lifetime of the assets. Interest and other charges also had to come from revenue. The source of the revenue used to balance major projects was not clear and a source of controversy. In the case of DH it was largely clarified by petitions against enabling powers in Local Bills. These established that schemes had to be entirely self-supporting; that is, capital charges, loan repayment and all running costs had to come from revenue to the scheme, and could not be subsidised from rates, block grants or the authorities' other sources of income.³¹⁰

This framework remained similar at least in outline until the early 80s.³¹¹ There was some reduction in the detailed control exercised by central government. Loan sanction was divided into 'key sectors' and a block allocation, and some individual projects were included in 'rolling programmes'. Authorities were allowed to finance capital funds from revenue. These measures in theory gave authorities more flexibility in capital programmes. The system became 'primarily a way of regulating local authority expenditure to keep it in line with national economic plans.'³¹² The absolute constraints became more important than the details of procedure.

From 1981, however, much of this flexibility has been withdrawn, the funding of capital projects from revenue curtailed, and the focus of control shifted to capital payments rather than loans. A sanction of total payment year by year now puts much greater emphasis on the scheduling

of projects.³¹³ The control of finance, particularly in a time of political disparity between central government and key local authorities, remains 'a "game" in which both sides manoeuvre for advantage ...'³¹⁴

CHAPTER 5 CHP AND DH I: EARLY HISTORY

5.1 EXPERIMENTS AND PROPOSALS

Nineteenth Century

Piping heat from a central source was discussed and attempted by several engineers during the nineteenth century, an extension of early attempts to heat rooms or single buildings with steam or hot water as a medium. There are frequent mentions of plans or schemes, isolated examples as experiments or to take advantage of specific opportunities or circumstances, and recorded because of their novelty.¹ Possibly because proposals did not materialise and experiments were less than successful, there are few records of public advocacy of such heating in general terms.²

Recognisable district heating is widely held to have started with the experiments in 1876-7 of hydraulic engineer Birdsill Holly in the US and commercial operation in 1877 with his heating utility in Lockport NY, supplying first houses and three years later factories. Within 10 years, similar systems were operating in nearly 20 US cities, including those of the Steam Heating and Power Company and the New York Steam Company in New York.³

Early Twentieth Century

The gas and steam reciprocating engines used for small private generators from the mid-nineteenth century onwards and for public supply from the 1880s were of low efficiencies, and the steam engines in particular produced a form of waste heat which was both obvious and in a readily useable form. To find a use for that heat was thus both an engineering objective - improving efficiency and eliminating waste - and for engineers in private firms, generating either for in-house use or for public supply, a way of increasing revenue or making savings; the congruence of these motives is clear in contemporary papers. Some of the papers are remarkable for their prescience in anticipating not only the main technical problems likely, such as heating and electrical load balance,

but also the principles and difficulties of economic evaluation and organisational problems which would be discussed for decades afterwards.⁴

In the States, engineers persuaded electricity companies to take on steam heating as another activity where local conditions were suitable. Steam heating companies had already solved the problems of distribution and shown the technique profitable, and the extra function could be taken on without detriment to electricity supply. 'The pioneer work has been done, and the electricity companies are therefore in a position to reap the advantage of the experience gained, and to begin their work where the steam companies have left off.'⁵ Speaking to American electrical engineers, George Thayer said,

The problem confronting the station manager of the day is this: Can this stream of energy now being wasted be put to some use, and, if so, will it pay to do it? generally speaking, there is no extension of your business that will pay larger profits on the investment than steam heating.⁶

Similarly around the turn of the century the use of waste heat from the exhaust gases or cooling jackets of gas engines was advocated.⁷

Discussion of American developments was carried in British technical journals. The American engineer had 'lighted upon a source of profit which, unfortunately, is not available to his English confrere'⁸; with no established steam distribution networks, CHP in Britain was limited to single establishments or industries.⁹ Several engineers expressed frustration at the lack of opportunities and perceived resistance of authorities to adopting their idea or specific proposals. OF Allan anticipated the 'inevitable opposition of the local authority possessing streets to be crossed.' He suggested:

A whole London square, for example, with a central garden could easily be supplied with heat, water and electric light and power from a comparatively small station. Such an installation would be capable of being exploited at a minimum of waste, yet no one attempts to do it, perhaps because the scheme is so palpably sound that the ordinary suspicious landlord company thinks there must be some knavery at the back of what he cannot criticise.¹⁰

There are scattered references, in technical journals and elsewhere from the turn of the century, to proposals and occasional implemented schemes for heat supply using either engine waste heat or live steam taken from

boilers at times of low electrical load. In 1917 St. Marylebone Electricity Department was supplying the Public Health Committee's 'cleansing and disinfecting baths' for 'verminous persons' with steam from its power station boiler house; the former found it 'remunerative' and the latter was saved 'considerable expense and trouble'.¹¹ ER Dolby recalled two proposals around the time of World War I. One was for a supply of steam from a City of London Electricity Supply Company power station for a brewery and public baths in Wandsworth; the other for a steam supply from the Westminster Electricity Supply Company's Eccleston Place Station to St. George's Swimming Baths in Buckingham Palace Road. Both were rejected.¹²

W Nelson Haden's evidence to the Royal Commission on Coal Supplies in 1903 similarly advocated central heating for office blocks, public buildings, institutions and housing estates, using exhaust steam from generating plant to achieve 'large economies in the use of fuel'. Haden himself had designed a CHP/DH system in 1898 for a scheme of shops and houses on Bournemouth sea-front which was never built.¹³

5.2 EARLY SCHEMES

Manchester

Manchester Corporation Electricity Department started supplying steam from its city centre power stations in 1911.¹⁴ The City Electrical Engineer was Leonard Pearce, later to be involved in the Pimlico scheme as Chief Engineer of the London Power Company. Reciprocating engines at Bloom Street supplied warehouses and factories within a few hundred metres via overground pipes. GN Haden negotiated a supply from the Dickinson Street station, which powered Manchester's tramways, for the adjacent St. James Buildings of the Calico Printers Association. Later the supply was extended to other buildings within a few hundred metres of the station and the maximum heat load grew to some 10MW_h.¹⁵ Additional steam was later bled from the first condensing turbines installed in the stations during WW1.

None of the stations became selected stations under the 1926 Act, and consequently their importance declined. By 1929 reduced use of the stations and consequent load balance problems forced the Electricity Department to substitute a live steam supply, and this was to continue for several decades. Dickinson Street was closed altogether in 1930, but supply from from heat-only boilers at Bloom Street continued for several decades.¹⁶

The Engineer and members of his Committee visited Europe and the States to study generating and steam supply practice. From the American trip, they concluded:

Public heating supplies are best furnished from independent central stations, or, in other words, that it is not practicable to combine such supplies with the production of electrical energy.¹⁷

Pearce himself argued by the early 20s that the supply of heat produced numerous difficulties and the economics was dubious because of the high cost of ducting.¹⁸

In the late 20s the Corporation sought to clarify its legal powers, and s.15 of the Manchester Corporation (General Powers) Act 1930 formally

enabled it to supply steam up to one mile from its generating stations. Powers to break up streets were provided by extension of the relevant clauses of the Electricity Acts. The permission of the CEB was needed for selected stations, but such consent was not to be 'unreasonably withheld'. The clauses were not contested.¹⁹

Blackley and Gorton

With the desperate shortage of housing after WW1, the subject of much official inquiry and legislation, the provision of local authority 'working class dwellings' grew rapidly in the 20s (App. 14).²⁰ Manchester experimented early on with central supply of hot washing water. In 1920 the City Council proposed supplies to two estates of 2000 homes at Blackley and Gorton, built as assisted schemes under the Housing Acts.²¹ Two postwar Government committees had recommended hot water supply for such estates, and the Manchester project was encouraged personally by the Minister of Health.²²

The Ministry refused to allow the scheme to be subsidised from the authority's housing account. The capital expenditure for each scheme was £130 000 and the running costs £5200/y; revenue was £3 18s per year per dwelling. Doubtful about the economics, the council authorised installation somewhat reluctantly.

By the mid-20s, only 580 houses had been built at Gorton, of which 540 were connected to the hot water supply, and only 1000 out of 2000 at Blackley. The Council sought compensation from the MoH for the expenditure on excess capacity in the system, and threatened legal action. It was eventually compensated for the loan charges and losses on installation.²³

The system was beset by problems, particularly with corrosion of the untreated cast iron pipes producing leaks and discolouration, and allegedly vermin in the ducts. Frequent alterations and repairs failed to maintain adequate supply. The system became a contentious local political issue and the charges were dropped. In 1931 the system was abandoned and back boilers fitted in the houses.²⁴

Similar washing water schemes are known to have been installed at Craighton in Glasgow in 1922, supplying some 90 flats in 11 blocks, and at Staveley, Derbyshire, where the Staveley Coal and Iron Company supplied 2000 employees' homes.²⁵

Dundee

The local authority housing programme in the 20s could likewise have been expected to provide opportunities for early attempts at networks for space heating, though the low density of the heat load, compared say to the city centre steam networks in the US, made the economics doubtful. A single coal fire in each dwelling was the rule, and the one significant example of DH, the exception.

Dundee Council discussed DH as early as 1914²⁶ but proposals were shelved during WW1. In the 1920s the City installed two schemes designed by Donald Smith for its first council housing estates.²⁷ The first, for the 250 houses of the Logie Estate, was finished in 1920. It used steam with heat exchangers in the streets giving hot water for space and heating and washing. Smith proposed a larger second scheme of 1200 houses, but the poor performance of the Logie scheme in its first two years led to its rejection. Instead only 268 houses of the Hospital and Stirling Park estates, completed in 1922, were connected to a second system. This used hot water with space heating and washing water supplied separately in a 4-pipe network.

Both schemes provided background heating and hot water for 16 hours a day. The DH supply provided typically 40GJ_H/y per dwelling and coal fires an extra 5GJ_H/y. The charges were initially around 3s/week, and Smith maintained 'it is certain that no householder in this country can get an equivalent service of heat and hot water under any other system at a cost approaching the charges now made in Dundee.'²⁸

But the economics of the schemes came in for criticism from early in their life, and the controversy continued for decades; the Dundee schemes were two of very few examples to which people interested in DH in the 30s and 40s could turn for operating experience and actual costs.²⁹ Smith sought to counter 'ill-informed criticism' made, he claimed, before the

schemes were complete and while their management was still not properly understood. He argued that the schemes had permanently to bear the consequences of mistakes made in planning, but that lessons could be learned and that the economics of DH was good. The configuration of the second site had been highly unfavourable and could have been 16 times larger without needing longer mains than those installed. With overheads spread, such a scheme could have generated a £16 000/y surplus and the proposed 1200-dwelling scheme some £4000/y. Both estates had a low density of housing - 25-30/ha. Both schemes had much redundant boiler capacity, having been intended to supply public baths and washhouses as well; only one of the two boilers was in regular use at Logie and one out of three in the second scheme. Much higher grade fuels than necessary had been used.³⁰

The economics of the schemes was poor for the first two years and marginal thereafter. The second scheme showed a surplus of some £500 from a total revenue of £2700 in 1925/6 and a slight deficit the following year.³¹ The revenue and costs roughly balanced for several years but by 1938 the schemes were losing steadily. Both Smith and the City Engineer continued to defend them as technically successful and demonstrating the economics of DH to be favourable.³²

5.3 20S AND 30S: CHP DEBATE

CHP and Electrical Engineers

The fuel shortages and rationing after WW1 produced a spate of interest in CHP. The Haldane Committee on Coal Conservation, for example, included a recommendation on the use of waste gas and heat from generating stations.³³ Efficiency of fuel use was still the major concern of the National Fuel and Power Committee, reporting in 1928 after a two year inquiry which formed the major official review of energy matters in the interwar years.³⁴ Its preamble usefully outlines the context. Prewar development of fuel use had been based on cheap supplies; after the war, fuel had become 'a much more important element' in costs of production. There was 'much wider and deeper interest' in 'the problem of obtaining the utmost value from the fuel consumed in any particular manner of use.'

The Committee's report acknowledged the growing practice in industry of using exhaust steam, in many cases with very high efficiency; probably 'in all cases where power and process heat is required the efficiency of such an arrangement would be higher' than separate generation. It advocated sizing the plant on heat load and taking the extra electricity needed from the local supply. It saw private generation of electricity by itself as uneconomical and likely ultimately to disappear. These were, however, simply observations; it made no related recommendations.

However, distinct divisions among engineers in attitudes towards CHP were apparent by the 20s. At gatherings such as the Joint IEE/IHVE Discussion on the Utilisation of Waste Heat from Power Stations,³⁵ electrical engineers, many in the employ of electricity undertakings and few remaining as independent consultants, argued strongly and exclusively for the trajectory of increasing electrical efficiency through larger turbines with improved steam conditions. Many small generating stations were being scrapped and supply consolidated into larger public stations, a process encouraged during the war by the Ministry of Munitions and which underlay the approach of the committees tackling the reorganisation of the supply industry.³⁶ 'Electricity enthusiasts in this country,' said one critic, 'are

always thinking of large sums of money for super stations, to the exclusion of all other methods.³⁷ Some electrical engineers were equally vocal in their opposition, regarding CHP operation as 'a retrograde policy'; it 'would amount to a complete volte face and an admission that all the efforts of the last thirty years to improve the efficiency of generating stations have only been steps along a blind alley.'³⁸ They were starting, too, to argue for electric heating.³⁹ Others seemed sympathetic but stressed the practical difficulties and dubious economics, among them Leonard Pearce, Manchester's Electrical Engineer responsible for the early steam supply at Bloom Street and Dickinson Street:

Only those who have tried or are interested in such a scheme fully realise the many practical difficulties. In short this proposal is ... another illustration of the fact that the theoretically perfect scheme is not always, or seldom, attainable.⁴⁰

Some felt the supply industry had sufficient problems without making operations more complicated and taking on a commercially dubious second function: the industry 'has already had an uphill fight against vested interests; is it wise voluntarily to invite other difficulties?'⁴¹

Heating engineers and a few remaining general engineers questioned the wisdom of the dominant trend. Even one writer in Electrical Review wondered

whether the proposed system of supplying the country with electrical energy from huge power stations may not with advantage be modified, at all events, for small residential towns and groups of buildings that are close together, where internal combustion engines could supply the electrical energy as well as the heat and hot-water supply, and could be run cheaply on tar oils or heavy fuel.⁴²

C Ingham Haden called the scrapping of small stations 'a most calamitous proposition' and called for their retention as CHP sources with new back-pressure sets or refurbished old sets converted to BP operation. As for the future, no new electricity generation scheme 'can be complete which does not make some provision for the utilisation of waste heat.'⁴³

Critics blamed electrical engineers, as having a technical obsession arising from their institutional role.

So long as this question is left in the hands of power station engineers who are interested in and responsible for the power station as a power station only, nothing will be done. Their whole professional ambition is to turn out a unit of electricity for a fraction less than anybody else.⁴⁴

Others saw the organisation at fault in not recognising an opportunity in its own interests:

... it is somewhat surprising that the competent electrical authorities, while deploring the low thermal efficiency of their stations, should not have made a serious investigation into the possibilities of this large field with its promises of a greatly increased overall efficiency and a regular source of income.⁴⁵

Some demanded a change of attitude: the electrical engineer should 'step out of his "rut" and take a broad view, in order to arrive at the best policy in the national interest.'⁴⁶ Others in a more conciliatory tone called for cooperation:

Sooner or later a more efficient system must be evolved by the cooperation of electrical engineers and heating engineers. What is wanted is goodwill and fairplay on both sides.⁴⁷

The cooperation of heating engineers with electrical engineers is the only satisfactory way of dealing with this important matter so as to produce economical, efficient and profitable results...⁴⁸

But there were also calls for coordination or regulation. Municipalities needed someone 'whose main object is to see that none of these watertight compartments which constitute the machinery of our social life wastes what another department wants.'⁴⁹ Regulation of the commercial terms of buy-back was another possible route:

Public electricity supply companies or corporations should be required by law to accept supplies of current at a certain percentage ... of the price charged for current furnished in the same district, under the same conditions. If this were so, the problem of the utilisation of waste steam, waste gases or waste heat of all kinds would largely solve itself, because people or firms having the command of such waste heat would become alive to the fact that they had a valuable asset and proceed to develop it.⁵⁰

CHP and the ESI

Besides private CHP plant for process and space heating in industry, a number of small self-contained CHP or group heating schemes were installed in hospitals, military bases and other establishments.⁵¹ But despite the diversity of organisational and operating conditions, few public electricity supply undertakings appear to have started or even proposed CHP schemes in the interwar years.⁵² Even within municipalities, with electricity undertakings and potential consumer departments nominally under the same control, cooperation - as in the public baths supply at St. Marylebone, which continued for two decades - was exceptional. Some scattered proposals, mainly for industrial supply, are recorded, including:⁵³

- Weston Street baths from Poplar Borough Council in 1929;
- Dunlops from Leicester City Council in 1929;
- a printing works from the same authority in 1937;
- Bibby and Sons from Clarence Dock power station in Liverpool in 1935.

As regards the attitude of the industry's central body, the Electricity Commission, the subject of CHP seldom warranted a mention in its annual reports.⁵⁴ It approved the Clarence Dock industrial scheme, but rejected another for supplying an industrial estate from a CHP station at Worksop, after a legal battle and public inquiry.⁵⁵ Its sole authoritative pronouncement on CHP for DH was made in 1921 in response to a specific proposal, again from St. Marylebone.⁵⁶ The Chief Engineer wanted to supply heat to residential blocks within a short radius of its generating station. He anticipated 'considerable revenue' for the authority, and assumed that the Commission had powers to authorise the scheme, 'this being one of the methods scheduled for the conservation of coal supplies.' In fact the Commission asserted it had no powers to do so, except where a JEA had been established, as appropriate powers had been included for them alone in the 1919 Act (App.6). St. Marylebone would have to promote a special Bill or risk ultra vires action.

5.4 20S AND 30S: DH ADVOCATES

A number of consultant engineers continued to advocate DH through the 20s and 30s, by lobbying central and local government, and through the professional institutions and technical press. They stressed the advantages to be gained: fuel saving, smoke abatement, labour-saving, etc., and publicised the experience of US, continental and Soviet schemes.⁵⁷

Donald Smith, designer of the Dundee schemes, saw 'no reason why the advantages should be limited in this country to hotels, business premises, and a few of the larger mansion houses.'⁵⁸ He was later to write, as DH became more widely discussed in the late war years:

I placed the facts before no fewer than three Cabinet Ministers and several Under Secretaries in pre-war days. I met nothing but incredulity and apathy.⁵⁹

Oscar Faber conceded the marginality of the economics as assessed conventionally.

It is doubtful whether a system of district heating can be justified until we become sufficiently civic-minded to give some value to such things as convenience, absence of smoke and dirt, since it is not easy to make an actual saving ...⁶⁰

Sydney Donkin, responsible for a number of industrial CHP schemes, doubted its applicability to existing towns but was keen to see it tried in new towns.⁶¹

In the mid-30s, Abraham Margolis, who had initiated Hamburg's extensive CHP/DH scheme in 1921, settled in Britain and later joined Kennedy and Donkin, bringing with him extensive knowledge of other countries' schemes and practical experience and enthusiasm. Struck by the lack of development in Britain, he considered it was 'for the central heating engineer in conjunction with the municipal authorities, to bring about a change in this.'⁶² This was in fact to be one of the major channels through which DH advocates would press their case more successfully in the 40s.

CHAPTER 6 CHP AND DH II: 1940S AND 50S

6.1 INTRODUCTION: CONTEXT AND ACTORS

Reconstruction and Fuel Shortage

The period of planning for reconstruction, from the mid war years on, provided the context both for widespread interest in CHP/DH and good opportunities for its introduction. Politically, broad support developed during the war for greater state intervention in the economy, both to restructure and regulate capital and to prevent unemployment on the scale of the interwar years, and in providing better living conditions for the population. The machinery of wartime controls and planning accelerated longer-term trends in the accruing of state powers and responsibilities. And in 1945, a Labour government was returned committed to a programme of building a mixed economy and welfare state. Physically, the destruction of city centres by bombing, the acknowledged need to clear inner city slums, and plans for new towns and suburbs, presented opportunities to install innovative and improved infrastructure and services. The anticipated need for a concerted planned effort in reconstruction produced a plethora of national and local expert and consultative bodies, in which professionals and interest groups joined public officials to discuss and plan publicly controlled or coordinated initiatives.¹ In addition, severe fuel shortages made efficiency in energy use a major concern.

These twin concerns, reconstruction and fuel economy, dominated the major discussion of national energy issues in the early postwar years: the Fuel and the Future Conference of October 1946, attended by some 4500 delegates.² Government representatives emphasised both short-term and long-term needs for conservation: to overcome immediate shortages but also to ensure that in a time of great change efficient practice and patterns of consumption would be established.³ As a Deputy Secretary at the MFP said in relation to the domestic sector:

... we have been brought by the circumstances of war to a position in which we can at last contemplate a really revolutionary change in the whole of our domestic heating arrangements. If it had not been for the war it is possible that we should have continued to muddle along in the same old way, and nobody would have been sufficiently moved to take the

action which is now about to be taken ...⁴

The major actors in the debate and negotiations on DH were government departments, the electricity industry and the other fuel industries, the local authorities, and individual heating engineers. Aside from the internal processes of deciding policies and actions, there were five significant arenas of interaction between these actors: professional and public debate, especially through the technical press; expert committees and working parties, chief among them a group assembled by the DSIR; the legislative process by which local authorities could obtain powers to run DH schemes; negotiations over specific schemes; and the processes by which central government action was determined. Chronologically these overlapped and the effect of each on the others was complex.

Heating Engineers

It has already been noted that a number of consultant heating engineers were the most ardent advocates of DH in the 20s and 30s. Smith, Margolis, Haden, Faber, Selvey and Donkin - and later LJ Fischer, another German exile who joined Arthur Scull and Sons responsible for DH plans in Bristol - continued and increased their efforts to publicise and press for DH through the war years and after.⁵ Through two channels they were able to pursue the objective more fruitfully: through participation in government advisory bodies, which relied heavily on outside experts for many subjects; and in acting as consultants to local authorities considering DH. In several of the early plans for large cities, consultants were largely responsible for the authority pursuing a scheme. They often acted as witnesses for authorities pursuing legal powers for DH and resisting opposition to them. Faber, Donkin, Haden and Selvey served on the DSIR committee investigating DH, and several of their colleagues on the associated working party; Margolis was also closely involved in the work. Smith served on the Scottish Regional Fuel Efficiency Committee and with Haden on the Ministry of Fuel and Power Study Party on District Heating in the USA.⁶

Government

Several government ministries were to be involved: initially the Ministry of Fuel and Power, the Ministry of Health, the Ministry of Town and Country Planning and the Ministry of Works. Each, of course, had its own major responsibilities and concerns in the war years and postwar reconstruction which formed the basis of its approach to issues such as those here. Each had different, though often not well defined, responsibilities on DH; each had relationships with different relevant bodies outside; they had discussions and frequent communication on the topic; and they participated in negotiations on specific schemes.

The MoH had responsibility for the massive postwar housing programme. There was an urgent need for around a million dwellings at the end of the war, and various estimates put the number needed within ten years at anything up to five million.⁷ The MTCP, besides overseeing the increasing state powers for land use planning, was to plan and build over a dozen new towns.⁸ The Ministry of Works controlled public buildings and many major projects. The Treasury and other ministries controlled financial and material resources.

Centrally involved throughout was the MFP. An understanding of its actions requires some background on its character and structure - in particular its internal divisions and its relation to other departments and to its constituency industries.

The Ministry of Fuel, Light and Power was set up in 1942 by Order in Council and confirmed as the Ministry of Fuel and Power by Act in 1945.⁹ Its duties included

securing the effective and coordinated development of coal, petroleum and other minerals and sources of fuel and power in Great Britain ... and of promoting economy and efficiency in the supply and distribution, use and consumption of fuel and power, whether produced in Great Britain or not.¹⁰

The first few years of its existence saw the formation through considerable conflict and change of its relations with outside bodies and its approach to energy matters, indeed the formation of the government's postwar energy

policy, implicit and explicit. Dominating these processes was the nationalisation and restructuring of its client industries and the consequent redefinition of its relations and role.¹¹

The Ministry was set up with some conception of a coordinating or directing role across the fuel and power industries and was therefore necessarily concerned with energy aspects of a variety of areas. It thus also faced problems throughout the 40s in establishing a division of responsibilities with other departments, in getting them to acknowledge its right or need to intervene, and in asserting what it saw as important. As one official complained, for example, by 1943 the Ministry of Works was ready to place orders for heating appliances for some 100 000 houses and had not even consulted the MFP. While the MFP was interested in low fuel consumption, the MoW was primarily concerned with low initial cost.¹²

The MFP's early discussions showed a quite clear acknowledgement in general terms of its desired role and needs. Against a background of increasing concern for coal conservation - the position worsened sharply in 1946 - and pressure for an increase in living and environmental standards, it wanted to eliminate waste, coordinate the fuel industries' actions to this end, and in some way direct the end uses of fuel, primarily by persuasion and detailed information but backed by sanction if necessary, especially in industry. Specifically it saw a need to coordinate development of plant and appliances, improve forecasting and statistical information, and to provide information to consumers not only for its own promotion of conservation but also to balance what it saw as partial propaganda from each industry.¹³

The Ministry was conscious of its small size, a lack of information, its dependence for information on bodies representing particular interests, and the vagueness of its wide-ranging responsibilities compared to the clear statutory duties of other bodies. While convinced the continuation of its work was essential, it had little idea of how it would establish the authority it would need, particularly when the sanction it had had in wartime by virtue of controlling supplies was no longer available. Compulsion was debated but regarded as undesirable because it would jeopardise the gains made through cooperation from industry in this and in other fields.¹⁴

Among over a dozen sections of the Ministry, the two which are central to this study were the Gas and Electricity Division - the Electricity Division split from it in 1948 - and the Fuel Utilisation - later Fuel Efficiency - Branch. The Statistics, Economics, Planning and Priorities Division had responsibility for nationalisation plans, and the Fuel Utilisation Branch was part of this until it moved to the Chief Scientist's Branch in 1949. Divisions were numerically small; throughout the 1940s these divisions and branches had between one and two dozen officers each.¹⁵ In 1944, for example, the MFP still had 'no one who had any knowledge of electricity'.¹⁶

Responsibility for electricity had been with the Ministry of Transport until September 1941, then briefly with the Board of Trade Gas and Electricity Division until June 1942. The prenationalisation industry, as represented by the Electricity Commissioners, the CEB and the leading companies, was highly suspicious of a sponsoring department which now had a much wider role, fearing the form and consequences of coordination; as a senior civil servant advised the Minister in 1944:

until the creation of this Ministry, the Government never sought, in any definite way, to coordinate its fuel and power policy nor intervene in any way in the rivalries between different fuel industries.¹⁷

He anticipated 'little chance of their ever working with you wholeheartedly in your endeavour to secure real cooperation between the three main fuel industries', and stressed the need for impartiality and firmer control as electricity became a subject of political interest and required increasing referral of Commission decisions to the Ministry. Both parties, it seems, regarded the whole concept of a coordinating industry as 'contradictory' to the Electricity Supply Acts and the powers of the EC.¹⁸

Conversely, the Ministry felt excluded from the industry by existing arrangements and constrained by its reliance on it for advice. The CEB, for example, was responsible to the EC not the Ministry, and there appeared little practical meaning to the nominal accountability of the EC to the Minister.¹⁹ The Commissioners, as specified by the Ministry's establishing Act, were the Minister's sole advisers on electricity matters and many specific powers had been delegated to them by the Minister of

Transport in the 1920s, or had accrued through references in miscellaneous Acts in the 30s and 40s.²⁰ The EC reasserted its power and autonomy and tried to assure its advice was not mediated by Ministry officials. It expressed displeasure at the appointment of even one electrical engineer to the Ministry, preferring secondment from the industry, and accused the Ministry of trying to by-pass it.²¹ Significantly, then, the Labour government chose to formulate the nationalisation legislation itself without consultation with existing supply industry bodies.²²

Local Authorities

Local authorities had various functions relevant to DH. They were first of all housing authorities, responsible for providing rented dwellings, largely for the working class, under the direction of the MoH. Though the great shortage of accommodation after WW1 had in large part been made up by the mid-30s, considerable slum clearance was still needed and was to wait till after WW2.

They were by stages becoming planning authorities, and the immediate postwar period was dominated by their obligation to prepare a development plan for their area and in particular to plan and carry out reconstruction of damaged areas. To varying extents they also ran undertakings for energy provision, and were responsible for construction and maintenance of public works through direct labour.

Thus the authorities were the vehicles for implementation of much of the physical reconstruction and establishment of welfare institutions decided and directed centrally. In their own initiatives, and in the discretion they had in implementing centrally directed programmes, the broad influences operating were described in 4.6. Of specific importance here were their reliance on technical advice, first from academic or private consultants, and second from central government through consultation or circulars; the centrality of technical officers in authority departments and undertakings, who were invariably members of outside professional bodies and often participated in government advisory committees; and the strong divisions between departments, especially electricity and gas undertakings.

Energy Industries

The state and priorities of the electricity supply industry as it emerged from the war have already been described in 4.5.²³ It had a serious shortage of capacity for the existing and anticipated demand, exacerbated by wartime constraints, and problems of fuel supply. Though the need to rationalise and centralise the industry was widely recognised, maximising output took priority.

Of other energy interests, the gas industry was to figure prominently in debates on DH.²⁴ Prior to WW2, it had supplied some 60 - 70% of its output to the domestic market. It had lost most of its lighting load - apart from public street lighting - to electricity in the late 20s, and in the 30s much of its domestic heating and cooking load went the same way. Efforts to improve publicity and service had had little effect. The war itself was a period of 'great strain' for the industry.²⁵ Its prices were controlled and its labour and materials limited. Much of the effort of both the supply industry and the appliance manufacturers was diverted to war products. Its domestic and commercial sales were controlled and dropped, compounded by shifts of population and war damage. Its public lighting sales were eliminated suddenly with the blackout. This was more than matched, however, by an increase of over 50% in its industrial output, and total output went up by 18% during the war. The industry was hard-pressed to find adequate sources.

The industry emerged from the war in a 'rundown state'.²⁶ It had been recognised before the war that reorganisation of its fragmented structure was needed. There were few economic incentives to concentrate and restructure itself, and further amalgamation had been controlled during the war to prevent changes which might cause problems with the Government's own attempts to restructure the industry from outside. Technical parameters and the quality of service varied greatly. The industry recognised the potential for expansion especially in the domestic market, but that it was ill-equipped for such; it had difficulty supplying existing customers.

6.2 INITIATIVES ON DH AND CHP

Reconstruction Studies

The origins of initiatives on DH and CHP during and after the war can be found in the local authorities, in central government and the various ad hoc expert groups it set up, and, working through all of these, the DH advocates among heating engineers.

The first central initiative on DH had its origins in Ministry of Works technical studies, anticipating the need for a large reconstruction and new building programme after the war and the opportunity for improving the standard and efficiency of domestic heating.²⁷ This was the most important study of DH in the period: that conducted by the District Heating Sub-Committee (DHSC) of the Heating and Ventilation (Reconstruction) Committee (HVRC) of the Department of Scientific and Industrial Research (DSIR), the detailed workings of which are the subject of 6.3.²⁸

The study had its origins as early as 1941 with the formation of an informal study group, of representatives of the Institution of Heating and Ventilation Engineers, the Ministry of Works, the Building Research Station and the Fuel Research Station, 'to review scientific information and practice relating to domestic heating.'²⁹ This became the Joint Standing Committee of the Building and Fuel Research Boards on Heating and Ventilation. In early 1942 the MoW set up a Directorate of Post-War Housing, with a structure of committees formed where possible from existing groups.³⁰ Accordingly, the heating study group was incorporated as one of six sub-committees under the Installations Policy Committee convened by the BRS. The group's identity was finally settled when it was constituted in August 1942 as the Heating and Ventilation (Research) Committee of the BRB, then part of the DSIR.³¹

The Committee's terms of reference included 'a review of existing knowledge and the making of recommendations for post-war heating practice.'³² The work of the Committee, under Alfred Egerton, was itself significant, constituting 'the first comprehensive effort to set down the

heating problems of the country in relation to fundamental requirements, building design, appliance performance, atmospheric pollution, and the economical use of the national fuel resources.³³ Its report appeared in 1945.³⁴

The HV(R)C sifted evidence on numerous topics in its first few months, including DH. By September 1942, it was reported to have turned up only 'meagre' information, but to be 'satisfied that district heat supplies are possible and worthy of thorough investigation.'³⁵ Accordingly a District Heating Sub-Committee was formed 'to enquire and report on the desirability of developing in this country schemes for the supply of heat for various purposes, by means of steam or hot water from central sources.'³⁶

Ministries

From the end of the war, the Fuel Efficiency Branch of the MFP, with its associated Fuel Efficiency and Domestic Fuel Planning Committees, was the main source within the government of initiatives and enthusiasm for conservation and for DH in particular, and was acknowledged as such by other Divisions of the Ministry and by outsiders.³⁷

The Committee and Branch were responsible for the Fuel and the Future conference, where DH was the subject of a special session³⁸ and was encouraged specifically in a plenary speech. The government was 'very anxious to encourage the making of experiments which will increase our knowledge' and wanted more proposals to be put forward.³⁹

The MTCP was initially keen to encourage experiment in DH in new towns, even though plans were to be hampered by their slow progress. The possibility of DH for new towns had been raised in the 30s⁴⁰ and had become significant again in postwar planning. Here advocates saw opportunities for rational planning of energy provision as an integral part of the design of a town under the control of one authority, with the advantages for DH of laying a network during construction and without the haphazard congestion of existing underground services.⁴¹ The main problems would be the rate of construction and the low density of much

new development. Reith's New Towns Committee drew on the early DSIR work to be described in 6.3, taking the largest of the DSIR representative schemes and scaling it down to produce indicative figures for a new town of 50 000.⁴² It reported in encouraging terms, recommending that development agencies should be given powers to set up DH undertakings. It thought 'there is little doubt that district heating may already be accepted as entirely practicable in a commercial or industrial area this may also apply to a domestic area with a density as low as ten houses to the acre.' It considered 'the time has arrived for a full scale test. District heating would confer such benefits that we recommend a trial on an adequate scale in one of the first new towns.'⁴³

Within the Ministry of Health, DH first started to be discussed in late 1945 as local authorities began to consider schemes, and with pressure from individuals, organisations and parliament.⁴⁴

After Egerton's report, a second major official study indicting poor domestic heating in Britain appeared in 1946: that from Ernest Simon's Fuel and Power Advisory Council.⁴⁵

To sum up, we are using excessive quantities of coal; we are providing inadequate heating in the houses; we are pouring out masses of soot and tar into the atmosphere.

In our view we cannot afford to maintain our low standards of heating; we cannot afford to continue to depress and destroy the life of our cities by smoke pollution; we cannot afford to waste our limited national coal resources.⁴⁶

The report's treatment of DH was sketchy because of limited information.⁴⁷ In part in anticipation of its recommendations, the Ministers of Fuel and Power, Health and Works set up in January 1946 an Interdepartmental Committee on Domestic Heating, with representatives from their own ministries and those of Town and Country Planning and Supply, and the Department of Health for Scotland. It immediately formed three sub-committees on appliances, standards and district heating; the Committee had been 'charged specifically with the task of paying special attention to the possibility of developing district heating in this country.'⁴⁸ The terms of reference of the District Heating Sub-Committee (ICDH/DHSC) were to 'consider and make recommendations on the practicability of district heating schemes generally and of particular schemes which may be referred to them.'⁴⁹ In practice it was to become

the machinery for considering and approving the technical basis of the schemes which came to the MoH for statutory approval before loan sanction.⁵⁰

Not before several major local authorities had already proposed and planned DH schemes, the first effort to get authorities to consider the technique for their housing programmes came in November 1946, with the circulation of the joint MoH/MFP Memorandum on District Heating as Applied to Small Housing Estates, an Interim Report from the DSIR study, and a questionnaire from the ICDH/DHSC.⁵¹ Responses to the questionnaire showed a large number of authorities to at least be considering the matter. Typically local authority engineers had been instructed to prepare reports on the subject in general and had been frustrated by inadequate information. On technical aspects they wanted to know when the DSIR report would appear and on economics they wanted to know whether the Ministry could advise on specific schemes.⁵²

CHP

The beginning of attempts to get the electricity supply industry to take CHP seriously also came from within the MFP, through the Electricity Act 1947 nationalising the industry.⁵³ The Act contained a section on DH which was to become the focus of discussions within the industry, and of controversy outside for decades afterwards. Its key clauses were as follows:

50. (1) It shall be the duty of the Central Authority to investigate methods by which heat obtained from or in conjunction with the generation of electricity may be used for the heating of buildings in neighbouring localities, or for any other useful purpose, and the Authority may accordingly conduct, or assist others in conducting, research into any matters relating to such methods of using heat.

(2) Any Electricity Board may themselves provide, or assist other persons to provide, for the heating of buildings by such methods as aforesaid or otherwise for the use of heat obtained as aforesaid.

The section was included by the MFP Working Party drafting the Bill in 1946.⁵⁴ The Working Party agreed 'the most which could be done' in the Bill on the subject was to place the new authority under obligation to

investigate the technique and to give it the necessary powers to promote schemes.

Taking a lead from the discussion on DH at the Fuel and the Future Conference, the FEBr had identified three possible organisational arrangements for CHP: an electricity authority running the entire scheme; a DH authority buying heat in bulk from an electricity authority; and a DH authority running the whole scheme and selling surplus power to an electricity authority. It wanted to leave the powers in the Bill flexible to cover all three, and therefore asked that the electricity authority should not have exclusive power to initiate schemes. DH schemes with heat only sources or with electricity as a by-product could thus go ahead unhindered. It considered the Area Boards should also be able to distribute and sell heat as well as the Central Authority.⁵⁵

The draft section passed through the legislative procedure unchallenged and barely mentioned. There was no hint of controversy or opposition and no consideration of how other provisions of the Bill and the organisation and programme of development might affect the prospects of DH.⁵⁶

6.3 EVALUATION: THE DSIR STUDY

Introduction

The DSIR study of DH is important for three reasons. First, it was the most thorough and comprehensive study of the subject, involving collecting much information from Britain and abroad, devising representative schemes, and detailed examination and resolution of many technical and economic issues hitherto argued even in the technical press in only general qualitative terms. Consequently, second, it was awaited as the authoritative and definitive work on the subject, and its delay probably profoundly affected in several ways the chances of introducing DH after the war. Third, it became a focus of activity on the topic. Because the government relied heavily during and after the war on voluntary work by outside experts, the DHSC was a forum in which heating engineers, government officials and representatives of the electricity industry - indeed many of the key figures involved in DH - met throughout the first half of the period covered here. Thus the workings of the Sub-Committee are a useful window on the different viewpoints in the debate and on the means of influence of groups on the outcome of deliberations in an expert arena.⁵⁷

Early Work

The DHSC started meeting in October 1942. Chaired by Egerton, an academic, and largely drawn from the main Heating and Ventilation (Reconstruction) Committee, it comprised four consultant engineers (Faber, Donkin, Selvey, Haden), two representatives of the electricity industry (Pearce, Wright), a municipal engineer (Manzoni), a representative of the IMechE (Guy), representatives from the Ministry of Works and Planning (Pallot), the MTCP (Holford) and the MFP (Quirk) and a secretary (Handyside and later Beckett) from the DSIR.⁵⁸

Its early meetings were taken up with general discussion, focussing early on the question of linking DH to CHP stations, but consisting largely of statements of, and arguments over, preconceived opinions about the merits of DH and CHP in particular. The points raised were fragmented

and muddled, and the standpoints taken in some cases inconstant and inconsistent.⁵⁹

An impressively systematic collection of information by BRS staff started feeding the DHSC with articles from literature searches and data on schemes in Britain and abroad.⁶⁰ In particular it reviewed correspondence with US DH companies, translations of Soviet articles, and Scull's Bristol proposals. In addition, individuals inside and outside the DHSC produced memoranda for discussion. Pearce provided much of the early material, accompanied by comments stressing difficulties. CHP/DH might, he thought, be 'altogether impracticable for existing built-up areas' and should only be considered for new or reconstructed areas.⁶¹

The work of the DHSC became more orderly and directed with the recognition that existing information was inadequate. There was disagreement with the guidance which could be derived from foreign experience - or rather from the still patchy information available at the time - and the review of existing schemes in Britain convinced members that the experience could only illuminate a few fairly obvious technical points: '... (in) none of the schemes was sufficient care and forethought given to the design, equipment and layout.'⁶² Thus, according to the final report, it became 'clear that no satisfactory assessment of the value of district heating in relation to conditions in this country could be made without a detailed investigation of an illustrative scheme ...'⁶³ In terms of the working of the DHSC, it is more accurate to say that this course satisfied those with differing enthusiasm for the technique; proponents were eager to see this necessary groundwork done as preparation for actual schemes and to convince doubters, and critics were pleased to see plenty of time spent spelling out what they foresaw as probably insurmountable technical and economic difficulties. Accordingly a Working Group was set up, consisting of three members of the DHSC and technical personnel seconded from the electricity industry, consultants' firms and the Mow.⁶⁴

Representative Schemes

The DHSC was already aware of the plans instigated by Kennedy and Donkin for a scheme serving commercial and public buildings in Coventry city centre, and in late 1942 Donkin suggested to Manzoni that his firm

and Birmingham Corporation should cooperate in working out a scheme for the Duddeston and Nechells Redevelopment Area in the city, to serve some 20 000 people.⁶⁵ The DHSC also encouraged the MoW and MFP to produce a separate memorandum on DH for small housing estates. The DHSC, conscious of the reliance of government departments on a limited pool of experts effectively loaned for unpaid wartime work in the national interest, thus adopted work already in progress and stimulated work elsewhere, to add to that it could commission itself. It was thus agreed that the Working Group should concentrate on a hypothetical CHP scheme for 250 000 people in a major part of a city, completing what would be a satisfactory range of studies.⁶⁶

Thus the work of the DHSC settled early onto examination of the general technical and economic feasibility of DH schemes. Indeed, though at least one member argued that it should consider administration, the DHSC subsequently never touched questions beyond technics and economics. It saw its work, as the final report stressed, as 'intended to give technical guidance rather than to make recommendations on matters of policy.'⁶⁷ But the working rationale of the DHSC became the assumption - widely adopted elsewhere - that the future of the technique should depend largely on its economic attractiveness. Thus the outcome of the DHSC technical calculations assumed the importance of a policy statement to those awaiting it, and its debate over ostensibly technical matters substituted for policy debate. As a Heating and Ventilating Engineer editorial commented while criticising the government for failing to give a lead, 'the future of (DH) in this country would, apparently, stand or fall by its recommendations.'⁶⁸

The 'Basic Scheme', as it became known, was underway by mid-1943, but was not to be completed till 1946. Kennedy and Donkin's 'Preliminary and General Survey' for Coventry centre was presented to the DHSC in October 1943.⁶⁹ Donkin and Margolis's work on Duddeston and Nechells was submitted in August 1945.⁷⁰

Interim Report

The DHSC was aware of the pressure on it to produce material quickly.⁷¹ It was told that the Coventry and Bristol proposals were being

held up pending publication of its findings.⁷² Numerous requests for details of the Basic Scheme calculations were received before they were ready, and the delayed report appeared repeatedly in deliberations on DH as a factor underlying uncertainty and hesitancy, a reason for caution, or an excuse for inaction or lack of direction.⁷³ In Parliament the Minister of Fuel and Power indicated the government would want to see the DSIR findings before formulating any policy.⁷⁴ The ministries involved and Simon's Fuel and Power Advisory Council were pressing the DHSC for guidance and urging it to produce at least an interim report as a matter of urgency.⁷⁵

Pearce and Wright produced a draft interim memorandum intended for publication, and presented it to the DHSC in April 1945.⁷⁶ It provoked immediate criticism from Beckett and, probably anticipating a similar reaction from members of the DHSC, he produced a brief unpublished 'Interim Statement' to go from the DSIR to the ministries without being referred to the DHSC.⁷⁷

In their four-page draft, Pearce and Wright referred to 'definitely misleading' statements in the press and elsewhere, and set out what they saw as the 'main considerations' in their 'proper perspective'. They dismissed conversion of turbines as involving 'very extensive alterations of a costly nature'. New turbines would reduce the capacity of a station by 'about half'. Soviet and American experience was hardly applicable, but the latter, they claimed, had shown that it was 'most difficult in practice' to balance heat and electricity loads in smaller CHP stations. They envisaged 'extra risks' to electricity supplies if, for example, a CHP/DH network was damaged in wartime or by subsidence, and enumerated various problems of siting CHP stations in town centres. Questions not entirely prejudged - relative costs, commercial viability, consumer acceptance - were phrased discouragingly and numerous difficulties - including legislation, ownership and costing methods - were stressed. The only begrudgingly positive notes concerned air pollution and 'theoretical' fuel saving. Pearce and Wright concluded by conceding that DH might best go ahead in a limited form in areas being rebuilt or in new housing districts, perhaps later being linked into major schemes should such experiments prove successful.

Faber, Donkin, Nobbs, Haden and Egerton himself did indeed object strongly to the electricity representatives' draft.⁷⁸ Egerton considered it was 'written entirely from the electricity generation angle and in defence of the present practice', emphasising the disadvantages of CHP supply. Donkin thought it 'unduly prejudices the outlook for district heating' and Nobbs considered the disadvantages 'overstressed'. Faber protested that it unfairly condemned CHP stations and appeared to 'prejudge the whole question'. Wright responded that it had merely 'seemed necessary to clear up certain misconceptions'. His critics maintained that many of the arguments the draft put forward should have been left as open questions. The ensuing arguments demonstrated that with the paucity of existing information and with the results of specific studies yet to come, there was, after three years and 17 meetings of the DHSC alone, still strong disagreement on basic technical and economic matters and little change in some members' predisposition to the topic.

The first draft was referred to a drafting panel of Pearce, Wright, Beckett and Pallot for revision. With Pearce dominating the work, only minor changes were made; the sixth draft was still stressing the tendency for the 'lay mind' and the 'non-technical reader' not to appreciate the difficulties involved.⁷⁹ Faber, originally not favourably disposed to CHP but shifting his position, resorted to presenting alternative drafts which posed each of Pearce's definitive statements as questions, and Egerton tried to produce a compromise between the two. MoH officials intervened, worried by the discouraging tone. It had been policy on the Minister's instructions to encourage enterprising local authorities to consider DH and experiment with schemes; it was shortly to issue, with the MFP, the joint Memorandum on District Heating as Applied to Small Housing Estates - 'optimistic in tone' - and the New Towns Committee Final Report had contained 'encouraging' remarks on the topic. They anticipated considerable embarrassment if these conflicted with what would be seen to be the 'parent document', and would 'then be faced with the awkward problem of adjudicating in a matter where experts had spoken.' It wanted to see at least an 'expression of hope' that local authorities would go ahead.⁸⁰

It took seventeen months and eight drafts for Beckett to steer the group to an acceptable document. The DHSC Interim Memorandum finally

appeared in September 1946,⁸¹ with a favourable if cautious tone and showing little resemblance to the first draft and little influence of the electricity representatives' view, except in that Pearce's view that conversion was 'too costly to contemplate' was retained.⁸² The Memorandum stressed the urgent need for practical experience. 'The important thing,' Beckett wrote, 'is to get something started.'⁸³ The accompanying press notice was even more optimistic; the Memorandum brought out 'clearly the improvements in amenity and efficiency which could result from this type of development, in particular the possibility of achieving a better standard of comfort with appreciable saving in coal.'⁸⁴ Its appearance, along with the MFP/MoH circular and the ICDH questionnaire, undoubtedly stimulated local authority responses, but in stressing the experimental nature of DH and in omitting any detailed proposals and costings, may at the same time have increased their doubts and caution, and made them more reliant on the definitive work to come.⁸⁵

Completion of Work

The Basic Scheme work was finished by August 1946.⁸⁶ The scheme was for a hypothetical provincial town of 250 000 people covering 66km². The DH system would serve 60% of the town in 2000ha, supplying 4400TJ_h/y. The station would contain BP and condensing plant totalling 120MW_e in a combination fitted to a typical demand pattern. The total heat capacity would be 570MW_h, including additional live steam supply, to meet a peak demand of 510MW_h.

The report on the Basic Scheme work was circulated immediately to a number of organisations and individuals.⁸⁷ By this time the report of the Fuel and Power Advisory Council on domestic heating had appeared, with its comments on DH allegedly limited because the DHSC work had not appeared.⁸⁸ The DHSC had been able to supply the New Towns Committee with a vaguely encouraging memorandum on which to base its comments on the subject, but the quantitative information came from a simple scaling down of the DHSC Basic Scheme to a population of 50 000, since it had felt unable to take on another specific study.⁸⁹

A draft of the DHSC final report was produced in November 1947,⁹⁰

and the DHSC held its last meeting the following month. The completed report was presented to the BRB in October 1948.⁹¹ The report was not published until 1953. The delay, and its effect on the usefulness and impact of the DSIR work is described in 6.8.

6.4 MAJOR PROPOSALS

Introduction

As indicated already, DH schemes were suggested in several cities in advance of government initiatives. In this section the original proposals for major schemes, and their treatment within the local authorities, are described: London, for the City, the South Bank and Pimlico; the Wythenshawe area of Manchester; Birmingham, for two areas; Bristol city centre; and Coventry city centre. The progress of the plans, and the eventual demise of all the major schemes except that at Pimlico, are followed in later sections.

London

The possibility of district heating in London was raised in general terms during the early discussion of reconstruction towards the end of WW2 by the two main bodies looking at London as a whole: the LCC and the RIBA London Regional Reconstruction Committee. Forshaw and Abercrombie's County of London Plan prepared for the LCC saw district heating as potentially helpful in combatting air pollution, but did not follow through with any discussions of how it might be implemented or its relation to existing public utilities.⁹² The RIBA Committee thought this 'further public supply service' would have 'many benefits' and great 'generalised advantages', especially in reducing pollution. It pointed out the need for research on the central supply of energy and the coordination of its different forms.⁹³

Advocates of the technique raised a vision of London-wide DH in the technical press. Margolis⁹⁴ argued the need to 'show the possibility of a general unified district-heating scheme' at an early stage, to avoid a repeat of the chaotic development of London's electricity supply. The task would present 'a problem of great magnitude, the solution of which (would) require a great deal of investigation and comprehensive planning.' The technicalities of DH had however, he argued, been sufficiently explored to allow this. His outline was based on conversion of existing power stations, allowing older stations to be preserved, and BP plant for new generating

capacity; it showed 'the paramount importance of complete co-ordination of heat and electric power generation.'

With the absence of institutions to achieve such coordination, the possibility of London-wide DH was pursued no further. Subsequent plans for the development of London as a whole became almost exclusively concerned with land use and transport and dropped discussion of energy supply, increasingly assuming that the LCC would be unable to plan its development.⁹⁵ Indeed it did have little role in energy except as a planning authority able to influence siting and architecture and through its housing developments. Its role in DH was limited to providing enabling legislation and encouraging specific proposals. It was left to individual London authorities to raise more limited schemes, and the future of DH in the capital became the sum of the fates of these individual proposals. Three CHP-based schemes were pursued: two, for the City of London, and for an LCC development in Stepney and Poplar, failed to get started; the third, for Westminster City Council's housing development in Pimlico, was to be the only CHP/DH scheme in the country with ESI involvement. In addition the LCC and several Boroughs initiated plans for smaller heat-only schemes.⁹⁶

London: the City

Energy provision in the City of London was virtually ignored in much early discussion of reconstruction.⁹⁷ Several consulting engineers contacted the City during and shortly after WW2 to suggest DH.⁹⁸ Following a motion on the topic to Common Council in November 1945, the Improvements and Town Planning Committee started considering the topic, via articles in the technical press.⁹⁹ Sydney Donkin sent the Committee a resume of work for the DSIR/DHSC, particularly on the Coventry and Duddeston/Nechells proposals. Donkin was commissioned in May 1946 to prepare a preliminary report for the Committee within six months. With delays caused by the lack of detailed reconstruction plans, the reluctance of City banks to provide information, the slowness of electricity companies to answer questions, and the Bankside power station public inquiry, the report was finally presented to the Committee in May 1947 and relayed enthusiastically by the Committee to the Council in October 1947.¹⁰⁰ Its findings were mentioned in the City consultants' report, although the text

of the main plans already prejudged the issue:

Various systems of what is known as 'District Heating' have been investigated on behalf of the Corporation. At present there is no surplus steam from the major electricity generating stations, which are attempting to keep pace with enormously increasing electrical demands. A large new heating station in the City is also out of the question at the moment, and district heating on any considerable scale must therefore await a general improvement in national and metropolitan power resources.¹⁰¹

Donkin's report envisaged a two-stage development over 30 years to cover the 100ha of new buildings in the City consultants' reconstruction plans, with a final maximum heat demand of 388MW_h and generating capacity of 60MW_e. The capital costs were estimated at £6.44m. Donkin stressed the advantages of DH to the City - in particular smoke abatement, convenience and labour-saving, reduced traffic congestion and space-saving. The report considered various heat sources, including combinations of CHP, heat-only boilers and off-peak electric heating. It showed a substantial cost advantage for CHP over all individual heating alternatives, and, taking into account a two-part tariff offered by the CEB in consultations in March 1947, a slight margin over coke-fired group or district heating. It included a survey of existing power stations which might provide heat and of sites for new plant. With no suitable site in the City, and the Council in any case opposed to a station within its boundaries, Donkin envisaged a major power station on the South Bank or two or three smaller power stations to the north and east of the City. Four sites other than the South Bank were investigated: all four had limited capacity suitable for one or other stage and none could take a larger ITOC station which would have allowed a capacity credit favourable to the economics of the scheme. Two of them would involve heat supplies to the Boroughs in which they were located. The largest, Shoreditch, was scheduled for a 'selected' municipal power station in 1951 which would need conversion. Donkin recommended the City Road and Shoreditch sites, or the Bankside site for the first half of development if the station was permitted.

The Council declined to act, referring the report back to the Committee and preventing Donkin from releasing it to other organisations.¹⁰² Nothing was done for over a year, despite the Committee's acknowledgement of the urgency of taking the scheme into account in preparations for rebuilding, except to consider the need for

local legislation.

London: South Bank

Independent of the City of London initiatives, London County Council officers started in mid-1947 to consider district heating for the South Bank.¹⁰³ The County Engineer had seen the Paris DH system and was convinced of the merits of the technique. They wanted to cover the whole area from Lambeth Bridge to Bankside power station, the redevelopment of much of which was already being planned by the County Architect and consultants, with offices, hotels, public buildings, entertainment complexes and residential areas. A scheme of some 60MW_h was envisaged by 1958.¹⁰⁴ They were keen to use heat from Bankside but were prepared to adopt smaller group heating schemes. No detailed plans for the network were made, and no decision in principle was sought within the Council. Instead, LCC officers pursued the idea informally, entering discussions early on with government ministries and the BEA on the possibility of a CHP source.

London: Pimlico

The Pimlico district heating scheme, initiated before nationalisation of the ESI, was to be the only CHP/DH scheme in the country supplied by the nationalised industry.¹⁰⁵ In 1946 Westminster City Council Housing Committee approached the London Power Company about the possibility of a heat supply from Battersea power station for its new Churchill Gardens and Cambridge Street housing estates, a complex of blocks of some 1700 flats and maisonettes to be built in a large area of Pimlico cleared after bomb damage. With a sympathetic response from Chief Engineer Leonard Pearce, the Committee commissioned Kennedy and Donkin in 1946 to design a DH system.

Donkin's report¹⁰⁶ assessed five different heating arrangements, and identified several features favouring DH. A HO source was feasible but taking heat from Battersea would more than halve capital costs and eliminate fuel and ash handling operations on the Pimlico side of the Thames. The LPC agreed to instal two 1.35MW_e BP turbines at Battersea specially to serve the scheme. The turbines, each providing 6.7MW_h at

full load, would use common facilities in the station, and a live steam standby would be available.¹⁰⁷

The distribution network designed by Kennedy and Donkin featured twin mains in a tunnel under the Thames and a 40m high accumulator on the filled-in Belgrave Dock able to store some 400GJ_h thus allowing the BP turbines to operate independently of the heat demand. This, claimed Donkin and colleagues, 'created a new basis for heat-electric generation and district heating'.¹⁰⁸ The scheme would provide space heating for 17 hours of the day for 30 weeks of the year, for a flat rate charge.¹⁰⁹

Manchester: Wythenshawe

A Technical Committee of Manchester Corporation considering the question of smoke abatement reported to the city's Housing Committee in late 1944 that it was 'much impressed with the advantages which would accrue from a district heating scheme', and suggested and made rough costings for a scheme to cover the whole of the undeveloped area of the Wythenshawe estate.¹¹⁰ Wythenshawe was an area of 2250ha on the outskirts of the city, added to it in 1930 and only partly developed. It was proposed to double its population of 40 000. Existing houses would retain their other heating methods. Since work on the estate was already underway, the Technical Committee consulted with the Wythenshawe Estate Special Committee so that ducts could be laid, to avoid the need for breaking up roads should the scheme be adopted. The Council promptly set about acquiring the necessary powers, in this case an extension of the powers of S.15 of the Manchester Corporation (General Powers) Act of 1930. The new powers were included as Part IV of the Manchester Corporation Bill of 1946.¹¹¹ Consulting engineers Ernest Griffiths and Sons were appointed to produce a report on the adoption of district heating in the NW and SW Neighbourhood Units and industrial areas at Wythenshawe - a total of 530ha - with facilities for the generation and sale of electricity. Griffiths' report was submitted in June 1945.

Griffiths considered two schemes: CHP matched to the heat demand and selling surplus electricity to the local undertaking, and heat only. The scheme would have two separate but interconnected coal-fired stations in the two industrial areas of the estate, and supply space heat and washing

water via a three-pipe network to some 7900 dwellings plus public buildings. It would not require hot water storage beyond that in the mains and house internals. The report took the layout and housing details as given and further assumed: a 24-hour supply with washing water all year and heating for 35 weeks; temperature controlled centrally, independently in each of several zones and that of the hot water independently of the that of the space heating; a fixed weekly charge rather than meters; a temperature limit in house internals; and top-up heat from, for example, a single coal fire.

The overall criterion for charging was that the total charge should be kept within a reasonable margin of current costs in the existing areas of the estate. With CHP stations, Griffiths reckoned a charge of 4s5d per week could be made, substantially less than typical expenditure.¹¹²

Optimistically Griffiths saw the only difficulty in the way of adopting CHP would be the delay from the 'necessary procedure and formalities' of obtaining the agreement of the Electricity Committee and the Electricity Commission. To avoid such delay, the report explored a heat only scheme giving partial heating at a cost of 6s per week for an average house, with the option of converting to full heating later if CHP became feasible. The necessary agreements appeared at the time to pose little problem as there was a fortunate agreement of opinion among the electricity interests involved. The Corporation Electricity Department was keen to experiment; it would be 'a pity to miss an opportunity of demonstrating what a combined station can do, especially with such favourable conditions as at Wythenshawe.'¹¹³ The Electricity Committee subsequently instigated the necessary legislative powers and the Electricity Commission let it be known early on that it was keen to see CHP at Wythenshawe.¹¹⁴

With CHP, Griffiths anticipated selling 61GWh/y of electricity. The Electricity Department agreed to purchase at .324d/kWh with a capacity credit of £2.1375/kW_e at the time of winter peak demand, roughly 16MW_e. This would have given an income from electricity sales of £113 400/y, cancelling out a substantial fraction of the annual operating costs of £143 000. The capital costs were put at £1.6m.¹¹⁵

The Joint Sub-Committee considering Griffiths' report found the

scheme acceptable provided: it was not subsidised from the rates; that the Government would 'give adequate guarantees against a loss falling upon the rates'; that the scheme could be adopted in time to expand as Griffiths envisaged; and that it could be agreed that tenants would be willing to pay the weekly charges envisaged. Though these conditions were actually rescinded before the matter came to the Council for decision in principle, the Joint Sub-Committee had anticipated the points of controversy and the criteria which were to lead to the project's abandonment.¹¹⁶

Birmingham

The possibility of DH in the reconstruction of Birmingham first surfaced in 1942, when the City Public Health Committee, considering 'Smoke Prevention in Post-War Reconstruction' suggested DH for the central area.¹¹⁷ The focus shifted in late 1942 when Herbert Manzoni, the City Surveyor and a member of the DSIR/DHSC, took up Sydney Donkin's suggestion that the City and Donkin's consultancy look at one of the city's five designated Redevelopment Areas, Duddeston and Nechells, and produce a study which could be incorporated in the DSIR Report's range of model schemes. The Council envisaged clearing over 100ha and rebuilding some 5000 dwellings plus public buildings, for about 14 000 people.¹¹⁸

Initially encouraged as the study proceeded, Manzoni obtained outline approval from the Council in late 1943; the scheme would proceed as soon as Government sanction was obtained, probably one or two years, he thought, after the end of the war.¹¹⁹ The Ministry of Works tried to discourage the scheme, but as the matter was still 'somewhat academic in character', it was left to proceed slowly.¹²⁰

Meanwhile, the City's Wartime Reconstruction Committee, set up in 1942 - seeing itself as 'likely to develop as a coordinating committee, with the duty of considering the social aspects of post-war schemes in the light of a plan for the City as a whole'¹²¹ - undertook research and showed interest in a number of issues which could have been expected to point to DH as a specific project. Its Social Survey completed in 1945 showed widespread discontent with heating and hot water supplies, or rather the lack of such, and their provision ranked high in a list of suggestions for

improvements in both Council and privately built dwellings. The research also showed strong public support for planning, public works to create employment, an extension of municipal services and enterprise, and an extension of direct labour to undertake house repairs and other functions, as well as a willingness to pay increased rates for such activities.¹²² Strangely a coordinating role for the Reconstruction Committee was never accepted by other sections of the Council, and the Committee and its associated Department in the Council were disbanded in late 1945 after barely starting their practical work.¹²³

The Public Works Committee took up the subject of DH and in particular the Duddeston and Nechells Area scheme in May 1945, when Manzoni was authorised to get a 'comprehensive report from technical advisers' as soon as appropriate.¹²⁴

Donkin's preliminary study on the Area was presented to the DSIR/DHSC in August 1945.¹²⁵ It was to cover 108ha including some 20ha of industrial space; it would serve flats and houses for 17 500, factories and various public buildings, with a total maximum heat demand of 44MW_h . Three alternative supplies were considered: a special 6.5MW_e BP set in the replacement Nechells power station about 1km from the area; heat from steam bled from one or more of the 50MW_e condensing sets at Nechells; and four HOBs. The three supplies would give heat at 21.3d/GJ_h , 22.5d/GJ_h and 31.5d/GJ_h respectively, with the savings over separate supplies credited to heat. A 530GJ_h accumulator would reduce the maximum demand to 55% of its normal value, and increase the load factor from 29.1% to 52.9%.

In late 1946, Manzoni also started considering plans for DH in the new Shard End Estate, based on a CHP station in its industrial zone. In February 1947, the Public Works Committee authorised a start on the scheme, subject to approval by the Council and the MoH. The scheme had not yet been designed in detail, but Manzoni considered there was 'no technical difficulty in providing such a service at a reasonable cost' without subsidy when completed.¹²⁶

The estate was to consist of 3000 houses on 160ha with 25ha of industrial space. The heating scheme would be run as a public utility,

providing a 24-hour service of background heating to Egerton standards in all rooms of dwellings, full heating in public and other major buildings, and a hot water supply. Preliminary costings assumed the sale of all power to the Grid 'at the same rate it would cost to generate'. The capital cost of the scheme was put at £1.6m, with a saving of £.21m on house internals. It would take five years to complete the scheme, but the supply could be in operation by the third year with temporary HOBs. A saving of some 12 000t/y was envisaged over coal fires and condensing generation. A typical charge would be 6s per week for a 3-bedroom house.

The Council approved the Shard End scheme in March 1947 'subject to the consent of all necessary Government Departments' and authorised the Finance Committee to borrow the capital.¹²⁷

Bristol

Proposals for a district heating scheme in the destroyed centre of Bristol were initiated by the local heating consultants Arthur Scull and Sons in 1941.¹²⁸ Scull offered to prepare a report without charge for the Planning and Public Works Committee of the Council. A preliminary report was considered by a conference of Chief Officers and the Committee in 1942, and a copy was sent to the DSIR. Scull submitted his detailed report in September 1943.¹²⁹ The conference of Chief Officers pointed out the lack of experience in such schemes and recommended that the Committee await the publication of the DSIR report. Scull pressed the Committee to publicise or allow him to publicise the work done; the summary and conclusions of the report were sent to councillors and were reported in the press.¹³⁰

Scull proposed a scheme to supply 1300TJ_H/y to 140ha of the central commercial area of the city from ITOC turbines totalling 25MW_e. Total capital expenditure would be £1.55m over 15 years, recoverable in revenue over 30 years. Scull calculated a yearly revenue of £271 000 would cover all charges; this could be obtained by selling heat at 3s7d/GJ_H and debiting electricity - assumed still under Bristol's control - at .214d/kWh. Scull compared this price for heat with thermal storage from electric heating, open fires, gas, solid fuel central heating and slow burning stoves, calculating it to be cheaper than all but the last two options.¹³¹

The Central Area Plan for the city was published in 1944.¹³² The City Engineer was under the impression that the subject of district heating 'was under consideration on a national basis' but recognised that a policy decision on its adoption would need to be made before major reconstruction work got underway.¹³³ Nothing further was done; in a subsequent report on the Central Area to the Planning and Reconstruction Committee in 1945, it was stated that no useful purpose could be served by pursuing the matter till the DSIR report had been received. The Committee remained keen but needed reassurance of 'favourable economic balances before committing themselves.'¹³⁴

Coventry

Coventry City Council started considering postwar reconstruction in late 1943 when new planning legislation gave it more extensive control over the city centre.¹³⁵ The centre had been 'manifestly quite inadequate'¹³⁶ in a number of respects before the war, and an area of some 180ha had suffered extensive bomb damage. Before the Act, no planning powers had existed for comprehensive reconstruction. But initial enthusiasm faded as constraints became evident. The MTCP Declaratory Order was made for an area of only 110ha of the total, and the Government would not allow outright purchase by the Council which would have made planning much easier.¹³⁷ Its control over building was to be limited to that of ground landlord and planning authority. The Council early on rejected a proposal for a single Standing Committee on Redevelopment and Planning of the City and adopted a more passive role, processing proposals from elsewhere for developments within the area.¹³⁸

Coventry's first introduction to district heating came in mid 1942 when Kennedy and Donkin approached the Council for cooperation in preparing plans for district heating in the blitzed central area.¹³⁹ This was to form one of the studies for the DSIR/DHSC investigation of DH and would not involve expenditure by the Council. Kennedy and Donkin's report,¹⁴⁰ completed in late 1943, envisaged a scheme covering 53ha. It would be built in two stages, the first to supply about 200TJ_h/y to a central area, the second another 100TJ_h/y to surrounding commercial buildings. No residential load was planned, but provision would be made for later

connection of other areas of the city. Donkin favoured the installation of special CHP plant at the Corporation's Longford power station. He calculated delivered heat costs of 2s9d/GJ_h initially, falling to 2s7d on completion, 20% lower than by other methods. The scheme would save an estimated 10 000t of coal a year.

The report stimulated the Council's Redevelopment Committee to take up the 'general idea of the scheme ... (which) merits full and impartial consideration as a possible feature of the redevelopment of the city'.¹⁴¹ Senior officers of the Council's existing undertakings discussed the proposal but considered the distance from the heat source - some 6km from the centre - likely to jeopardise the economics of the scheme; a station would be needed nearer the heat load. It was felt that Kennedy and Donkin's plan could 'perhaps be bettered' if 'on a different basis'.¹⁴² The Council decided not to pursue the Donkin scheme, but tactfully asked the City Gas and Electricity Engineers to prepare schemes for the city centre separately based on CHP and gas and in a collaborative effort for a combination possibly using other heat sources.¹⁴³

In 1947 the Council commissioned an outline plan for a city centre DH scheme from Carrier Engineering. The plan proposed coal-fired heat-only boilers. The Water Engineer was given responsibility for preparing a detailed scheme and started discussions with the Ministry of Fuel and Power. The options explored included a refuse destructor as heat source.¹⁴⁴ In July 1948 the Council appointed Kennedy and Donkin as consultants, who advocated further discussion with the Ministries.¹⁴⁵ The Corporation obtained powers for a heating undertaking in the Coventry Corporation Act 1948.¹⁴⁶

Other Schemes

In all some 80 local authorities are recorded as having considered DH schemes for specific areas between 1940 and 1955, most stimulated by the encouraging initial pronouncements from central government in 1946. Of these, about 35 reached the stage of preliminary plans and costings (App. 4). Several - such as those at Swindon and Darwen, as well as the major schemes reviewed in this section - originally proposed CHP sources, often because of the proximity of an existing power station. In many

places it was hoped that limited HO schemes would eventually be linked up in wider CHP-supplied networks. As well as those for new housing areas in existing towns, several proposals were considered for new towns: at Stevenage, Newton Aycliffe, Hemel Hempstead, Harlow, Glenrothes and East Kilbride.

A recurrent feature of local authority deliberations on DH was the dependence on central government for a lead both technically and in policy. Several authorities postponed decisions on schemes waiting for the DSIR/DHSC report and long before the MoH finally started actively discouraging DH proposals its unwillingness to give a positive statement was taken as casting doubt on the economic viability and technical merits of DH and certainly on the willingness of central government to back schemes with loans and other forms of support. As one consultant observed,

In talking to officers of local authorities, I find that their main complaint is lack of guidance or a lead from some central authority. For instance, when they first feel they would like to consider a scheme, it appears that they are told it cannot be considered until a consultant has prepared a draft design and assessment of the cost. They reply: "If, say, we employ someone to do this, can you tell us whether it will be passed or not, or whether we shall be saddling ourselves with this initial cost for nothing?"¹⁴⁷

6.5 INTERNAL DISCUSSIONS

Heating Engineers

The positions and arguments of even the advocates of DH among heating engineers were not uniform.¹⁴⁸ Smith, for example, having earlier advocated CHP, later tried to counter the assumption that it was necessary to give good economics for DH, which he saw as likely to discourage HO/DH schemes.¹⁴⁹ Within the wider professional and trade grouping the merits of DH were far from generally accepted.

Editorials in the trade journal Heating and Ventilating Engineer were ambivalent and inconsistent from the start. Recognising its constituency included many apparatus manufacturers and small contractors as well as large consultancies, an editorial in 1935 found Margolis's vision of extensive DH 'sinister'; '... there would be a great danger that our Industry would undergo drastic changes that would operate unfavourably to heating engineers and their businesses.' It envisaged local authority undertakings would want to carry out fitting of house internals, and networks would be laid by 'large firms of public works contractors'. DH stations 'would cut out the manufacturer of the present heating and hot water supply boiler almost entirely.'¹⁵⁰

In June 1941, in starting to focus on 'the immediate consideration of heating and other problems which will face the Trade at the end of the war', it was still antagonistic:

There is no doubt that the communal heating protagonists are going to leave no stone unturned in putting their point of view before the responsible authorities. Those supporters of individual or small central-heating schemes must begin to prepare their case now ...¹⁵¹

Yet in November 1941 it argued that large central and DH schemes in postwar reconstruction would have benefits for both large and small contractors, and that the trade should be ready to take advantage of opportunities.¹⁵²

In late 1942 it started to worry about what it saw as the enthusiasm of electrical engineers for DH and appeared worried that control over

schemes would be taken away from the 'steam and hot water people'.¹⁵³ Of central government discussion all it asked was 'a full, fair and free investigation of all types of heating medium'.¹⁵⁴ By late 1943 it was warming slightly; it had 'never urged district heating ... (but that it) should be considered in all its aspects ... and should not be cast aside out of mere bias or sectional interests' and was prepared to defend DH against the attacks of the gas industry.¹⁵⁵ It remained at best lukewarm, pointing out problems with economics as they became apparent and expressing doubts, though advocating rational planning and objective assessment of alternatives, and criticising the lack of a lead or definitive statement by central government or 'the experts of the engineering world'.¹⁵⁶

The professional institution to which the engineers belonged, and which acted as an important forum for discussion and publicity, - the Institution of Heating and Ventilation Engineers - likewise failed to make a clear stand on DH, despite Smith's efforts in 1947 to get a clear statement in favour. There were substantial disagreements on its economics and a feeling that more information and experience were needed.¹⁵⁷

Electricity Supply Industry

The treatment of the CHP option by the prewar ESI has already been described, such as it was. The Electricity Commission and the CEB usually supplied the industry's representatives at discussions on DH or at negotiations on specific proposals - like its general monopoly on advice to government on electricity matters, an arrangement regarded as unsatisfactory by the MFP.¹⁵⁸ Though the Commissioners had a reputation for promoting 'electricity development without regard for any other competing interest',¹⁵⁹ their individual attitudes towards DH did vary.¹⁶⁰ The CEB, and subsequently the CEB element in the BEA, was perceived as a source of resistance.¹⁶¹

In the prenationalisation electrical industries as a whole, attitudes in detail varied, but the dominant current derived from their main technical and commercial priorities was still much the same as that seen in the 20s and 30s:

... no obstacle should be allowed to prevent the supplying of

industry as a whole with electrical energy at prices that are based on the normal trend of generating costs shown in present practice.¹⁶²

It can be in no self-regarding spirit that these (electrical engineers) would accept a lowering of the efficiency of generation of electricity ... or forego the utmost advantages obtainable from advances in power station practice, on which hang the prospects of securing some of the larger power and industrial heating loads. Nor is it narrow self-interest that would prompt them to consider yielding to rival agencies any opportunities that arise for meeting the potential space-heating and water-heating requirements of the public.¹⁶³

The newly formed British Electricity Authority had no chance to formulate an explicit policy on CHP in response to the mandate of Section 50 before the subject impinged on it; it was forced to respond within 14 days of notification to the first batch of Heating Undertaking sections in Local Bills to come before Parliament in 1948. As a holding operation it immediately lodged petitions against the Bills - Darwen, Rochdale, Coventry, Birmingham and Smethwick.¹⁶⁴

In subsequent discussions with the MFP, detailed in 6.6, the BEA sought changes in the Bills to provide itself with as much scope as possible for future action and cover all contingencies. It aimed to be adequately informed of proposals outside and to have powers to control or even take over their development. It argued that it was not opposed to DH, and might want to develop its own schemes; the Local Acts should therefore not prejudice the provisions of s.50.¹⁶⁵

The eventual outcome was a set of clauses providing the industry with information, an opportunity to give a counter-proposal for heat supply to a scheme, and arrangements for arbitration of disputes. Powers to restrict the enabling powers to specific sites, for statutory BEA approval, and for compulsory purchase of CHP stations, were rejected.

With reasonable safeguards in place against developments which would be outside its control and might create problems for its programmes, the BEA started general consideration of CHP and DH in late 1948.¹⁶⁶ A sub-committee of the Full-time Members and Chief Officers was formed to consider s.50, with a working party of officers. This was one of many ad hoc groups on specific issues set up during the first few months.¹⁶⁷ The attitude of the Authority was by no means already fixed - possibly an

indication of how little attention personnel had given the topic before s.50 brought it more firmly into their view. If the individuals had brought firm opinions on DH into the Authority, there was no immediately apparent consensus of general attitude and no obvious procedures for dealing with the matter. Early discussion and briefing material ranged widely. The members noted, though underestimated, the adoption of CHP in other countries. They were aware of the interest shown by local authorities in Britain and acknowledged the opportunities for 'experiment' presented by the reconstruction of bombed city areas and the building of new towns. Some regarded consulting engineers' estimates as unrealistic, and local authorities as not having had balanced information.¹⁶⁸ They identified many of the issues and points of controversy surrounding the technology, enumerated the advantages and disadvantages claimed from different viewpoints, including economy of coal in the 'national interest', suggested a number of positions which might be adopted and explored their implications.

It was acknowledged that the supply industry had 'not been forward in taking an interest' and thought perhaps 'desirable that the nationalised electricity supply industry should move rather less in a watertight compartment than has been the case hitherto.' The Authority would have to decide and declare its policy quickly because of the developments which would come in the next few years. Some fifty DH schemes were under consideration by then and twelve had been sanctioned by the MoH. Several authorities had or were about to obtain powers in Local Acts which included CHP generation. Even if the BEA took no active role it would almost inevitably be forced to formulate policy at least on the purchase of by-product power from local authority schemes - an obligation in the Local Acts - and cooperate in technical arrangements for this.

There was further speculation on the effects of substantial development of DH by other authorities on the demand for electricity. Preliminary calculations were done, including local and total power outputs assuming CHP would be sized for heat demand - CHP would give $1-2\text{MW}_e$ per capita, at that time 2-4 times the consumption of electricity - and of increased capital costs. It was suggested that this might eliminate demands for space and water heating, which the industry hoped to develop further, thus accentuating the peaks of electricity demand and requiring

changes in the domestic tariff structure in an attempt to flatten them.

Section 50 itself (App.6) was obviously vaguely worded even as a general directive; there was wide scope for interpretation even before it was decided how to put any policy into operation. It was argued that the only duty was investigation; beyond this, the clause permitted carrying out or assisting in the provision of heat. The major ambiguity arose from the phrase 'heat obtained from or in connection with the generation of electricity' and the technical distinction it was argued could be made between the production of heat with electricity as a by-product and vice versa.

Thus the Authority could take the position that its duty was 'not to investigate schemes of district heating of all kinds merely on the grounds that the generation of electricity is incidentally introduced, but to investigate how the heat obtained in generating electricity can be used ...' The narrowest interpretation could thus be the use of heat obtained from normal condensing stations, that is, at whatever temperature it was rejected from stations designed for maximum electrical efficiency. Certain officials actually argued for this, presumably in full knowledge that it would exclude any involvement in technical configurations for getting heat at higher temperatures suitable for DH or industrial processes.

Beyond this minimum, then, the Authority could exercise powers to carry out research on a wider interpretation of CHP, undertake to provide or assist in providing heat for schemes, or actively exercise powers to generate and distribute heat - that is, be responsible for whole schemes. It was clear that there would be problems in the exercise of the full range of powers; the breaking up of streets, for example, would require a Ministerial order and local authorities might thus be able to intervene in opposition. Investigations might involve the exercise of the enabling powers at least in specific experiments.

The Authority would at least need to keep informed of developments and would need to investigate various issues before clarifying its policy: the comparative economics of different methods of heat supply, drawing necessarily on foreign experience and literature - it was especially critical of the apparent lack of rigour in the costing of consultants proposals and

considered them suspect and overoptimistic; the influence of CHP/DH on siting policy; the relative importance to be attached to economic and other criteria; the ultimate effect of large scale introduction of CHP/DH on the economics of the whole industry via load factors, demand patterns and changes in tariff, etc; and the desirability of different organisations being responsible for the distribution of heat.

It was recognised immediately that policies other than the minimal duty would require to differing extents special commercial and technical staff, a strengthening of Headquarters staff and of Area Board staff if they were to take on distribution.

Underlying the whole discussion was a general agreement that the issue was incidental to the Authority's main purpose; 'the time (was) not yet ripe for placing on the Central Authority responsibilities for investigating methods of district heating to the detriment or exclusion of their primary function of generating electricity.' One officer considered it

generally agreed that, where possible, we should not undertake activities outside those of electricity generation, but as a national body we cannot refuse to join in with schemes for getting the best use of the resources of the country.¹⁶⁹

It was appreciated that the BEA would inevitably be involved. It would be 'neither practicable nor expedient' to take the minimal role - not only to avoid criticism but so that development elsewhere would not be outside its control. A more active stance was thus taken to a large extent for defensive purposes. In particular the Authority was faced with the prospect of being forced by clauses in an increasing number of Local Acts to purchase by-product electricity, in quantities and at times it could not control. It was argued that the Authority would be unlikely to be able to set prices so that it could afford to buy from an unlimited number of schemes. It was thus 'imperative' for it to be able to offer heat from sources other than its main condensing stations.

Specifically it was suggested that the Authority should itself try a CHP scheme - an option less risky than trying to collaborate with a local authority. The benefits in information, whether for positive application or for defence in subsequent argument, would it was felt offset possible financial loss. It might offer to take over complete responsibility for one

of the schemes already proposed - Birmingham Shard End, Urmston or Wythenshawe.

The deliberations had little time to develop a firm policy or programme before the subject impinged on the Authority in several ways. Besides contesting local Bills, it had to devise a procedure for assessing and responding to proposals, and to negotiate on the first few schemes, such as Wythenshawe, which would set precedents. And it came under continued pressure from the Ministry to clarify its position. The MFP was receiving an increasing number of enquiries from local authorities and parliamentary questions. Reminders on the topic at first came via officers in the Ministry's Gas and Electricity Division, but it was soon the subject of direct communication between Gaitskell and Citrine.¹⁷⁰ BEA statements, as one official noted, continued to give 'no positive clue as to what they are doing or propose to do about meeting their obligations under s.50 ...'¹⁷¹ The general attitude of the Authority and its method of handling specific matters thus largely took shape in the process of interaction with local authorities and central government.

Gas Industry

While the electricity industry's position on DH was worked out in protracted internal discussion and subsequently in interaction with other actors, that of the gas industry was clear from the outset. It began in the early 40s to see DH as a serious competitor for existing and future domestic markets. Various more specific fears were raised: the possible exclusion of gas from new towns and housing developments with their needs provided by DH and electricity; a loss of the more profitable supply areas or base loads to DH leaving gas with uneconomic areas or intermittent demand; a reduction in the cost of electricity production through CHP operation; and, recognising the trend towards state planning or coordination of coal use, some form of intervention which overtly or inadvertently favoured DH.¹⁷²

As well as having a large number of undertakings and wide variation in size, the industry had problems in the pursuit of collective interests. While there were, as Williams observes, 'a number of national organisations representing various interests within the industry ... there was no single

body which could, over a broad front, represent the industry with executive authority, as opposed to presenting a consensus opinion.¹⁷³ The nearest to a national political body was the British Gas Federation, itself an umbrella body for five national organisations concerned with specific aspects of the industry.¹⁷⁴ With the industry's traditional strength in engineering and weakness on the commercial side, the Institution of Gas Engineers became an important forum for communication and for concerted action on organisational as well as technical aspects. There was, however, little overlap with other professional bodies, whereas electrical and heating engineers took part in discussions in the IEE, IHVE, IMechE and ICivE. The Gas and Electricity Division in the Ministry of Fuel and Power was largely concerned in the 40s with coping with coordination during the war and its practical problems, and in preparing its own plans for reorganising the industries. It was thus regarded with some suspicion and little used as a political channel. The industry's journals¹⁷⁵ carried papers on DH from outside the industry, and its own discussion and comment, but probably only served to make gas undertakings aware of the potential competition. Finally some of the most successful actions on DH, largely through legal channels, were taken by the oldest and largest of the private gas company, the Gas, Light and Coke Company¹⁷⁶ in London, which had long carried out technical work of wider benefit to the industry and had resources to pursue the interests of the industry as a whole while other sections were weak.

The industry's attack on DH through public and professional debate started in 1943, before most specific proposals had been formulated, on 'the rosy pictures ... being painted of the possibilities of the system in general'¹⁷⁷ and the 'often far-reaching and sometimes extravagant'¹⁷⁸ claims of advocates. The whole subject was contentious and fraught with problems. It depicted the enthusiasm of planners for this novelty as somewhat naive; the technique appeared 'to hold much fascination to the minds of many town and city planners, who visualise in the use of steam for the purpose a cheap and altogether wonderful service, the while overlooking the complex problems involved and the capital costs entailed.'¹⁷⁹

Gas was claimed to provide the same benefits but to have the added advantages of precision of control and of control by the consumer which

would outweigh price differentials. While DH was acknowledged as 'practicable' the problems were stressed. It would be risky and speculative. It would need top-up radiant heat sources. 'An Englishman's predilection for an open fire is both undeniable and an indication of the limitations of heating by steam or hot water.'¹⁸⁰ The capital and labour needed for such schemes would be scarce. CHP/DH might be economic in areas of high heat load density 'but compares unfavourably with the use of gas and coke in those areas of normal demand which represent the greater part of British towns.'¹⁸¹ If the objective was saving coal, then there were cheaper ways including the expansion, centralisation and improvement of the electricity and carbonisation industries.¹⁸²

As quantitative evaluations of DH schemes emerged, gas industry critics questioned assumptions and calculations, suggesting that comparisons with other fuels were unfair; that too high a heat consumption per dwelling was taken; that heat losses would be greater; and that 'the cost of such factors as management, consumer service and local rates ... (which) form a considerable part of the total outgoings of existing utility undertakings' had been ignored.¹⁸³

In contrast to the 'almost unreasoning advocacy of some of its supporters',¹⁸⁴ the first report of an IGE Committee investigating DH was promoted as 'a sober appraisal' and 'a welcome corrective to the claims of enthusiasts'.¹⁸⁵ It estimated that a DH network would cost over four times that for an equivalent gas service.¹⁸⁶ A Gas Journal leader writer was careful to stress that it was the large scale of DH which presented the problems. 'Small scale application comes into quite a different category.' Thus block heating by coke could be economical where schemes over a wider area would not.¹⁸⁷

One of the industry's main lines of argument was that the new utility, especially if given unfair advantages, could have serious effects on the operation of existing services, to the detriment of consumers.¹⁸⁸ These possible impacts had not been explored. Any penetration of DH into areas previously served by gas would add to the cost of the latter by rendering already installed gas mains oversized or redundant. 'The general introduction of steam or hot water supplies, by contracting the potential field for each service, would tend to raise the cost of all.'¹⁸⁹ And worse,

the reduction or elimination of gas supply in high density areas or for base loads would increase costs of supply elsewhere in what 'might well amount to a subsidy for the city centre';¹⁹⁰ as the IGE 1st Report put it:

... if the newcomer can only operate in selected and most profitable areas or on selected and most profitable loads and cannot economically advance beyond these special circumstances, then the effect will be that the utility which has to continue to serve under the less favourable circumstances must increase its price and injustice may be done as between one group of consumers and another.¹⁹¹

Put bluntly district heating (which is no more efficient than heating by gas) cannot be given the cream of the market if the result is unduly to increase the cost of heat services to other consumers outside the "favoured" area.¹⁹²

One writer thought this consideration should form the basis of cost comparisons with gas for town centre schemes:

...it is not sufficient to compare estimated costs of district heating to users in a specially favourable centre with the price at which gas service could be supplied anywhere in a much larger area¹⁹³

but argued further that the gas costs should be the marginal costs of supplying a new load, disregarding the capital expenditure on existing mains.

The industry was conscious of trends towards state planning for efficiency in fuel use. Though careful not to be seen to question the principle, its unease about the consequences for its own interests was evident.¹⁹⁴ But its main fear was that DH would be encouraged and introduced in a rush without the opportunity to put arguments against it and in favour of gas. It thus argued for caution, open debate and 'objective consideration and effective coordination' by advisory bodies and government.¹⁹⁵ It called for a broad assessment of the advantages and disadvantages of each option, acknowledging the wider social claims for DH in terms of cleanliness, convenience, etc., but claiming gas could match them.¹⁹⁶ At the same time it depicted evaluations of DH as selective, and wanted the counter considerations it had raised on the effects of a new undertaking on existing services 'given their proper balance and perspective'.¹⁹⁷ This might need an inquiry before each development to allow the gas industry to put forward counterproposals.¹⁹⁸ It feared and

warned against preferential treatment by loan or subsidy, either overt or inadvertent, as in the selection of favourable loads and areas already mentioned. In public it always portrayed these conditions as leading to overall economy and hence to the benefit of the householder, as much as in the interests of the industry. It almost invariably upheld the individual's 'freedom of choice'.¹⁹⁹

Besides criticising DH proposals and stressing problems with both DH schemes and their effects on other utilities, the industry put forward various plans and suggestions - not always consistent - as to how the new option should be treated. While it claimed to accept that DH should be introduced in the right circumstances, it was keen to set out stringent terms of evaluation and treatment relative to other options; that is, its more specific arguments and suggestions were often hardly consistent with the rhetoric of even-handedness, in that it sought what was arguably discriminatory treatment against DH. It pressed for the improvement of existing utilities rather than the creation of a new one.²⁰⁰ The existence of developed production and distribution of gas and electricity should be counted to their advantage in comparisons.²⁰¹ DH should only be considered if it provided something the others could not: greater cleanliness or convenience or lower costs.²⁰² The existing services of gas and electricity could provide for all fuel needs; DH would only provide low temperature heat and would therefore need supplementing.²⁰³ From this it was argued that since a gas supply to each house would be needed for supplementary purposes anyway, it made sense for it to be used for all purposes other than lighting.²⁰⁴ Thus the industry should be advocating an all-gas house and seeking to persuade local authorities to adopt it.²⁰⁵

The industry continued to criticise proposals for DH as more emerged in the mid-40s, and was jolted again by the focus on DH at the MFP Fuel and the Future Conference 1946.²⁰⁶ It exhorted individual undertakings 'in their own interests and in the interests of the community ... to exercise the greatest vigilance when schemes for district heating are proposed in their locality, to ensure that such schemes are properly costed',²⁰⁷ and to formulate plans to meet this competition.

The industry increasingly accepted that the popularity of the idea of DH was indicative of increased expectations and standards of domestic

heating; DH was 'at once a challenge and a stimulus to the Gas Industry.'²⁰⁸ Discussion within the industry thus increasingly turned to ways in which it could increase its own performance, cut costs and provide an appropriately improved service to consumers.²⁰⁹ And it reflected the contradictions between the fragmented structure of an industry with some 700 undertakings and poor national representation, and the pressures on it to restructure and expand to suit postwar conditions. It was acknowledged that the industry had barely considered let alone planned for the expansion which potential markets indicated. The 2nd IGE report on DH, though the Committee had more information on DH schemes and proposals and had started out to put forward more detailed criticism and cost comparisons, had on its own admission 'given the greater part of its time to studying methods by which the Gas Industry can provide a service equivalent to district heating.'²¹⁰

The industry thus argued for a large expansion and for the extensive use of gas and coke in new homes. One proposal for a typical home would use 49GJ_h/y (22GJ_h gas and 3.6t coke) with coke-fired central heating, gas fires, and gas-fired cooker, washing machine, sink heater, refrigerator, clothes dryer and cooker.²¹¹ One critic pointed out this would require 14Mt/y of coke - compared to 6.7Mt for domestic and miscellaneous use in 1944 - and an extra 85 000TJ_h of gas for new domestic users - compared to a domestic demand of 110 000TJ_h in 1944.²¹² The IGE 1st Report suggested a total of 64GJ_h/y per house for all-gas provision of space and water heating and cooking.²¹³

While its position was unequivocal, then, the gas industry had problems of representation and limited opportunities to intervene even in general debate on DH. Its most successful actions to regulate, if not to curb, the development of DH were its objections to local legislation, described in 6.6. The Gas Light and Coke Company was especially active. Seeking 'to prevent the propaganda value of district heating from being exploited at the expense of ratepayers',²¹⁴ it petitioned successfully on its own behalf and through its activity in the Conjoint Conference of Public Utility Associations against the LCC (General Powers) Bill of 1947 and thereby strongly influenced the content and process of subsequent legislation.

Solid Fuel Industries

Most domestic heating used coal, though electricity and gas had made substantial inroads into the market before the War. The most prominent collective voice in the period of producers and distributors of solid fuel and appliances for it was the Coal Utilisation Council. Putting the case particularly of coal merchants, it argued in the press against DH as another potential competitor to the open fire.²¹⁵

The coke industry took a similar line to the gas industry.²¹⁶ At the same time it feared that complete gasification might sever its alliance with the gas industry on which it was so dependent. It argued that it must remain a 'two-fuel industry' because of the need for both in homes; gas and coke together 'could provide a combination of fuels which is cheaper than gas separately and more convenient than coke separately.'²¹⁷ It was conscious of its reputation for inefficient appliances and pleaded that new devices in the postwar years would be greatly improved. It criticised vehemently government statements on DH and enthusiasts' claims. Similarly suspicious of government intervention but recognising its necessity 'since the voice of the industry is not sufficiently unanimous',²¹⁸ it supported the BGF idea of a national fuel body which would regulate but not destroy competition.

6.6 LEGISLATION

Need for Local Acts

Enabling legislation for DH was important in its development in the early postwar years, and the legislative process was one of the major arenas of interaction in which the objectives and arguments of the groups involved are usefully exposed.

Section 72(2) of the Housing Act 1936 and Section 43(2) of the Housing (Scotland) Act 1925 on the provision of housing for the working classes (App.6), were deemed to have given any local authority powers to supply a housing estate with heat but not to break up streets to lay mains outside an estate. There was considerable confusion in the mid-40s about the interpretation of these powers; legal advisers suggested they covered council-owned properties on council-owned land, but not other properties.²¹⁹ The Urmston and Salisbury schemes were approved by the MoH under the 1936 Act, the Ministry seeing it as a 'wide interpretation' but unlikely to be challenged.²²⁰ Dagenham disputed the need for a Local Act as its scheme was to serve its own houses, LCC houses and a council school, but it was overruled, and had to obtain powers in the Essex County Council Act 1952.²²¹ The Ministry's interpretation of the clause was not considered adequate assurance of legality - the powers could only be tested by challenge in the courts - and it was in any case advising privately by 1945 that local authorities had no general powers for DH.²²² Authorities thus had to obtain powers in Local Acts. The district heating parts of the Bills in the late 40s were frequently the main reason for their promotion.²²³

Manchester Corporation was the first to obtain special powers, applying to its Wythenshawe district only. The 1946 powers contained none of the clauses on consultation and supply of information which were to be enforced in subsequent Acts, yet was passed with little opposition.²²⁴

London County Council (General Powers) Act 1947

The major focus for working out DH powers was the LCC (General Powers) Bill in 1946-7.²²⁵ Westminster City Council submitted plans in 1946 for its Pimlico scheme on the assumption that powers under the 1936 Act were sufficient, but Ministry legal officials considered it dubious and there were fears of a challenge from gas companies.²²⁶ The City Council approached the LCC to obtain powers but the required clauses could not be formulated in time for submission in its Bill to be submitted in November 1946. The LCC decided after consultation with the Metropolitan Boroughs Standing Joint Committee to submit an additional provision in April 1947 seeking powers not only specifically for Westminster but for all the London Boroughs and for LCC estates outside the County area. The part of the Bill consisted essentially of extensions and modifications to the 1936 Housing Act provisions. It mistakenly submitted that the powers were unlikely to be opposed.²²⁷

In fact 17 petitions were deposited in the House of Lords against the DH clauses, by adjacent county and district councils, water, gas and transport concerns.²²⁸ The range of objections reflected the general view that the clauses had been hastily composed and ill thought out. The utilities argued forcefully that since precedent was being created the powers should be considered far more carefully. It is worth here considering the main types of objection.

First, general preambles to the petitions stressed the 'theoretical' or 'experimental' nature of the technique and hence a need to limit the scale of schemes and safeguard other interests from unforeseen effects. Some put forward a technical argument against large schemes, claiming 'such a scheme cannot be made satisfactory if it is extended to cover a wide area.'²²⁹ Some claimed it was 'potentially dangerous'.²³⁰ Some attempted to discredit the idea as a whole, using technical arguments to try to establish that it was not practicable, despite the fact that only enabling powers were being sought and schemes would be subject to technical scrutiny by government departments.

Second, utilities sought to mitigate the effects of competition from

the new undertakings. They wanted the same obligations and constraints to apply as to themselves, in particular an obligation to supply rather than simply enabling powers.²³¹ There should be no subsidy either from central government or from rates, and this absence of subsidy should be open to inspection. And - though no specific measure was suggested which could have mitigated this - they feared the removal of profitable loads leaving them with an obligation to continue uneconomic supplies. Similarly local authorities wanted the option of setting up their own DH supply without the detrimental effects on its economics of duplication by authorities from outside taking away areas of load. Water undertakers objected to powers to supply hot water, wanting similar bye-laws to apply as they were subject to and in particular measures taken to prevent waste of water.²³²

Third, utilities wanted protection against damage or expense caused by the installation of the distribution network. Local authorities outside LCC boundaries anticipated more LCC housing estates and objected to inadequate protection against interference with their various duties and in particular against the effects of mains laying. Their legal representatives sought to have the powers limited to the County.²³³

The Gas Light and Coke Company not only petitioned on its own behalf but also for the Conjoint Conference of Public Utility Associations, thus putting the force of all major electricity, water, gas and public transport utilities behind its attack.²³⁴ The Conjoint Conference petition argued that gas and electricity undertakers had to supply 'under stringent and far-reaching statutory obligations and safeguards imposed in the public interest.' They would still be obliged to supply houses with DH for supplementary purposes, and to maintain the necessary capacity and readiness. The 'proposed competitive supply of heat and hot water' should be 'afforded on an economic basis and not be rate or State aided.' It should be subject to similar obligations. Thus the petition sought the inclusion of clauses to ensure fairness, specifically providing: for separate accounts; for charges which would ensure no subsidy; for no preferential charging; for the declaration of the temperature and pressure of supply, an obligation to maintain them and penalties for failing to do so; for an obligation to supply any premises within 25 yards of a main as well as those to which the Bill related. It maintained that tenants should not be deprived of their right to take a gas supply by 'undue pressure' from the

housing authority; nor should they be forced to take a DH supply as a condition of tenancy; and that charges should not be recovered in the form of rent but separately. It objected to the lack of technical specification and of provision for protection against the 'dangerous nature' of the technique, and suggested technical regulation by the MFP and provisions for other undertakers to object to the Ministry to safeguard their underground installations.

The GL&CC's own petition wanted similar conditions, pointing out the company's own statutory obligations. It would still have to supply even if the main heating load had been taken up by DH. It claimed that DH was 'theoretical' with 'little experience' behind it.

In protracted negotiations with the LCC from June 1947 onwards,²³⁵ solicitors for the Conjoint Conference worked out the basis of much of the procedure for objections to subsequent Bills. They pressed for the powers to be limited to specified estates, and stressed the principles of self-supporting schemes, fair competition and no interference with 'freedom of choice' for the consumer. In its proposed amendments the Conjoint Conference claimed it did not oppose the principle of local authorities establishing DH undertakings, but considered them 'experimental'. They should be subject not only to safeguards for other utilities, but also to 'impartial inquiry' in each case; there was variation in 'conditions governing the supply of fuel and power' and 'no justification in conferring on local authorities a general uncontrolled power to establish heating undertakings on any of their housing estates without an impartial examination of the particular conditions pertaining on each particular estate'.²³⁶

The LCC put up arguments against most of the objections²³⁷ but by the time the Bill came to its Committee stage in the House of Lords in July 1947, with only the petitions from the Metropolitan Water Board, the Conjoint Conference and the GL&CC left, it had already conceded in conference with the Boroughs that it would be 'unwise' to pursue the Bill as it stood. Particularly as the powers had been asked for in a late amendment, the LCC anticipated they were likely to be struck out by the Lords as too hastily conceived and that such a failure would reflect badly on the Council. It conceded that the powers should be limited to Pimlico.²³⁸

The end result as the Bill emerged from the House of Lords Select Committee²³⁹ was the limiting of powers to the single scheme and the assertion that it was a special case, not a general principle. It established many of the clauses that were to become standard in DH Bills: separate accounting for the undertaking; like charges in like circumstances - that is, no undue preference; separate billing of heat charges; the return of technical and financial statistics to the MFP; safety measures and declared technical parameters to be approved by the Ministry; representation of objections by other utilities to the Ministry before approval; provisions for the protection of other utilities' installations;²⁴⁰ and liability for nuisance. By conceding the limiting of powers to Pimlico, the LCC temporarily avoided confronting the full onslaught of opponents and contesting their demands. But this effective defeat, the provisions incorporated in the limited powers it did obtain, and the issues raised in the legislative process, largely determined the pattern of subsequent legislation.

Dudley Corporation also obtained powers in 1947. The Bill contained no provision for electricity generation and few of the other clauses which were to become standard. Protection for local gas and water undertakings were included.²⁴¹

BEA/MFP Negotiations

Five authorities - Smethwick, Birmingham, Coventry, Darwen and Rochdale - submitted Bills in the 1947/8 session. With the withdrawal of the extensive powers from the LCC Bill, although the wishes of the utilities and other authorities had been expressed it was not clear which of the controversial clauses might be passed, and the backing of the MFP for the clauses as submitted encouraged the authorities to try.²⁴² Both Smethwick and Birmingham sought powers to supply to any premises outside their areas, albeit with the consent of the relevant Borough. Oldbury, anticipating promoting its own DH legislation in the next session, objected to this provision in the Smethwick Bill. Smethwick modified it to cover only its own estates outside its boundaries but Oldbury still resisted and powers were eventually limited to within its boundaries. Birmingham likewise encountered opposition from six adjacent boroughs and districts and agreed to limit its powers to the city, but without limits on the type

of premises. Thus all the 1948 Acts were limited to Borough boundaries.²⁴³

The BEA and the Area Boards, with their policy on DH still unformed, petitioned against all five Bills to cover themselves. The government departments involved met with the BEA in early 1948 to work out consistent approaches to the Bills.²⁴⁴ For the Authority these discussions served two purposes: to influence the MFP's policy, which it knew to be unformed; and to use the Ministry to exert pressure on local authorities to change the provisions of their Bills so that the Authority would not need to petition and thereby expose its actions to Parliamentary scrutiny. The MFP wanted to sort out its own policy, to ensure that its actions were coherent and consistent with those of other departments, and to standardise the clauses.

Rather than taking a positive stance, the MFP mainly reacted to the views of the Authority, with the sanction of approval of standard clauses in subsequent Bills. BEA officers argued for a number of provisions: that powers should be confined to areas in which the local authority was in a position to carry out schemes in the near future; that the powers should not prejudice the provisions of s.50 including the right of Boards to run their own schemes; that it should be informed of such schemes at an early stage of the proposal; that all schemes using CHP should be submitted to the Authority and subject to its approval; that it should have powers to take over the construction and/or operation of any local authority CHP station on arbitrated terms; and that local authorities should not be able to generate electricity for sale other than to a Board. They claimed the Authority was not opposed to DH; indeed it would encourage schemes as rehearsals of possible ones of its own later. But it did not wish to see a large number of small power stations built.

Ministry officials privately feared the clauses for approval and compulsory purchase would 'enable the Authority effectively to stifle the development of all DH schemes if they wished to do so' and that the threat of these powers would 'greatly reduce the enthusiasm of local authorities for district heating.' Authorities would be alarmed at having their potentially profitable schemes taken over but being left with any unprofitable ones. The effect might be to discourage CHP in favour of

heat-only supply. It was suggested authorities might react by opposing BEA stations in their areas, since the financial benefits of having them were dubious anyway.²⁴⁵

The Ministry conceded on exclusive sale of power, but resisted - largely at the instigation of the FEBr - restriction of area to that of already planned schemes, statutory approval and optionally exercisable compulsory purchase powers for CHP stations. On early information the Ministry explored various means by which news of schemes might be channelled to the Authority - including using regional MoH officials as 'scouts' - bearing in mind that while early proposals would come to its notice via the DSIR or the MoH anyway, because the authorities were reliant on them for technical advice, it might be more difficult when schemes became 'more standardised and reliable.'²⁴⁶ The MoH decided against obligatory inquiries as suggested in petitions against the LCC Bill.²⁴⁷

By June 1948 the Ministries had agreed a procedure which was to become included in standard clauses in later Bills at the drafting stage, whereby the Authority would be notified of schemes and the Authority or Area Boards - as they had petitioned - would be able to give notice within a fixed period of a counter-proposal to supply heat for a scheme. Disputes would go to arbitration by the Minister. In the intensive pre-legislation discussions that followed between Ministries, promoters of Bills and petitioners, first Rochdale and then the other local authorities were persuaded to accept the information and counter-notice provisions.²⁴⁸

Thus in advance of deciding its own approach to the possibilities of CHP, and via the Ministry rather than through the legislative process proper, the BEA obtained some, though by no means total, control over CHP and DH development by others. Though the Authority could have petitioned to obtain compulsory purchase powers and considered and threatened doing so, it backed down. As well as shunning the scrutiny of Select Committees, the Authority privately thought it better to avoid arbitration if at all possible, though the Wythenshawe case had already shown the extreme reluctance of the Ministry to get involved anyway.²⁴⁹ By contrast, gas undertakings still had to petition the 1947/48 Bills, but clauses for consultation, protection and information were written into most

of the Bills passed in 1949.

LCC (General Powers) Act 1948

Immediately following the defeat of the 1947 Bill the LCC started to investigate the questions raised in the process, 'with a view to introducing proposals in the 1948 session which may have an easier passage', and to sound out the Ministries, to enlist their support and ascertain the prospects of success.²⁵⁰ It was encouraged by the granting of powers to Dudley and Manchester and the application of five authorities in the 1947/48 session, but was 'anxious to avoid another rebuff' and probed first to see if the government could be persuaded to introduce general legislation.²⁵¹ The new Bill accommodated most of the directions of the Lords Select Committee on the 1947 Bill and subsequent standard clauses in other Bills, but also included a number of clauses which it saw as useful for the specific conditions of London. A wider range of bodies had protection clauses, including the London Hydraulic Power Company, the British Transport Commission and the Port of London Authority and for sewers and subways, reflecting the complex administration of the city's infrastructure. It sought several provisions to ease the financial constraints which would hamper the development of undertakings: a reserve fund of up to 10% of the capital cost; a repairs equalisation fund; the power to invest money from either fund; and relaxation of the strict separate accounting.

The passage of the Bill was resisted even more forcefully than the 1947 version. 31 petitions against the DH powers were deposited in the two Houses by six counties and 61 adjacent boroughs and district councils, three separate gas companies, the Gas Council and the BGC, Slough Estates - a major private electricity and CHP generator - and the Conservators of the River Thames.²⁵²

The BGC and the new Gas Council petitioned along with the three major London undertakings - the GL&CC, the South Metropolitan Gas Co. and the South Suburban Gas Co. - submitting highly detailed objections which stressed the lack of clarity in the Bill's provisions. They demanded the same protection, information and counter-notice provisions as the electricity industry had obtained in previous Acts. They objected to

powers to supply any premises while there was still no obligation to supply. They again pointed out that the obligation on the gas industry to provide for top-up heat would intensify its peak load, producing wasteful duplication and a burden on all gas consumers. They objected to the possibility of the reserve and repair funds being used to obscure subsidies to the schemes.

The BEA and the LEB also deposited petitions, seeking improved protection clauses, the provision of information, reports and returns, and representations to the Ministry. They objected to exceptions in the provisions for separate accounting. Legal representatives of four Area Boards as well as the British Waterworks Association also raised objections to the supply of washing water. The LCC withdrew the powers to supply washing water in April 1949.

Many of the petitions pointed out the 'formidable' opposition to the 1947 Bill and its withdrawal, and that the powers sought in the new Bill were yet more extensive. Other local authorities claimed the technique still had little experience, citing a MoH statement of December 1948 that it was still 'experimental', and considered powers should be deferred until further investigation had been made of the 'whole subject'. They sought limitation of the powers to specified areas, and improved protection for themselves as highway authorities and for consumers. Most of them echoed the idea that if DH was to be provided, one authority in each area should do so. Some authorities took a position not based on discrediting the idea, but on the implications of widespread use: that supply to selected areas by the LCC while the other authorities supplied surrounding areas would lead to wasteful duplication.²⁵³ Several asked for assurance that the LCC would not object to their own DH powers.

The LCC found the opposition to supply outside the County boundaries difficult to counter, as it had no firm proposals to illustrate a need. It foresaw a protracted Select Committee hearing which might jeopardise the whole Part. It came under pressure from the MoH too to limit supply to its own or Borough estates outside. The outside authorities maintained their opposition to any outside powers and the LCC withdrew these clauses in April 1949.²⁵⁴

The LCC (General Powers) Act 1949²⁵⁵ thus finally gave DH powers to all London boroughs. Only one other County authority, Nottingham, obtained powers for its constituent areas, covering Newark, East Retford, Mansfield and Worksop.²⁵⁶

Standardisation

Thus by 1949 the Local Act DH powers had been developed into a set of about 20 standard clauses. Typically an undertaking was empowered to build CHP or HO stations, buy heat in bulk from elsewhere, lay networks, supply internal fittings, and supply heat in the form of hot water or steam to any type of premises. There was no obligation to supply but no undue preference was to be shown in tariffs. The provisions for notification of the electricity authorities, for counter-notice of supply of heat, and arbitration, have already been described. All utilities had protection clauses for their networks, including consultation over mains laying. Separate accounts had to be kept for the undertaking, and reports and returns had to be supplied to other utilities for inspection.

It is clear that centrally organised bodies had an inherent advantage over local authorities in negotiations over Bills, in the coherence of their position; the fragmented responses and concessions of individual authorities created precedents which could then be imposed on others, or more often were accepted in the drafting of Bills by the authorities' parliamentary agents.

Boundary Disputes

Ten Bills were promoted in 1949,²⁵⁷ four of which sought to supply outside the promoting authority's boundaries. By now the utilities had obtained the clauses they wanted as standard inclusions at drafting, and objections now came almost exclusively from adjacent local authorities. Swindon sought the most extensive powers, for supplying up to 5 miles from the Borough boundaries. After objections from the MoH and more obstinately from other authorities, it was eventually limited to areas up to 5 miles outside with the consent of the authority and the water undertakers.²⁵⁸ Crewe was the only other authority to obtain even limited powers outside its area in 1949, making with Dudley in 1947 a total of

three. Powers in subsequent Bills were limited to the promoting authority's area.

Several authorities promoting Bills subsequently had no definite plans for DH anyway. Wolverhampton's Bill, for example, sought powers to supply within the Corporation's water limits, an area some 30km by 20km extending well beyond the Borough boundaries.²⁵⁹ Both County Councils and several adjacent districts objected on the grounds either that their areas were unsuitable for DH or if suitable that the powers would lead to duplication or prejudice the chances of the other authority starting a viable scheme. DH advocate Oscar Faber gave evidence for the objectors on this point: that an outside authority might 'cream off' the best areas and render subsequent schemes unviable. The objections were reinforced by an admission that Wolverhampton did not have plans for any scheme at the time, though it claimed this was due to capital shortage not poor economics. An offer to limit the powers to specified areas led to all but five authorities withdrawing, but the remainder pressed their objections and mobilised opposition in the Commons Second Reading. They were successful in getting the Select Committee to limit the powers to the Borough boundary.²⁶⁰

Twickenham and Aycliffe

The only DH powers to be rejected outright were those submitted by Twickenham Corporation in 1949.²⁶¹ The scheme was approved by the Corporation in December 1948, a week too late for deposition of a Bill for the 1949 session. It submitted a late Bill, arguing the need to start the scheme in the summer of 1949, that it was one of the MoH chosen twelve, and that powers for DH were 'merely ancillary' to those for housing. Representations from seven organisations - including five government departments - were dealt with but three bodies petitioned: the GL&CC put forward its standard argument about the consequences of competition on its economics, maintained that gas would be cheaper, and objected to provisions to subsidise the interest on capital, repairs or a reserve fund from the general rate fund; Middlesex County Council wanted powers limited to Twickenham's boundaries; and Feltham UDC contested the scheme was not economical but that they should provide the supply if anyone. The Bill was rejected by the Lords Select Committee in April

Only one new town sought DH powers in the late 40s and early 50s - Newton Aycliffe.²⁶³ Though the scheme was envisaged as HO, the MFP suggested the Development Corporation should seek CHP powers too, but following a lack of interest by the BEA, the idea was dropped and the BEA did not seek counter-notice provisions. Like the Swindon Bill, Aycliffe sought powers to supply up to 5 miles beyond the authority boundaries.

This brought in another Ministry, the MTCP, with another angle on the matter and more complications about the division of responsibilities. The Ministries were aware of a need to sort out their differences of opinion among themselves and put combined objections and amendments to the DC, but were still unresolved while the Bill was on its way through Parliament.²⁶⁴ The MoH thought the DC should not be given powers since responsibility for the town would later pass to a local authority. As with the Housing Acts, s.2(2) of the New Towns Act provided powers for DH but none to break up streets unless the Corporation owned the whole area.

The Bill met resistance in the Commons on the grounds that schemes had already been abandoned, that none had proved the economics of DH, and that the local authority would inherit financial liability from the DC. The DC resisted, pointing out the powers were enabling only and that the scheme itself would still need approval. The Bill was withdrawn temporarily as doubts increased about the economics of the scheme with revised building schedules. It was abandoned entirely when the MTCP declined to approve the scheme.²⁶⁵

Delays and Decline

In 1952 the Ridley Committee looked at the question of legislation for DH and in particular the length of the process.²⁶⁶ It heard that powers took at least nine months to get through Parliament, often a lot longer, and it would be two years before an authority could start, allowing time for the passage of the Bill, the period for a counter-offer and negotiations. Powers sought in May 1952, for example, would have taken till July 1953 to get through Parliament, till January 1954 for counter-offer, and till

April 1954 for negotiations. On top came technical discussions with the MoH and ICDH/DHSC and a wait for loan sanction. The Committee concluded that while there were some difficulties and delays in the legislation process, the problems of cost had overwhelmed. It seemed satisfied that since the Ministries were already limiting the number of schemes it was reasonable for them not to have pursued general powers but to have attempted to get local enactments uniform.

In any case the number of Local Bills declined from 1949 onwards. By the early 50s, London plus 27 towns and cities had obtained powers (App.5).

6.7 NEGOTIATIONS ON SCHEMES

London: City

Both the City and South Bank schemes would ideally have used heat from the proposed Bankside power station. The application by the City of London Electric Lighting Company to build the station itself was the subject of controversy over amenity aspects which reached Cabinet and Parliament.²⁶⁷ A planning inquiry was held in January 1947, and the station was debated in the Lords in May 1947.²⁶⁸ The outcome was that oil-firing was stipulated to reduce fuel storage and berthing operations. This seemed sensible in 1946 when coal stocks were diminishing and an official coal-to-oil conversion programme was started. But by June of the next year oil supplies were short and it was clear that the cost of electricity from Bankside would not compare favourably with coal, and that it would have a low load factor.²⁶⁹

There was already pressure from several quarters to consider heat supplies from the station.²⁷⁰ The Electricity Commissioners argued that they had to avoid any delays; unless 'the local authorities are in a position to state at once what their heat requirements are likely to be' the matter would have to be left for the second stage of the station.²⁷¹ Minister of Fuel and Power Shinwell likewise took the line to critics in Parliament that the Bankside capacity was needed as soon as possible.²⁷²

Plans for DH in the City were in any case in abeyance. The City Engineer challenged the economic assessment in Donkin's original proposal, particularly in transmission and replanting power station sites, and was generally unenthusiastic.²⁷³ Other City committees were drawn into the discussions and eventually a modified proposal was agreed, to pursue group heating from central boilers with the possibility of later connection to district heating. Again the City Engineer stressed that the economics of emerging DH schemes was dubious, that they needed 'specially favourable circumstances' or a subsidy, and that there were still no precedents for city centre schemes.²⁷⁴ In later reports on other proposals, he suggested that none could be compared with the City. He favoured letting the scattered redevelopment proceed with central heating and, as for long-term

connection to a DH network, waiting until such time as the BEA might offer a supply of heat. This he considered unlikely and the necessary distribution network in any case 'a difficult and expensive business'.²⁷⁵

The Improvements and Town Planning Committee deferred further consideration of the group heating proposals, and the City formally abandoned them in February 1953.²⁷⁶

With the commissioning, ahead of schedule in 1952, of Bankside 'B', the BEA itself assessed the cost of heat from BP turbines run from the 'B' boilers in a similar arrangement to the Battersea 'H' sets for Pimlico.²⁷⁷ It raised the possibility of a pilot or nucleus scheme based on two small areas of the City in which coherent redevelopment was underway, with a total heat demand of some 18MW_h. Its interest was motivated partly by a genuine desire for experience, but it was also concerned, whatever the outcome, to reassure other bodies of its willingness to participate and to publicise its investigations to prevent accusations of opposition to DH.²⁷⁸ Heat from Bankside 'B' still proved prohibitively expensive.²⁷⁹ Additional small coal sets at the Bankside site were considered but rejected because of the planning limitations.

Discussions continued at officer level in the BEA and City keeping the subject alive throughout the early and mid-1950s, despite the City and particularly its Engineer, as it seemed to BEA officers, being disillusioned with the prospects and less than enthusiastic.²⁸⁰ Indeed BEA staff carried out detailed assessments in the mid-50s before even putting outline proposals to the City.²⁸¹

On the instigation of the LCC the topic was revived again in early 1954, as development in the City speeded up.²⁸¹ The BEA reassessed costs from the sites Donkin had recommended - Bankside and City Road with Shoreditch. For the first time it considered bleeding steam from a condensing set; its electrical capacity would be reduced from 60 to 38MW_e and it would provide 116MW_h, running at times it would otherwise have been shut down; storage would cover two daily periods of 2 hours running in condensing mode. As at Battersea, the BEA came up against problems as to how to cost the heat. The dubious economics and the reluctance of the City dissuaded the Authority from pursuing the matter.²⁸²

London: South Bank

The LCC attempted initially to get the support of the Ministries of Works and Fuel and Power for its South Bank proposal.²⁸³ The MoW was supportive, but the MFP/FEBP seemed confused as to the mandate of the BEA on heat supplies. The Ministries' assumption in this case was that no heat would be available for at least ten years, as the second section of the station was not scheduled to be started until 1954. Approaches were made in 1948 to the ICDH/DHSC and the BEA itself. The LCC stressed the amenity advantages of DH; that would weigh heavily in its favour even if no clear economic advantage could be shown.²⁸⁴

The possibility of heat from new plant at the Southwark power station site was raised but rejected because of its distance from the redevelopment area and its cramped site. The only other riverside plot of the necessary 1ha in the vicinity was the site of a bombed pottery works on the Albert Embankment. The BEA considered it suitable for an adequate station of 40MW_e provided no flue gas washing facilities were thought necessary and coal storage was kept to a minimum.²⁸⁵ The BEA again stated its willingness to build and operate a purpose built coal CHP station but its reluctance to run the whole scheme. Approaches were made to the Port of London Authority and the MTCP. The PLA had no objections to the berthing operation required - two 250t barges a day. The MTCP, however, raised strong objections, citing the aim of the LCC's own County of London Plan to restrict industrial use of the riverbank. The County's own Architect also objected because of the difficulty of installing flue gas washing and the scale of the building, comparable to the Bankside station over which there had been such controversy. Thus the LCC found itself at odds with its own previous rigorous opposition to Bankside.²⁸⁶ Three other sites away from the river, the use of heat from Battersea, and the use of large boiler houses in government buildings, were all considered and rejected.²⁸⁷

The subject was left in abeyance until August 1952, when the BEA approached the LCC to explore possibilities of using the new Bankside set, as it had done with the City.²⁸⁸ The redevelopment proceeding on the South Bank was largely private apart from the BEA's own offices, and schedules were unclear owing to building restrictions. Attempts to get

commitments from private developers were finally abandoned in 1954.²⁸⁹

London: Pimlico

Formal agreement for heat supply from Battersea to the Pimlico scheme was signed in March 1948 and the MoH approved the early stages in May.²⁹⁰ While the agreement was in draft, the London Power Company had also agreed to a supply to a proposed extension to the large privately owned block of over 1200 flats known as Dolphin Square should it be requested. This, reputedly the largest block of flats in Europe, would give a ready-made heat load and thus better utilisation of plant early on. The possibility of a third BP turbine was raised.²⁹¹

The agreement was vested in the LEB on nationalisation, but the Board wanted to be relieved of the obligation and it was agreed in March 1949 to transfer it to the BEA. In July 1950 the Authority made a new agreement with Westminster City Council as a matter of legal convenience; the terms of supply were almost identical, including the obligation of supply to Dolphin Square should the Council request it. The agreement had effect for a minimum period of 30 years from 31st March 1951, with three years' notice of termination required thereafter. The BEA were thus committed to supplying heat until 31st March 1984. The length of this obligation and the charging arrangements in this agreement were to commit the Authority to a heavy loss for many years.²⁹²

By 1948 the tendered construction costs were already over three times the original estimate, and the estimated cost of delivered heat 60% greater.²⁹³ The Dolphin Square option was taken up in August 1950, and further extensions were agreed during 1951 when it was calculated that overestimates of heat demand for the original area meant that the extensions could be supplied without exceeding the maximum demand on the station of 13.2MW_h specified in the agreement.²⁹⁴ Supply to the first stage started in February 1951 and Dolphin Square was connected in September of that year. The final scheme, to be developed in four stages, would have a maximum load of 22MW_h. It would contain some 3200 flats for 11 000 people and a number of communal buildings.²⁹⁵

The system by which the BEA charged the WCC for heat comprised

three elements: an annual service charge, a unit charge to cover plant capital charges and operating charges other than fuel, and running charges for supplies from live and exhaust steam. The cost of heat from exhaust steam was calculated as the cost of heat supplied to the BP sets less the cost of obtaining the same electrical output from the main Battersea 'A' sets.²⁹⁶

The outline costing method in the agreement left many ambiguities. These forced the Authority from 1950 onwards to discuss and develop its heat costing methods in general. The problems - especially the capacity credit and the amounts of heat actually supplied to the BP turbines - were still not resolved at the end of the nominal first year's operation in April 1952. Technically the operation was seen as a success by the City and the Authority. In particular the performance of the BP sets was good; over the last three months of 1951 their overall efficiency was assessed at 76.1%. But on a provisional basis the margin to the Authority of revenue over costs for the winter of 1951/2 was only £400 out of some £14 500; works costs other than fuel had been underestimated, and neither charges attributable to coal and ash handing plant and boiler house buildings nor overheads other than capital charges had been allowed for. The returns would be even less favourable for the summer.²⁹⁷

In October 1951 Kennedy and Donkin asked the Authority to consider a further supply of some 8.5MW_h to the reconstructed Chelsea Barracks. Already aware of the problems with the existing charging system, the Authority indicated it would agree to a supply if both variable elements were increased by 25% and the service charge increased to provide for a new BP set. The question of the extension was dropped when the rebuilding of the Barracks was suspended.²⁹⁸

The Authority was reluctant to release its assessment of the costs, partly through embarrassment at its unsatisfactory obligations, partly because problems in the costing methods were not resolved, but mainly because publicising the methods might have committed it to similar terms in other schemes. It even avoided giving them to a special group set up in 1951 specifically to monitor the scheme, the Pimlico DH Sub-Committee of the GLO-RLC, because it had representatives of other organisations.²⁹⁹ It revealed them to Westminster City Council in late 1953, but both

parties were keen to keep the economic performance quiet; they set about further joint investigations.³⁰⁰ The first comprehensive account of the scheme,³⁰¹ published when only one section of the network was in operation, contained no actual costings or evaluation of the 'overall economy' of the scheme, on the grounds that it was 'impossible to state definitely what parts of the total capital charges and operating costs of the condensing and back-pressure stations should be allocated to each';³⁰² assessments had been made, but 'had been based on such a large number of debatable assumptions that agreement ... was never attained.'³⁰³ Instead Donkin and colleagues combined hypothetical generation costs for larger purpose-built CHP sets - taking a higher efficiency and lower send out temperature than at Pimlico - and actual distribution costs from the scheme to demonstrate the economics of a scheme some eight times larger. They concluded the cost of heat compared favourably with other methods, and that the economics of the scheme was capable of improvement by increasing the ratio of power to heat. The conclusions were greeted with some suspicion.³⁰⁴

The results of the joint evaluation were finally published in 1956, but only for the year ending 30th September 1953, 'as being the only year to date with a constant number of premises supplied with heat', with estimates of overall costs on completion. No capacity credit was given despite the availability of the BP sets on-peak; electricity was valued at the running costs of condensing generation. It was concluded that the estimated costs in Donkin's 1954 paper were 'close to results obtained in practice'.³⁰⁵

Manchester

The enthusiasm of Manchester Council's Joint Sub-Committee for the Wythenshawe plan was not shared by other sections of the authority. The Finance Committee took a highly cautious view of a scheme of such 'considerable magnitude', and stressed the lack of information on which to judge the consultants' figures. It was aware of discussions in the MFP and DSIR on the general issue of DH and that these 'had not progressed beyond the experimental or research stage.' It questioned whether the Corporation should accept the risks and liabilities involved in what would be 'pioneer work' with 'national implications', and wanted some guarantee of

Government assistance such as a guarantee against losses if costs escalated. If such a guarantee were not forthcoming it suggested waiting for the results of 'a scheme of more modest dimensions'. The General and Parliamentary Committee did not question the desirability of the scheme but again pointed to the paucity of technical and economic information, recommending further discussions with Government departments on all aspects including general Government policy on the issue.³⁰⁶

Early informal consultations from July 1945 between Manchester Corporation and DSIR and Ministry of Fuel and Power representatives had provided widely differing views on the adequacy of the consultants' costings.³⁰⁷ While MFP officials thought Griffiths' figure of £1.5m capital was reasonable, the DSIR suggested it could be nearer £2.5m. The Department raised doubts about acceptability to tenants and the possibility of duplication of capital expenditure if preparations were made and the scheme not carried out.³⁰⁸

The reaction fuelled doubts in the already sceptical sections of the Corporation. When the scheme came before the Council, there was sufficient enthusiasm for a motion to be tabled approving the Housing and Wythenshawe Estate Special Committees' report and rejecting the Finance and General and Parliamentary Committee recommendations. Caution won out, however, and an amendment was carried following the latter line, to receive the report and defer action 'pending consultation with the Government departments concerned on all aspects of district heating and the submission of information as to the general policy of the Government in relation to the carrying out of district heating schemes.'³⁰⁹

Thus at discussions in May 1946 involving representatives of the Council, the Ministries of Health, Fuel and Power and Works, the DSIR and the Electricity Commissioners, the Council made it clear that it would not proceed without government assistance.³¹⁰ It was also looking to the government for 'authoritative technical opinion'. The Ministry of Health representative said it would need more information before considering bearing a financial burden for the scheme; if it were to justify backing in terms of the value of an experiment, it could be argued that Wythenshawe was not the best place for such. A Working Party was set up comprising the City Surveyor and Housing Director and representatives of the three

Ministries and the DSIR.

The Working Party reported in July 1946,³¹¹ unanimously finding the scheme satisfactory in both technical and financial terms. It recommended MoH support and wanted the scheme to proceed as quickly as possible 'in appropriate stages' to provide information for new towns. In November 1946 the MoH indicated that it was satisfied with the technical soundness of the scheme, but needed time to come to a decision on funding. It offered unspecified help should Manchester decide to go ahead anyway.

In fact MoH officials had indicated to the Ministry of Fuel and Power more than a year previously that it would not give it financial support - it appeared less likely then that Manchester would go ahead unassisted for fear of financial loss - and had tried to pass responsibility to the MFP.³¹² Officials feared financial support might remove any 'incentive to efficiency or economy' in the scheme. While the Ministry avoided making its intention known, the continued pressure from Manchester at least persuaded it in late 1946 to think more carefully about possible forms of aid.³¹³ Suggestions ranged from direct capital or annual subsidy, through guarantees to bear a percentage of losses after a given period, to arrangements which nominally acknowledged the value of the scheme as an experiment - the provision of resources or personnel for evaluation or the purchase of data. But it continued to argue that it already subsidised the housing programme heavily, that it had no powers to give aid, and that it was a matter for the MFP, suggesting it might find money for 'fuel research and coal economy'.

The MFP was undoubtedly keen to see the scheme started. Both the Secretary and officials in the Gas and Electricity Division concurred it should be given every possible assistance - yet similarly looked for ways of avoiding committing themselves to anything.³¹⁴ They considered whether electricity authorities had powers under the 1919 Act to subsidise such an experimental scheme, but conceded their sphere was limited to experiments in obtaining greater electrical efficiency. They went through various contorted arguments to justify not providing backing: that while it was important for Wythenshawe to go ahead, to prove the viability of CHP/DH it was also necessary to show that it could be self-supporting; that one should distinguish between schemes primarily for heat with electricity as a

by-product and vice versa, and that the former were intended primarily to improve housing standards and were therefore the concern of the MoH; and that sanctioning aid for an experiment might lead to 'experiments running all over the country'.³¹⁵ An attempt to lay out the pros and cons of Government assistance produced relatively weak arguments against.³¹⁶ In its favour: Wythenshawe was the first CHP-based scheme, and would demonstrate Government approval of DH; it would encourage other authorities to follow; the scheme would provide useful data; and if everybody's faith proved well-founded there would be no losses anyway. Against: other authorities would expect financial help; or they might misconstrue it as recognition of the speculative or hazardous nature of DH; that it was not now the only proposal for CHP/DH - there was indeed 'copious evidence of growing interest' - and support for only one scheme would be difficult to justify; and that the criticism might be made that a large city like Manchester should have been expected to fund it unaided. The Ministry also anticipated objections from the gas and electricity industries. They would be 'profoundly suspicious' of DH having government backing and would argue that schemes should stand or fall on their merits.³¹⁷

So the MFP, though making it clear to the MoH by October 1946 that it was going to reject the request, likewise deferred giving a definite answer to Manchester, merely indicating that it would need to obtain statutory powers from Parliament to give aid. Officials guessed - as it turned out correctly - that Manchester would by then go ahead anyway, and advocated the 'strongest persuasion' to induce it to do so.³¹⁸

The Ministries' bluff by procrastination worked. In January 1947 Council officers indicated that they would recommend that the scheme go ahead and the Ministries came clean so far as ruling out a direct subsidy. The Electricity Commissioners cleared up their worries: the Electricity Bill would not preclude the scheme being based on CHP; if another department built and ran the CHP station and sold power to the Electricity Department - or later the Area Board - the station would be regarded as a private station and would neither need consent nor be nationalised.³¹⁹

The scheme was finally put before the Council in February 1947. By January of that year, 900 dwellings were already being built in two areas

of the estate. The Housing Committee calculated that delay in connecting these could add .5d per week to the heating charges. Omitting the houses altogether would add 1d. It would take six months to prepare detailed plans for the scheme; the longer a decision on it was postponed, the more the charges would increase. The Committee was encouraged by suggestions that Dunlop and Ferranti would each want to build about 20ha of factories in the Wythenshawe industrial areas. It recommended approving the idea of a DH scheme in principle, pursuing detailed plans with CHP, and installing temporary immersion heaters in houses being built. The General and Parliamentary Committee was prepared to back the Housing Committee on the grounds that the Council would only be committed to a detailed study. The Finance Committee again counselled caution, pointing out the rise in capital costs to £2.4m, and recommended seeking assurance from Government this time of adequate supplies of materials and labour. The Council approved the Housing Committee's recommendations.³²⁰

Though the Council was informed that a detailed plan would take six months to prepare, the consultants would give no undertaking to complete within a time limit because of the need to consult further with Government departments. It took till August 1947 to agree a compromise on this time limit, and till June 1948 to finish the plan. The Finance Committee sought borrowing sanction in May 1948 for the first capital.

The average charges shown by the report were 7s6d per week, compared to an estimate in early 1947 of 5s2d. A number of design changes had been made following consultations with the Corporation and Government; there had been a sharp rise in materials costs affecting large works; actual tenders for contractors' work were much higher than original estimates; and power station coal prices had also increased. Finally a saving had been calculated for the elimination of all but one fireplace in the DH-supplied houses; but the MoH had meanwhile decided that all new households should have only one fireplace, invalidating this deduction.

In May 1948 the consultants had approached the new NWEB and the BEA to ascertain whether and on what terms they would buy power from the Wythenshawe CHP stations.³²¹ NWEB intimated by phone that it was prepared to buy at BEA bulk tariff rates - essentially the same terms agreed with the Corporation Electricity Department in 1945 - and this

assumption was incorporated in the report. It proved impossible, however, to get written confirmation of these terms, and it became clear that the BEA had held up agreement to reconsider the whole question of CHP electricity tariffs.³²²

NWEB suggested in July 1948 that the consultants could assume a specified two-part tariff; the reason given was that the availability of the station's capacity would be limited and that extra capacity would still need to be built. It was calculated that this would reduce the income from electricity by over 30% and raise the weekly charge further to 10s. At this the Planning Committee balked and asked the Town Clerk to start negotiations with the BEA and MFP.

The Ministry declined to participate - it would have been 'inappropriate' under the provisions of the 1947 Act - suggesting that if bilateral negotiations failed the matter could go to arbitration.³²³ Ambivalent about the whole business, Ministry officials were reluctant to say anything publicly about the dispute; even to say the offer was 'fair', they considered privately, might give ammunition to the BEA for future use.³²⁴ The BEA's private response to the Ministry's suggestion of arbitration along the lines of clauses in Local Acts was that it would seek similar conditions to other clauses - for example, that the Corporation would have to sell all the electricity generated to the Board and retain none for its own use.³²⁵ Manchester's Town Clerk tried in vain to get the Ministry to relent, arguing that the negotiations would not be an issue of day-to-day administration but one of 'national interest'.³²⁶

Manchester approached the BEA directly in mid-1948, and eventually discussions took place in November.³²⁷ They were described as 'most candid and exhaustive' and covered social as well as economic aspects. The BEA argued that they had to assume a future position in which most of the country was provided with DH, so that there could be no question of arrangements being made with Manchester which could not then be repeated for other local authorities. The BEA promised to reconsider the matter and prepare the most favourable terms it could.

The involvement of the BEA coincided with the start of internal discussions on its general approach to DH and preparation of its procedure

for counter-notice under the Local Acts.³²⁸ It was suggested that the Authority should take a close interest in Wythenshawe anyway to help its deliberations, and the importance of the case was soon recognised. On the one hand it was felt desirable to settle Wythenshawe before dealing with others proposals; on the other the Authority did not want the terms to set an unfortunate precedent. The Authority devised a two-part tariff for capacity and energy; the basic energy charge, linked to fuel costs, was to be supplemented by an allowance which acknowledged the experimental nature of the project. It was thus able to appear encouraging to the technique but also to set the terms that it wanted for future buy-back and avoid a 'bandwagon effect'. Though some members of the BEA thought the terms 'too generous', it was agreed to offer them provided the MFP would accept that while the BEA accepted the principle of 'assistance in experimental methods' it could only apply to a 'limited number' of schemes.³²⁹

The Authority made its revised offer in February 1949 and discussed its basis with the consultants, but it was clear by mid-1949 that it would not improve the terms further. When combined with slight increases in the capital and operating costs since the consultants' report a year before, this produced a weekly average charge of 8s9d.³³⁰ Though several councillors involved were by then in favour of dropping the scheme, another approach was made to the Ministry of Fuel and Power to try and get specific guarantees to cover the Corporation's losses and get priority in the supply of plant and equipment. Councillors argued in the press that it was 'unfair for Manchester to take all the risk without some offer of protection from the Government.'³³¹

Ten months passed before a delegation from Manchester met officials from the Ministries. It found the meeting 'most unsatisfactory'. The MFP again refused both grant and guarantee against loss, but offered to reconsider the possibility of the Minister intervening in the negotiations with the BEA over tariff. In August 1950 the MoH confirmed it too could not give financial assistance, and the MFP declined again to intervene.³³²

In December 1950, over six years after the first suggestion of district heating at Wythenshawe and after spending some £74 000 on assessment and preparation, the Council, on the reluctant recommendation of the two

Committees, finally abandoned the scheme.³³³ The Committees' report discussed at length the reasons. First was the 'failure of the BEA to quote acceptable terms' of electricity purchase - here the Committees noted the disparity in the offers from its own Electricity Department and the NWEB - and the unwillingness of the Minister to intervene in the dispute:

...as the Wythenshawe district heating scheme would have been the first of its kind in the country we conceive that it is surely the duty of the Minister of Fuel and Power to encourage any large scale experiment in conservation of fuel and that a vast amount of knowledge and experience would have been gained for the benefit of the entire country ... and we cannot evade the conclusion that we have not received from the Minister of Fuel and Power the measure of assistance and co-operation which we were entitled to expect.³³⁴

Second, the Minister of Fuel and Power had refused to make a grant or guarantee against losses:

In this country, district heating is in its infancy and sooner or later there will be a real need for a large local authority to act as a pioneer in putting into effect a really major scheme.³³⁵

Third was the 'uncertainty in capital costs and revenue'. The consultants envisaged some 40% of the heating revenue coming from industry, but development of the industrial areas was severely constrained, building licences only being granted to firms engaged in what the Government defined as 'essential work'. The original estimates for the scheme were based on the assumption that the western industrial area would be half developed by December 1951. In fact it had not been started by the time the scheme was abandoned. Finally the estimated capital costs - put at £5.3m by then - and the weekly charges had escalated enormously.

Birmingham

Discussions between Birmingham Corporation and the MoH on the Shard End scheme started in May 1947.³³⁶ Only minor objections were raised, concerning provision of temporary heating in dwellings and charging in the period before connection. The Council decided to make acceptance of DH a condition of tenancy from the outset.

Powers for the City to establish heating undertakings were sought in Part III of the Birmingham Corporation (General Powers) Bill, 1947.

Following nationalisation of the ESI, the BEA petitioned against the Bill, and in discussions in early 1948 between the Authority, the Midlands Electricity Board and the Corporation, set conditions for the withdrawal of its petition, amounting to the introduction of what were to become standard clauses: advance notification of construction or extension and the option of counter-notice of supply. The MEB petitioned against the Bill for compensation for mains already laid in the area, on the grounds that a DH scheme might render them redundant because of loss of heating loads. The Corporation acceded to the BEA's conditions but successfully resisted compensation for the MEB.³³⁷

By October 1948, Manzoni had reassessed the economics of the Shard End scheme, following specification of the loan repayment pattern by the MoH, an increase in coal costs and a decrease in quality available, increased labour and materials costs, and a lower estimate of the electricity which could be credited. While the capital costs could have been kept down to the original estimate by specifying different arrangements and materials, the amended balance sheet gave Manzoni doubts.³²⁸

Finally the BEA, after considering the Shard End project specifically at length and in much detail - it was raised as an example in communication at the highest level³³⁹ - offered terms of purchase based on reliability of supply, 'including a maximum output fee at periods to be selected by the Authority in accordance with the period of their maximum demand.'³⁴⁰ The guaranteed output would thus be considerably less than the probable maximum output, and the composite price arrived at was .31d/kWh, some 20% below the figure originally given as a guide by the Corporation's Electricity Department in 1947.

The cost of heat, for the scheme to be self-supporting, would have been over 9s/GJ_H, and even allowing for some reduction through higher charges to public buildings - the legality of which was in doubt - would have given a weekly charge for an average house of 12s3d, double that originally estimated.

The Council abandoned the Shard End proposal in late 1948, though members expressed hope that it might eventually be able to exercise its

new powers.³⁴¹ The Duddeston and Nechells scheme likewise went no further.³⁴²

Bristol

In Bristol nothing further was done on the city centre DH proposals till May 1947, when the City Engineer was asked to report on Government publications on district heating and on other authorities' schemes and proposals.³⁴³ At this stage a few schemes were 'under consideration' including the City of London and Coventry ones, but the patchy list gave little encouragement. Progress with reconstruction was slow because of national and local constraints, and accordingly - and because of a lack of suitable guidelines - a decision on the Central Area district heating scheme was deferred.³⁴⁴

In February 1949 the Engineer started to seek advice on DH directly. He started discussions with consultants 'with a view to obtaining the special technical advice needed in order that the Committee might come to a final conclusion as to the desirability or otherwise of arranging for district heating in the planning of the Central Area',³⁴⁵ and with the Ministries of Town and Country Planning and Fuel and Power.³⁴⁶ The Ministry representatives were not prepared to advise any local authority on engaging consultants, but suggested installing block heating in the first buildings to allow later connection to a district heating network. Their advice was followed and provisions were made in the leases for later connection.

Suggestions in July 1949 that the University and the Royal Infirmary, both planning to replace their heating systems, might form part of a Central Area heat load - an extra 40% on top of the load Scull had envisaged - prompted the planning officers to recommend reexamining the possibility of DH, appointing consultants and seeking the necessary powers for a heating undertaking in a Local Bill.³⁴⁷ A Special Sub-Committee was set up and Smith Seymour and Rooley appointed as consultants. The firm submitted a preliminary report in September 1949, asking for a decision in principle without commitment so that estimates could be prepared and tenders obtained.³⁴⁸ The report envisaged a modest first stage, with the Hospital and University forming 80% of the load of a

revised scheme, though it could subsequently be extended to all of the Central Area and perhaps beyond. Supply would have to be available within three years otherwise the Hospital and University would back out. Smith proposed HOBs for the early stages but wanted to allow eventual connection to a CHP supply. He indicated the possibility of using the Counterslip power station, by then redundant but under Council control. The Engineer was still keen and convinced that the scheme could be economic provided that the rate of reconstruction could be increased. The interconnection of scattered properties in the Central Area would require heavy capital outlay on mains early in the scheme. District heating clauses were included in the Bristol Corporation Bill of 1950.³⁴⁹

Following negotiations on tariffs for a heat supply, the University and Hospital showed reluctance to be connected, considering they could provide cheaper heat themselves from separate boiler houses. They both subsequently decided to proceed separately with group heating schemes, leaving the possibility of later connection to a central DH scheme.³⁵⁰ In July 1950, the City Engineer pressed for a decision on the central scheme as leases had to be arranged. The Planning and Reconstruction Committee reluctantly decided not to provide for DH in the early stages. The scheme was subsequently never revived.³⁵¹

Coventry

In early 1949, Coventry Corporation officers recommended to their Planning and Redevelopment Committee that the proposed city centre DH scheme be postponed, because of 'the singularly unfavourable conditions in which it would commence to operate in the central area', but suggested that interest in the matter should be maintained', and that allowances should be made in construction for its inclusion later.³⁵² Accordingly ducts for trunk mains were built into the central area and a site for a boiler-house retained. The key problem was the initial large capital outlay required while the load would develop slowly, probably over 20 years. The City Engineer was convinced DH could not be competitive 'unless you have a great many customers to take it immediately you have spent your capital.'³⁵³ Officers understood the MFP to be investigating the whole question and pending an authoritative answer were unwilling to commit themselves to any large scale heating scheme. They continued consultation

with the Ministries.

Gas price rises and supply problems in mid-1950 caused the Committee to reconsider the scheme and to commission another rapid report.³⁵⁴ The cost of district heating still compared unfavourably with solid fuel central heating but the centre had been designated a smokeless zone. It was decided to instal a temporary HOB for the first three blocks in the centre and make full provision for expansion throughout the city centre. The supply was assessed on the worst assumptions - that there would be no expansion - but charges still compared reasonably with other heating forms. A start was authorised in July 1950.³⁵⁵

By January 1951 the MoH had still not approved the scheme, and the Council sent a delegation to stress its urgency. Doubts about costs resurfaced, since it now appeared 'impossible to estimate with even a reasonable degree of certainty the financial effect in the initial stages of the Council's undertaking ...' The Council was conscious that it was 'a novel kind of undertaking for a local authority'. The future of the scheme had come to depend on the acceptance of supply by one large firm for which one of the blocks was being built. Support in the Planning and Redevelopment Committee for proceeding was marginal, and its recommendations wavered; a decision in February 1951 to go ahead and seek loan sanction for the first central blocks was rescinded ten days later and the matter referrrred to the Council. The decision of the single firm would decide the fate of the scheme. A few weeks later it declined. The Council fell back on the provision of ducts and sites for a future scheme, but it was never revived.³⁵⁶

Other Schemes

Of the other proposals which reached the stage of definite plans, most were abandoned before starting. Some were started but halted before reaching their planned size. The immediate reason was often drastically escalating costs. The constraints which authorities faced in the strict control maintained by central government over the reconstruction and housing programmes are considered more fully in 6.8.

Of the new towns, the plans at Stevenage for a network for the whole

town were abandoned in favour of a limited HO scheme in the centre.³⁵⁷ Hemel Hempstead rejected a DH plan because of high estimated charges,³⁵⁸ and Harlow because of high capital costs.³⁵⁹

The Aycliffe scheme, for the whole town of 10 000 people, was approved in outline by the ICDH/DHSC and sanctioned by the MTCP in June 1949.³⁶⁰ Supply was to be from a redundant boiler on an adjacent industrial estate. The development corporation had approached the BEA in mid-1948 about a CHP station but it had allegedly shown no interest.³⁶¹ Work commenced in January 1950 with the installation of internals in the first blocks of flats. By March 1950, doubts were raised about the building programme; the economics of the very low density DH scheme depended heavily on the completion of the town in ten years, but labour and material shortages had rendered this unrealistic.

The estimated charges needed to break even increased to near 10s per week, considered far too high, and the break even period for the scheme lengthened. The consultants revised the plans to try to reduce costs. Beveridge, chair of the Aycliffe DC, pleaded with the MTCP to find some way of allowing the scheme to progress - for example, by extending the loan repayment periods and by other accounting manoeuvres.³⁶² It is doubtful whether any reasonable extension could have lowered the costs sufficiently. By mid-1950 the capital cost estimates for the DH scheme had escalated by some 30% in two years. By revision of the plans the increase in cost per unit of heat had been kept to 10%.

The Bill to give Aycliffe powers for a DH undertaking was blocked in the Commons and withdrawn in May 1950 and in June the Minister of Town and Country Planning finally withdrew approval for the scheme. In July 1950 the Commons was told that the Ministry was not proceeding with any DH schemes in new towns because of the unfavourable economics demonstrated by Aycliffe.³⁶³

At East Kilbride, the DC investigated a whole town CHP/DH scheme, and adopted background heating from HO/DH for its first housing development, Whiternoss, in 1949, with a view to later connection to a larger scheme.³⁶⁴ Charges at Whiternoss escalated by 40% by 1952. The idea of a larger CHP scheme was never revived. A small scheme at Fife

went ahead, and although more houses than planned were connected, the scheme itself similarly remained isolated.³⁶⁵

In London, a scheme was considered in the early 50s for dwellings, schools and shops in the LCC Stepney and Poplar Development Area. The BEA considered supplies from stations at Watts Grove, West Ham or Brunswick Wharf, favouring the last, initially using live steam and later BP sets. The scheme was abandoned in 1953 because of high capital costs and prohibitive economic charges to tenants.³⁶⁶ At Dagenham, a slightly larger network was installed than originally planned,³⁶⁷ and at Paddington a reduced HO scheme went ahead.³⁶⁸ In Bethnal Green, LCC flats were supplied with waste heat from a nearby brewery.³⁶⁹ Three small oil-fired HO schemes were installed on Southwark estates³⁷⁰ and a small coal scheme in Wandsworth.³⁷¹

At Twickenham, the authority sought land outside the Borough for an estate, and obtained a site in late 1945 in Feltham.³⁷² Following confirmation of the housing scheme by a MoH inquiry in June 1946, and encouragement from the Minister to consider DH, it engaged Donald Smith to design a scheme to serve a total of 336 dwellings plus shops and public buildings. The ICDH/DHSC approved the scheme in July 1948, and the MoH sanctioned loans in October. After modifications from discussions with the MFP, the scheme was approved by the Corporation in late 1948. It was abandoned when the Corporation failed to get powers for a DH undertaking in a Local Bill.

At Swindon, DH was planned in 1947 for the new Moredon neighbourhood unit of some 1500 dwellings plus public buildings and light industry.³⁷³ The plans envisaged initially using surplus boiler capacity at off-peak periods at the Corporation's 35MW_e Moredon power station. Later it was intended to instal CHP plant at the station, and to use a large new refuse incinerator and methane-fired boilers at a sewage works as additional sources. When the BEA took over the Moredon station the price for heat it offered was considered prohibitive. The refuse incinerator was not built. The estimated heat charges increased by 50% and only a limited HO supply was installed.

At Urmston, a scheme for an estate with 1300 dwellings and public

buildings was approved by the ICDH/DHSC in early 1946.³⁷⁴ Costs and projected charges for heat rose from around 5s per house per week in the original plan, to over 6s when the network was started. The scheme was halted at a third of its planned size. There were 'operating difficulties', and by 1952 charges were over 10s per house, with the economic charge estimated at 12s.

At Salisbury, a scheme for Bemerton Heath was one of the first actually built. Again charges rose by 80% by 1950 and fewer dwellings were connected than planned.³⁷⁵

Darwen Corporation's CHP proposal in 1947 was mainly for industrial heat supply, from an extension of an existing power station. When the BEA took over the station it considered it unsuitable and favoured new plant. Darwen abandoned the scheme because of capital constraints and increased heat costs.³⁷⁶

6.8 CENTRAL POLICY-MAKING

Influence on Individual Schemes

It has already been indicated how central government departments at first encouraged local authority proposals for DH.³⁷⁷ Subsequently in negotiations over specific schemes, they declined to subsidise them or offer guarantees against loss, and refused to intervene in negotiations between authorities and the electricity supply industry. There were a number of other ways in which central government deliberately or inadvertently influenced the progress of CHP and DH plans: in setting financial conditions; in refusing to enact general enabling legislation; in retreating from attempts to direct the activities of the ESI; in avoiding formulating a coherent policy on DH and hence any active policy statements or measures; in the system of sanctioning local authorities' plans; and finally in actively discouraging them from submitting any further proposals.

However, in terms of the economics of schemes planned and in some cases started, the most significant problem was the slow start to reconstruction and the house building programme. Progress was hampered by shortages of capital, labour and materials; by problems in their allocation; and by the shift of priority in the middle of the Labour government's term of office towards manufacture for export.³⁷⁸ These factors were reflected in increasingly restrictive centrally imposed limits. In a White Paper in late 1947, for example, the government severely curtailed local authorities' capital expenditure on commercial buildings, and it was criticised for the time it took to grant Declaratory Orders for the rebuilding of bombed areas.³⁷⁹

Interdepartmental Disputes

By mid-1947, ten schemes had been approved as technically and economically sound in principle.³⁸⁰ Work was underway at Salisbury and Urmston and tenders were being obtained for Pimlico. The Birmingham and Manchester schemes were under discussion. Already the MoH was becoming reluctant as resource shortages hit the housing programme. District heating was for the MoH marginal; it provided only 'better

amenities'.³⁸¹ It sought to shift responsibility onto the MFP for decisions on whether to back DH.³⁸² Both Ministries had ruled out subsidies during negotiations over the Wythenshawe scheme in 1946. The MTCP followed suit in January 1947.³⁸³

The question of general legislation giving powers to local authorities for DH was raised frequently.³⁸⁴ Several authorities pointed out the protracted process involved in getting local powers, which would become impracticable if opponents established the principle of limiting powers to specified areas for which plans had already been made. In late 1945, the authorities' collective organisations pursued the idea and the matter was raised in Parliament.³⁸⁵ Early signs of encouragement for schemes from the MoH were widely interpreted as indicating that the Ministry would introduce it. But the MoH indicated as early as 1946 that it considered the MFP should take responsibility for sponsoring any general legislation if it were interested in fuel saving.³⁸⁶

Though it uniformly supported local authorities in their request for powers, the MFP in turn backed away from general legislation partly because of the evident complexity of the relations which would have to be acknowledged and sorted out within that legislation.³⁸⁷ It settled for a reasonable compromise on the powers in Local Acts, successfully resisting the BEA's attempt to get too much control over the schemes by compulsory purchase powers and reassuring concerned utilities that they would be adequately informed and protected in practice. So by late 1947 both Ministries were making it clear in discussions with authorities that neither would sponsor a Bill in the foreseeable future. They excused their inaction because of pressure of work, but privately justified it because of the insistence of the MoH on limiting on the number of schemes and because the technique had yet to prove itself.³⁸⁸

The outcome of the battle over financial provisions in Local Bills ensured that authorities would have to pay capital charges and repayments out of revenue from a scheme. Consultants' proposals had taken widely varying assumptions about interest rates and repayment periods. The ICDH/DHSC argued in early 1947 for different periods for elements of a scheme based on the lifetime of each: from 20 years for boiler plant to 60 for house installations. A special MoH Committee recommended a similar

pattern but with the periods for the boiler house and plant shortened. Though local authorities pressed for a uniform period of 60 years as for housing capital, the more stringent pattern was enforced, creating further problems for the poor financial balance of schemes.³⁸⁹

By September 1947, the MoH wanted to curb the influx of DH proposals.³⁹⁰ It pressed that only the three schemes already underway should continue and that other authorities should be told to defer. DH proposals were by now effectively ranked on a first come first served basis. The MFP wanted more to go ahead, stressing the need for experience with technics and economics, and suggested looking for ways of introducing smaller DH schemes which could be extended as housing programmes progressed. The MoH had already started discouraging specific authorities, including Hounslow, which the MFP particularly wanted to see go ahead. The MoH said the MFP should get Cabinet approval because of the high demands of DH for capital and steel, trying to push the matter up to higher levels. The MFP pressed for 12 schemes to be approved, and the MoH subsequently took this as a rigid upper limit, only allowing substitution as authorities dropped out of the shortlist.³⁹¹

So when the ICDH/DHSC reported in January 1948,³⁹² 12 schemes of widely ranging sizes had been approved. Two - Westminster and Wythenshawe proposed CHP sources. Four - Urmston, Salisbury, Wythenshawe and Bonnyrigg - were under construction. The DHSC was convinced DH was 'a practical proposition' in Britain and urged that schemes go ahead to provide information 'with the least possible delay'. The tone of its report showed an appreciation of the opposition growing within the MoH particularly. In particular it was 'alarmed lest the necessity to reduce capital expenditure should have any adverse effect on the economics of district heating schemes as well as delaying progress in obtaining evidence on the operation of the schemes ...'

Although the DHSC wanted to sanction all 12, it recognised that three were unlikely to proceed: Hounslow wanted a special subsidy; Twickenham wanted an assured building programme; and Dagenham was considered 'lukewarm'. The DHSC wanted one or other of Dagenham or Hounslow to proceed because only these schemes proposed full district space heating without top-up fires. The rest of the proposals were to wait until the

review of the housing programme in June 1948.

There was high-level pressure to discourage directly other local authorities from proceeding or coming up with proposals. Bevan wrote to Gaitskell in the spring of 1948 stressing 'the drain which such schemes make on very limited building resources' and said 'we shall have to warn other local authorities who may be contemplating district heating that the prospect of our sanctioning any considerable schemes in the next year or so is so small that they would be unwise to incur expenditure on preparation at the present time.'³⁹³ The MoH wanted to be responsible for phasing the schemes to fit in with the housing programme.³⁹⁴

The MFP resisted direct discouragement. Gaitskell replied to Bevan that 'it would be wrong to give the impression that the door is closed at the present time to such schemes for an indefinite period.'³⁹⁵ He raised the possibility of BEA-backed schemes for CHP/DH, and MFP officers were anxious that 'nothing should be said to local authorities which would give the impression that it was useless to put forward or contemplate any schemes of district heating in present circumstances.'³⁹⁶ The MoH had actually drafted a circular to authorities, claiming it would find 'great difficulty in allowing work' on new schemes; building resources had to be concentrated on dwellings rather than 'ancillary services which are not essential to providing satisfactory houses', and scarce iron and steel was needed for the national export drive.³⁹⁷ But it settled in the end for explaining the position and stressing the difficulties to whichever individual authorities were known to be considering schemes; it thus avoided conflict with the MFP yet as the channel of communication with authorities could get away with discouraging plans for DH equally effectively. It took a similar line in correspondence with consultants.³⁹⁸ The policy was certainly seen in the Ministry as one of 'discouraging new proposals' and it was assumed this would be sufficient; it did not press for mandatory public inquiries in local legislation.³⁹⁹ By mid-1949 its attitude had hardened and its rationalisation was fixed in terms of a shortage of steel and the lack of experience with DH. The MoH continued to stick to its list of approved schemes, and the MFP to press for its extension or at least substitution for dropped schemes.⁴⁰⁰ In 1950, the MTCP withdrew permission for the Aycliffe scheme,⁴⁰¹ and announced that it would not proceed with DH in any of the other new towns.⁴⁰²

CHP and the ESI

From its initially full and open-minded discussion of CHP and DH, the gradual hardening of the BEA's treatment is discernible from its public statements. Its first Annual Report in 1949 contained a large if bland section on DH, which reflected the attention it had given the subject and covered the general issues - s.50, the Local Acts, justification of buy-back terms, cooperation with the Ministry in investigations - and the specific proposals for Wythenshawe, Swindon, Pimlico and Stevenage.⁴⁰³ Entries in subsequent reports became smaller and more specific. In 1950 the report indicated that the Authority was willing to consider proposals from local authorities, but made no mention of any initiatives of its own.⁴⁰⁴ Its 1951/2 report contained a discouraging summary similar to the line which had developed in the Ministry: that while it 'would, of course, welcome any development which made economic use of the waste heat from power stations', and had examined many suggestions,

no concrete proposals likely to result in the absorption of large quantities of available heat have yet emerged. In the variable climate and with the existing social habits of Great Britain, and because of the very high capital costs of heat distribution systems, it seems likely that district heating schemes will only be practicable and economic in a limited number of cases with favourable conditions.⁴⁰⁵

The BEA presented a similarly discouraging view to the Ridley Committee on National Fuel Policy in March 1952;⁴⁰⁶ it 'did not think there was any wide scope for economic district heating schemes in this country.' There were 'difficult questions' concerning the economics of purchase of power from schemes run by other bodies and there would be 'no justification as a general rule for paying ... the same price as it cost to produce electricity in normal generating stations' because CHP/DH stations would produce little power in summer - the same argument used against the Manchester scheme which other parties had found dubious.⁴⁰⁷

The approach of the Authority had indeed become consistent by the early 50s, although no explicit policy was publicised.⁴⁰⁸ Indeed avoidance of making a firm general policy was the major feature of the approach. It claimed to have discharged its obligations under s.50 - implicitly taking the narrow view - by examining 'a large number' of schemes, and depicted

the demise of these as a result of local authorities balking at prohibitive costs - essentially correct but effectively denying its own involvement. It had not promoted CHP itself, but instead considered the merits of private or local authority schemes brought to its attention, and possible involvement in them. It did not attempt to take over responsibility for a particular scheme. Uppermost in its defence against criticism was that its primary purpose was to expand and secure electricity supply and that its effort and capital allocation was to be concentrated on that, a view by then forcibly transmitted through the MFP's Electricity Division.⁴⁰⁹

Thus later BEA Annual Reports stressed the need to consider each proposal on its merits, and reflected the strengthening assumption that, except for industrial process heat for single establishments, the Authority or Boards themselves would be called upon to provide and operate the station. No further mention of general policy appeared - simply reports of discussions, progress on specific schemes, and steam supply.⁴¹⁰

Reluctance to interfere with the ESI programme and its treatment of CHP had become apparent in the Electricity Division by the late 1940s.⁴¹¹ It reflected the Ministry's general retreat from an active energy policy involving direction or coordination of the nationalised energy industries, as originally envisaged by some sections of the Labour government and of the Ministry itself. By 1948, Gaitskell was arguing defensively against pressure for such:

Much has been said about the need for a National Fuel and Power Policy. Such a policy already exists. It is that our fuel and power resources ... should be so organised and utilised as to satisfy consumers' needs at a minimum cost.⁴¹²

This non-intervention found more open expression from 1951 with the election of a Conservative government, when the nationalised industries could reassert their need to run as commercial bodies free from Ministerial direction.⁴¹³

Ridley Committee

The Ministry's attitude to the Ridley Committee and its proposals in 1952 show the extent of that retreat and the relations which had become established in the energy sector after the upheaval of the past few years.

The Committee's deliberations also provide a useful indication of the positions of the main fuel concerns in the early 50s on general issues including the degree and form of desirable state intervention, and specifically on CHP and DH.⁴¹⁴

The Committee was appointed by Gaitskell in July 1951 as a Committee on National Fuel Policy, 'to consider whether any further steps can be taken to promote the best use of our fuel and power resources, having regard to present and prospective requirements and in the light of technical developments.'⁴¹⁵ It effectively replaced Gaitskell's Joint Working Party of the Three Nationalised Industries, which had not by that time met.⁴¹⁶ Both the TUC and the FBI had pressed strongly for such a committee. The idea was resisted by the MFP but it was finally conceded by the Minister as politically expedient as a way of 'avoiding that pressure until after the impending general election.'⁴¹⁷ To avoid the implications that nationalisation had failed to deliver better coordination and that the inquiry should have been started at the outset of the Government's term of office, the terms of reference of the Committee referred to new circumstances: 'the growing demands for all forms of fuel and power arising from full employment and the rearmament programme.'⁴¹⁸ The MFP was concerned to 'limit the embarrassment which the report of a committee of this kind would be likely to cause.'⁴¹⁹ While answering the call for 'policy' it was anxious to avoid setting any 'principles of policy' or talking about a 'national fuel policy', with the implicit admission that it had previously had none and should have. The terms were thus also intended by the MFP to force concentration on short-term issues.⁴²⁰

Nevertheless the Committee took a wide interpretation, setting out to cover all aspects of energy except production of primary fuels.⁴²¹ Early discussions did cover policy principles, and scepticism was evident. One member could 'find no evidence of a National Fuel and Power Policy ... so there can be no question of reviewing it.'⁴²² The general problem as interpreted by MFP officers in their initial briefings was still quite broad too: 'how the Government can influence current patterns and techniques of fuel use so as both to reduce the effects of present and prospective shortages and uncertainties and to make the most economical use of real resources.'⁴²³ In greater detail, however, the MFP view of the options available was more restricted. It defined the major short term problem as

getting over shortages. In the long term it needed to 'guess the scale and pattern' of usage to promote the best use of resources. It stressed the managerial autonomy of the nationalised industries and the need for competition between them.

DH was suggested for the Committee's agenda as a possible 'long term development', and the Committee sought briefings from the MFP specifically on DH and industrial CHP.⁴²⁴ The MFP suggested it was 'probable that the future development of district heating will be based on ... combined generation of heat and power' with the stations operated by the BEA and selling heat to a DH authority, 'stations being designed to take account of both the district heating and electricity requirements of the area.'⁴²⁵ The Committee studied a summary of the DSIR report in advance of its publication. DH was mentioned briefly in some submissions, but it was notably absent from many and seldom raised in discussions on, for example, domestic heating.⁴²⁶ The Committee investigated the local legislation process for DH powers, finding that while there were problems and the process was protracted, economic problems overwhelmed them.⁴²⁷ It considered organisational forms, with differences of opinion. Ridley himself favoured the BEA being responsible rather than a new authority, but agreed that the BEA needed to be pressed; he thought it should form a new internal body to pursue CHP.⁴²⁸

The BEA's position on DH was by this time fairly well developed, and the phrasing in its submission careful.⁴²⁹ It 'would, of course, welcome any development which made economic use of the latent heat lost in the generation of electricity by present methods.' There had, however, been few concrete proposals from other bodies. It did not think 'there was any wide scope for economical district heating schemes in this country.' Industrial CHP was a matter for industries to pursue. It defended its buy-back terms for schemes run by other bodies - there was 'no justification as a general rule for paying for the by-product electricity at the same price as it cost to produce electricity in normal generating stations' - with the summer-winter demand argument and was careful to present its offers to Manchester and Birmingham as exceptions.

The Committee received little evidence which was enthusiastic for CHP. Of individual advocates among engineers and others, only Oliver

Lyle submitted written evidence.⁴³⁰ One consultancy argued for BP schemes serving industry and homes and complained of 'inhibitive tariffs' against private generation.⁴³¹ The TUC was suspicious of the BEA in its written submission:

The BEA now claim to have no objection to such schemes in principle, but for an unsatisfactorily long period the conflicting interests involved resulted in confusion and irritation. It was the same with private diesel generation.⁴³²

But in oral evidence when asked if the development of schemes should be left to the BEA, its representatives declined to press the matter further.⁴³³ The FBI urged consideration of BP generation and DH as against remote siting of large condensing stations, but likewise did not pursue the point.⁴³⁴

Eventually the Committee largely accepted the BEA's view of the limitations and problems involved, and declined to recommend a change of approach.

Despite its attractions as a fuel saver, we are informed that the wide adoption of district heating in this country for domestic purposes is not economic, because of the increase it occasions in power stations' plant cost for a given electricity output, the very high costs of connection either to existing houses or or to new low density housing estates, and the difficulties of coping with non-simultaneous demands for power and heat. In areas where the market for industrial and domestic use was large and concentrated, however, thermal electric schemes might be economic. The British Electricity Authority are under legal obligation to investigate methods by which heat released in the generation of electricity can be usefully employed, and they may initiate district heating schemes. Before they can undertake such schemes they must consider the best use of the limited capital at their disposal, but we trust that ultimately the Authority will be able to develop suitable schemes.⁴³⁵

There was annoyance in the Ministry that the Ridley Committee had ignored attempts to keep its attention on short term matters.⁴³⁶ Its report was issued with minimal publicity and comment, except to make explicit and to explain the Ministry's rejection of the proposed Joint Fuel and Power Planning Board and even the Joint Technical Advisory Committee.⁴³⁷ There was a happy coincidence between the new Conservative government's aim to 'diminish state activities that are not essential' and avoid 'over-centralisation' and the MFP's inclination to avoid long term planning and the organisation necessary for it.⁴³⁸

The report failed to follow through the inconsistencies which followed from some of its general exhortations, and the government was able to interpret its findings selectively, to claim the report endorsed existing arrangements, and to play down its specific criticisms and recommendations.⁴³⁹ Thus its assertion that tariffs should reflect costs to allow 'freedom of choice' to produce an 'economic pattern of fuel use' was depicted as justifying the view that adequate coordination would come through the price mechanism alone.⁴⁴⁰ On specific recommendations, it was able simply to assert that a topic was being pursued or that alternative action had been taken 'to achieve their underlying purpose'.⁴⁴¹

When the chairmen of the nationalised energy industries met the Minister in October 1952, shortly after the publication of the Ridley report, there was general agreement about the way to treat the recommendations.⁴⁴² Intending to dilute greatly Ridley's proposal of a Joint Planning Board, the MFP suggested instead an advisory Joint Fuel and Power Council which would only look at topics which affected more than one industry or fell between their responsibilities, such as new energy sources and CHP. It would rely on persuading industries to cooperate through its presentation of information. In the end the industry chairmen flatly rejected any sort of joint organisation or interference with 'managerial responsibility'.⁴⁴³

MFP/BEA Working Party

By late 1952 several of the DH plans originally approved by the MoI had been abandoned. A few had gone ahead on a reduced scale. All these, except Pimlico, used HO sources. Some had 'operating difficulties'. The cost of heat in all of them had worked out significantly higher than estimated, and in places tenants had protested at price increases. In several cases the fuel consumption was much higher than anticipated.⁴⁴⁴

These problems convinced the ICDH that no further HO/DH schemes should proceed, but at the same time were seen to strengthen the case for developing CHP. In reviewing the lack of progress, the DHSC realised

that the existing deficiency in generating capacity will necessitate priority being given for some years to means for generating the maximum amounts of electrical energy.

Nevertheless ... in the best interests of the national economy, it is urgently necessary that a commencement be made in thermal electric working ... all possible assistance should be given by the government in the formulation and erection of a scheme designed to reveal the administrative and technical factors involved in thermal-electric operation ...⁴⁴⁵

The ICDH resolved to encourage the BEA to start a CHP/DH scheme on a large scale, with the station forming an integral part of its programme for new capacity.

In early 1953, the MFP thus set up a Working Party on the Joint Generation of Power and Heat,⁴⁴⁶ composed mainly of MFP and BEA officers with representatives of the Ministries of Works and Housing and Local Government. The MFP suggested the terms of reference as:

To examine the possibilities of further application of combined heat and power generation and supply, to consider the desirability of setting up a suitable thermal-electric district heating scheme embodying the principle of combined heat and power generation and supply on a large scale, and to report.⁴⁴⁷

On the BEA's insistence, however, the part referring to a CHP/DH scheme was dropped.⁴⁴⁸ Anticipating this, the MFP suggested the Working Party concentrate on supply from ESI stations to industry, particularly because many firms were about to replace existing private generating plant. When it first met in July 1953 this emphasis was agreed.⁴⁴⁹

Thus the Working Party was steered away not only from CHP/DH but also, like the ICDH/DHSC before it, away from general policy to discussion of specific schemes. It reviewed information on existing supplies and on private generation, and attempted to identify clusters of factories, particularly as planned in new towns, where a new CHP station might be useful. Four plans were developed and costed:⁴⁵⁰

- for the Bloom Street site in Manchester, where electricity generation had ceased in 1950 but where the Authority felt it had inherited a duty to continue supply - by then some 116TJ_H/y with a peak demand of 12MW_H; HO supply was considered better, but there was support within the BEA for installing BP plant for experience;

- for a supply to Levers at Port Sunlight from the Bromborough

station, considered 'very advantageous';

- for a new CHP station at Spondon, to supply British Celanese with process heat;
- for a group scheme for 20 industrial consumers at Warrington based on new BP plant at an existing station; the load would include some residential space heating.

By late 1953, with continued pressure on the MFP through parliament and with the final emergence of the DSIR report,⁴⁵¹ the BEA was being pressed through the Working Party to clarify its policy on CHP and embark on such schemes.⁴⁵² The four at the centre of discussion would involve the BEA in additional expenditure of over £7m beyond the equivalent condensing capacity. They would save some 180 000t coal per year but provide a total of 57MW_e capacity of which the BEA could treat little as firm. Citrine pushed the decision back to the Minister, asking for high level policy discussions and posing specific questions: should the Authority 'in the national interest' pursue CHP to save coal even though it involved high capital expenditure? to what extent should the Authority proceed if schemes were uneconomic for it? and given the statutory ceiling on BEA capital, would additional allocations be made, for these schemes or for others assessed as economic in the future?⁴⁵³ Given economic constraints, and knowing the Ministry's position - that it had no clear fuel and power policy to refer to and had avoided formulating such, and would continue to do so under the new government; that specifically on DH it had failed to spell out a policy but had muddled through ad hoc; and that it increasingly deferred to the Authority on all electricity matters, or at least that they were channelled through the by now very defensive Electricity Division - the Authority expected and wished for little definite response so that it could pursue its approach.⁴⁵⁴

The BEA was effectively asking for guidance on the 'relative importance of conservation of coal and conservation of capital'; as Ministry officials observed, this was not a question it could decide, and it was unlikely the Treasury would find extra capital.⁴⁵⁵ It was acknowledged that coal was undervalued but the question of its real value to the economy was unresolved. Having put the question in these terms, Citrine

then provided a final argument: if it was worth spending over £7m on coal conservation then there were easier ways of achieving that goal than CHP projects.⁴⁵⁶

MFP officials found Citrine's stark questions difficult to handle and left the Minister with briefing answers that avoided rather than confronted the problems of capital allocation and failed to clarify the question of clashes of interest.⁴⁵⁷ At the meeting in April 1954,⁴⁵⁸ the Ministry declined to give 'general guidance', limiting its role to advice on particular schemes. It suggested the Working Party could take up discussion on the whole problem. Citrine obtained the result sought: in the absence of guidance the BEA would continue to assess individual schemes as before and ignore the resolution of national problems in favour of its own commercial operation.

As the Authority and Boards are trading in a highly competitive market, it would ... be inappropriate for the Minister to exert pressure on the Authority to carry out at their own cost schemes of this nature, which however worthwhile they may be to the economy as a whole, may, nevertheless, be unremunerative to the ESI. Any substantial expenditure on such unremunerative schemes would add to the cost of production of electricity and so tend to weaken the power of the ESI to compete with alternative forms of fuel.⁴⁵⁹

With this demonstration of its lack of control over the industry, the Ministry largely withdrew from high level intervention on the subject; it pronounced itself satisfied to rely on the Authority's judgement about individual schemes.⁴⁶⁰ Attempts to prod the Authority, such as a campaign by MP Gerald Nabarro in 1954,⁴⁶¹ met with a clear expression that the Authority was a commercial body which should be left to run its own business. The details of schemes which Nabarro sought through parliamentary questions were to Citrine confidential information which 'no organisation operating on commercial lines should be expected ... to furnish ... to anyone.' The Working Party on the Joint Generation of Power and Heat was disbanded in 1955.⁴⁶²

DSIR Report

The DSIR Report on DH was complete by late 1947. The BRB reported in 1949 that it had 'gone forward for printing', and in 1950 promised its publication within a year.⁴⁶³ It was not until 1953 that it actually appeared.

The report was an impressive document of 434 pages in two volumes.⁴⁶⁴ The first had five parts: General Report; Survey of District Heating Practice Abroad; Donkin and Margolis's Memorandum on Duddeston and Nechells; the MoH/MFP Memorandum on District Heating as Applied to Small Housing Estates; and a paper on relevant aspects of heat pumps. The 242 pages of the second volume were devoted to the Basic Scheme.

The General Report outlined existing information on British and foreign schemes, the technical arguments, the specific considerations applying to Britain, the features of the studies undertaken, and the general economic considerations. Its conclusions were cautious but favourable. DH as a 'public service' was 'in line with modern ideas of urban development ...'⁴⁶⁵ Its practicability 'under British conditions, and the economics and advantages which may accrue from its adoption, cannot be doubted.'⁴⁶⁶ While conversion of condensing stations to CHP operation was considered impracticable in general - Pearce's original assertion thus remained - and could not be contemplated in a time of capacity shortage, new CHP stations could and should be fitted in to future programmes of the electricity industry, so that eventually such stations could provide a large part of electrical capacity.

The exhortations in Egerton's preface to start some HO and CHP schemes to gain experience seem tardy given the demise of most of the major proposals by that time. In particular the Coventry and Duddeston/Nechells proposals included in the report as model schemes had been abandoned long before it came out. The main conclusion was that the national case for DH rested on potential fuel savings by using CHP sources.

The large scale development of district heating in this country thus seems likely to be bound up with the development of electricity generation consideration of district heating in

relation to the future expansion of the electricity generating industry is a matter of the utmost urgency.⁴⁶⁷

Thus like the ICDH/DHSC review of the problems of the first few DH schemes, it focussed attention back on the ESI.

Egerton insisted that the delay in publication had 'not unduly hampered the consideration of schemes of district heating in this country'⁴⁶⁸ since the information in the Report had been available to the Ministries concerned. It seems probable, however, that with its detailed technical work and generally encouraging text, that it would have had a significant effect on the fortunes of DH in the period had it appeared some years earlier. It would certainly have influenced a debate carried on largely in qualitative and general terms and given backing to advocates; it might have saved valuable time in the preparation of specific schemes and, as a substitute for a positive policy statement from the government, encouraged local authorities to press on; and it might well have influenced the Government to give more positive direction and perhaps financial help.

By the time the Report appeared, as Egerton observed, 'the whole future of district heating in this country is being jeopardised by the economic troubles that have befallen some of these small scale experiments.'⁴⁶⁹ As one journal editorial noted poignantly, the report contained 'a number of lessons which, had they been applied, would undoubtedly have saved some of the disrepute under which district heating now lies in this country.'⁴⁷⁰

As it was, the eventual appearance of the report had little impact on policy or action. Most commentators noted its thoroughness and lateness. While still 'a valuable source book for data and general information,' it was 'probably too late to be of any great value in practical application.'⁴⁷¹ Manzoni expressed bewilderment at the report's publication, having thought it 'safely buried'; the report effectively presented the Duddeston and Nechells scheme, abandoned five years previously, as a model for local authorities to take. He considered that district heating had 'died as a financially practical idea shortly after the Committee last met ...'⁴⁷²

6.9 LEGACY OF POSTWAR PLANS

District Heating

Thus few DH schemes emerged from the many proposals of the 40s and early 50s. Several which did had been reduced in size from that planned. Several had technical problems. The lack of consumer control, and the limited heating days and seasons, were widely criticised. A survey of Dagenham, Salisbury, Swindon, Urmston and Pimlico in late 1952 showed high charges: total energy costs per dwelling were 40-70% greater than elsewhere, though it was not clear to what extent higher levels of heating accounted for this.⁴⁷³ The Urmston scheme, one of the first started, was dismantled in the early 60s after heavy pipeline corrosion and the houses fitted with gas central heating.⁴⁷⁴ Despite continued advocacy from engineers in the technical press,⁴⁷⁵ few schemes were contemplated in the late 50s and early 60s and fewer still installed. Exceptions were Sheffield's Hyde Park and Park Hill developments and several small oil-fired schemes in Southwark.⁴⁷⁶

The fortunes of the gas and coal industries which had resisted the introduction of DH were thus little affected by it. Coal retained most of the domestic market for some years, with most new local authority housing still fitted with open fires (App. 9). Competition came first from electric heating; it was several years before domestic gas sales increased significantly (App. 10). Both benefitted from concern over air pollution in the 50s and from continued dissatisfaction with standards of domestic heating.⁴⁷⁷

Ministry of Works: Government and Military Complexes

Ironically as the Ministries of Health and Fuel and Power were retreating from DH for housing schemes and city centres in the early 50s, the Ministry of Works, later of Public Buildings and Works, was starting installing group heating schemes in government buildings and complexes and in military bases. Its programme continued throughout the period when activity on domestic DH was negligible.⁴⁷⁸

The first stage of a scheme in Whitehall, with a load of 11MW_h , was completed in 1952; it eventually expanded to several times that size.⁴⁷⁹ A 35MW_h system covering Imperial College and the museums in South Kensington followed in 1958.⁴⁸⁰ Over 50 military establishments had group heating installed between 1950 and 1975, adding to several dozen earlier schemes.⁴⁸¹ AWRE Aldermaston was supplied from 1951 with steam from from two BP sets totalling 8MW_e .⁴⁸² The largest publicly acknowledged one was built at Aldershot in the late 60s and early 70s, initially with 8.5MW_e diesel CHP plant and HOBs providing capacity of some 9MW_h , and later expanded.⁴⁸³

The ESI

Of the industrial schemes planned by the ESI in the early 50s, two proceeded.⁴⁸⁴ At Bloom Street, Manchester, oil HOBs were installed in the mid-50s to continue the the supply begun before WW1, and with a view to expansion by up to 80%.⁴⁸⁵ At Spondon, a 30MW_e CHP station was commissioned by the CEGB in 1960 to supply steam to British Celanese.⁴⁸⁶ Another industrial scheme, using a combination of converted and new plant at Hammersmith power station, was examined in the late 50s but shelved.⁴⁸⁷ The CEGB continued to supply an assortment of industrial users with live steam from some 20 suitably located power stations, totalling $7000\text{TJ}_h/\text{y}$ at its peak.⁴⁸⁸

The Pimlico CHP/DH scheme - best 'regarded as the seizing of a convenient opportunity rather than as a typical development'⁴⁸⁹ - was complete by the early 60s. Technical expositions on it were frequent and the undertaking had visitors from Britain and overseas. But the Central Electricity Authority and Westminster City Council continued to resist pressure to publish the findings of their Joint Working Party, or otherwise discuss its merits in public.⁴⁹⁰ The problems the scheme posed for the CEGB, which were strongly to condition its attitude thereafter, are taken up in 7.2.

While the industry by the mid-50s had successfully avoided having any general commitment to CHP/DH forced upon it, staff continued to have scope and to take initiative in investigating specific schemes. In 1957, a reduction in the price of fuel oil for the Bankside station

prompted CEA officers to raise once again the possibility of a CHP/DH scheme for the City of London.⁴⁹¹ The third set at Bankside scheduled for 1965 would be 120MW_e, capable if modified to CHP operation of supplying some 600MW_h and 4800TJ_h/y, by that time about two-thirds of the City's estimated heat needs.⁴⁹²

The proposal put to Authority members was optimistic. A core DH network was envisaged in the redevelopment area around and to the north of St. Paul's. The scheme was 'the most attractive large scale district heating development that (could) ... be envisaged in this country',⁴⁹³ favoured by a high heat load density, high required standards of heating, the possibility of using existing plant for the heat source, and the stringency of smokeless zone regulations which would otherwise involve consumers in considerable expense. The main technical difficulties anticipated were siting five 54m high accumulators and laying mains in congested streets.

Costs were calculated on the basis of the anticipated operating regime of the new Bankside set, and a four-stage development from 1962 to 1971. Delivered heat costs compared favourably with central heating costs,⁴⁹⁴ and there would be an eventual fuel saving of some 160 000tce/y. The BEA again considered three roles: giving bulk supply at Bankside or at a distribution centre in the City, or running the whole scheme itself. The last option had the disadvantages of requiring the Authority to provide all the capital - and the expected return of about 7% was considered low for optional investment; to obtain powers to break up streets; and to take on a completely new responsibility. It had the advantages of allowing the Authority to perform a thorough technical and economic assessment, given the problems it was having with evaluating Pimlico, and to try out heat meters as an alternative to the flat rate charging the City would adopt. In the end the Authority chose the second role; the first would have been unacceptable to the City.⁴⁹⁵

Once again an approach was made at high level to the City Corporation. It was made clear that the CEA would only provide the capital for the generation part of the scheme - £1.9m out of over £12m. The City claimed this showed 'little faith' in the scheme.⁴⁹⁶ The possibility of seeking extra capital from the Ministry of Power was raised,

but the Ministry was seen to have held back from involvement and was unlikely to provide it. The matter was referred to the Policy Committee of the City, which finally rejected the scheme in June 1958.⁴⁹⁷ In July the CEGB put its viewpoint forcefully to the Ministry: it had done its best to provide opportunities for CHP/DH and could not now reasonably be blamed for its lack of development.⁴⁹⁸ It was to be the last high level involvement of the Board in potential new schemes until the early 70s. The industry had already dropped the notion that CHP would play any significant role,⁴⁹⁹ and the general assumption became entrenched in the industry

that even had there been a case for this kind of thing in the past, the changing circumstances are such that we seem to be moving away from, rather than towards, conditions which would make district heating advantageous in this country.⁵⁰⁰

CHAPTER 7 CHP AND DH III: 1960S AND 70S

7.1 REVIVAL OF DH

Actors and Context

In the mid-60s there was a revival of interest in district and smaller group heating. Activity this time resulted from the specific needs and circumstances of councils as housing authorities and of fuel interests. On a relatively modest scale and not dependent on any major central initiative or coordination, it nonetheless led to a substantial if patchy introduction of schemes up to the early 80s. The ESI remained essentially untouched by this resurgence till the early 70s. Even then much of its activity on CHP was stimulated by factors internal to the industry, and at the end of the period covered in this chapter it still had little involvement or material results. For these reasons the two currents of activity are dealt with in separate sections.

The revival accompanied a new wave of housing developments, often system-built and high-rise blocks, as well as planning for a further batch of new towns and expansions of existing towns to accommodate overspill.¹ For local authorities and architects, DH appealed as part of rationally designed services for these new developments, eliminating problems of handling and flues which individual solid fuel heating would have entailed.² It could provide the higher heating standards of the Parker-Morris recommendations of 1961, which though not initially mandatory were adopted by many authorities.³ It was suited to a greater emphasis on combatting air pollution.⁴ And it promised cheaper heat than, for example, the electric underfloor heating systems installed by some authorities.⁵ There was interest among local authorities, too, in refuse incineration, as a solution to pressing disposal problems.

Much of the impetus for DH, then, came from a changing pattern in the competitively structured domestic market (App. 13), so that the roles of the fuel industries were markedly different. Much of the action to be followed took place locally, around particular schemes or proposals, with points of contact determined by detailed divisions of responsibility or

conflicts of contingent interest, and through a commercial nexus and within the existing organisational framework, rather than through political arenas and amid institutional upheaval.

Insofar as central government was involved, the same departments, or rather their nominal successors, showed a remarkably similar pattern of initiative and response. The Ministry of Public Buildings and Works took a technical lead. The Ministry of Housing and Local Government responded to local authority activity. The Ministry of Power expressed support, but made little practical intervention.

The growth of DH, however, had little to do with the character or central concerns of government energy policies in the 60s.⁶ There was little concern for energy efficiency and conservation or socially defined objectives. Emphasis was exclusively on the supply side - on ensuring continued 'ample, efficient and cheap'⁷ supplies of fuel for economic growth. The shift was a reaction to early postwar constraints, when conservation was firmly associated with shortage. The optimism accorded with general economic prosperity and political stability. Energy policy was firmly subordinate to the expansion of production and the general health of the economy: '... the fuel sector should make its full contribution to the strengthening of the economy and the balance of payments.' Specifically '(a)adequate and continuous supplies of fuels of suitable quality should be available to sustain the desired rate of growth in the economy' and fuel prices were to be 'such as to enable them to play their part in making the United Kingdom economy as a whole competitive ...'⁸ The main problems would come from adjustment to an era of cheap energy without social dislocation - in particular from the reduced role of the coal industry. Demand was forecast and the pattern of supply tailored to suit the results. Beyond this, consideration of use was limited to a reassertion of 'consumer freedom of choice' with the proviso that prices should 'fully reflect all the relevant costs'.⁹

The chief concern of government intervention was to design the mix of primary energy supply and 'to exploit the new opportunities' of cheap oil, natural gas and nuclear power 'to the greatest benefit of the country'.¹⁰ The Labour government's approach to setting the balance between the fuels, embodied in the 1967 White Paper, fitted a technocratic

ideology and the general ascendancy of indicative economic planning of production at macroeconomic and sector levels, exemplified by the National Plan of 1965.¹¹ The reappraisal of fuel policy was indeed instigated by the Department of Economic Affairs alongside other attempts at sectoral reviews.¹²

The objectives of the late 60s were, as observed in 4.2, the rapid introduction of cheap natural gas, the expansion of nuclear power, and a smoothed reduction in coal use. The balance would continue to be provided by imported oil; the government 'judged it right to plan on the expectation that we shall continue to get regular supplies of oil at competitive prices.'¹³ This was the period of greatest government intervention in the conduct of the sector since nationalisation, and the 1967 White Paper represented the nearest to a comprehensive energy policy which any government had produced. The key features of that policy and intervention, however, were their limitation to supply issues, their maintenance of the competitive framework of the nationalised industries, and indeed the strengthening of the industries' independence and commercial terms of operation, described in 4.4. The incoming Conservative government in 1970 tried to distance itself in public statements from the previous administration's conception of a rationally designed fuel policy and its implied intervention.¹⁴ The different rhetorical emphasis belied the essential continuity of approach up to the major upheavals of 1973.

It is from this competitive framework, then, that much of the detail of interaction between the fuel industries over the domestic market is derived, in which it will be seen DH was caught up. Competitive advertising, discriminatory tariffs and connection charges, or threats of such, as Cook and Surrey observe, verged on the absurd, proved difficult to arbitrate, and produced irrational results.¹⁵ In addition, the terms on which energy projects, especially marginal ones, were assessed, depended on the detailed financial conditions for the industries' operation, relying increasingly heavily on economic theory and at the same time used by government as an instrument for tuning the economy in ways which conflicted with that theoretical basis.

Fuel Interests and Heat Companies

In large part the revival of DH was stimulated by the National Coal Board; by 1970, representatives of solid fuel interests were claiming the industry 'to have been the prime mover in the growth of DH in Britain'.¹⁶ Worried by its loss of the domestic market to the gas and electricity industries, the NCB saw in DH an opportunity to capture a significant section of it and maintain it through long-term contracts. NCB involvement was the outcome of two developments. First, it rekindled discussion on the topic. Following a conference on domestic heating which it organised in March 1962, Chair Alfred Robens set up, in consultation with RIBA, IHVE, BRB and CUC, a Design and Heating Study Group of architects and engineers. It started looking at group and district heating in 1963.¹⁷ Second, the NCB had started developing heat services for major coal consumers, and DH was to form the large scale end of that activity.¹⁸

The first product of NCB involvement was the 14MW_h scheme for Billingham town centre, first suggested to the District Council in 1962, approved by it in 1963 and completed in 1965.¹⁹ The Board operated the boiler plant and supplied heat in bulk to the Council, which operated the distribution scheme. Several more schemes followed, especially, like Billingham, in coal-producing areas.²⁰ The NUM contributed loans towards the capital costs of schemes such as the Smirthwaite development at Normanton, near Wakefield.²¹

The late 60s then saw the emergence of specialist heat companies, prepared to handle DH as well as more limited operations like heat management in individual firms.²² The NCB started offering a service to small solid-fuel consumers in certain areas in 1963.²³ The motivation was similar to that behind its involvement in DH: to compete with other fuels. In this case, it sought to relieve consumers of the inconvenience associated with handling solid fuel and ash. Similar schemes were set up by private companies. The services gradually expanded to larger scale operations. In 1966 the NCB formed Associated Heat Services, in partnership with foreign concerns with wider experience in heating,²⁴ and devolved to it all district and group heating and heat service operations. By that time, 26 schemes

in conjunction with local authorities were in operation, under construction, or planned.²⁵

The oil companies followed suit in late 1965 and early 1966, starting to install and run DH schemes based on cheap bulk contracts, and to offer wider heat management services. They likewise perceived a significant market, an opportunity to compete with gas and electricity in the domestic sphere, and to compete with coal in this activity. Installing a large number of small systems, the oil companies appear to have caught up with the coal industry in DH by 1970.²⁶

A spate of heat companies followed from 1966.²⁷ The market was highly competitive. Companies offered capital for installations; long-term contracts, between 5 and 30 years; operation and maintenance; and design and consultancy services for plant and, in the case of DH, distribution networks. They perceived economies of scale and developed technical and organisational techniques to take advantage of them. Much of the work was initially subcontracted - design to engineering consultancies, consumer installations to smaller heating and ventilation companies - but these functions were increasingly absorbed. Metering remained subcontracted, with Clorius dominating this function.²⁸

Though DH remained only a small part of the activities of heat companies or heat service branches of the fuel industries, a new pattern was set: whereas local authorities had assumed in early postwar plans that they would run schemes and contract out only limited parts of the design and installation work, the spate of DH schemes in the 60s and 70s was encouraged by the offer of a complete service, relieving authorities of operation and the perceived risks. As Municipal Journal put it, 'a tempting prospect is being dangled before local authorities ...'²⁹ The MHLG guidelines in 1967 warned that authorities should seek independent advice,³⁰ and by the early 70s, the control of many of their heating schemes by fuel interests was attracting criticism from supporters of the technique. It was alleged that the advice the authorities obtained was tied to one fuel and the benefits of the schemes were not being passed on to the authorities.³¹

Technical Developments

The revival of DH was thus largely produced by the organisational structure of the energy sector and changes in it, and their effects on the economics of fuels. There were, however, a number of technical developments introduced during this period which were stressed by DH advocates as overcoming some of the key problems of earlier schemes. Prefabricated pipe-in-pipe mains with much lower heat losses and greater reliability gradually replaced ducted mains with loose-fill insulation methods, though not before several authorities as late as the mid-70s used and found fault with the older methods.³² The losses attributed to hypothetical schemes have always been controversial, with estimates usually aligned to protagonists' or critics' disposition to DH. Little reliable information on actual losses was available till the mid-70s. Improved control systems were the second major feature, including complete remote control in some oil-fired schemes, and flow control to maximise heat extraction in the network.³³ One major drawback remained till the mid-80s, however: the lack of an accurate, reliable and cheap heat meter, and hence the widespread use of flat-rate charging.³⁴ Probably less than 10% of UK dwellings on GH/DH were metered, and the predominant evaporative meters and apportioning technique were notoriously inaccurate. Opinion and evidence varied as to whether and by how much consumption was greater in flat rate schemes because of the absence of incentive to economise.³⁵ It is likely that the limited market and uncertainty over possible expansion acted as a disincentive to private and government research and development on metering.

Refuse Incineration

The mid-60s also saw renewed interest among local authorities in refuse incineration, as a solution to disposal problems such as transport costs and shortage of landfill sites.³⁶ The use of incineration expanded, with large plant often shared between several authorities. But though its costs could legitimately be subsidised from the disposal budget and the heat produced thus be considered cheap, its use for DH remained exceptional and was seen as a side issue.³⁷ Clennell and Lowe list 46 plants containing 77 furnaces built between 1966 and 1975.³⁸ Only three,

at Sheffield, Mansfield and Nottingham, provided heat for DH networks; two, Nottingham and Edmonton, generated and exported electricity; and three others included heat recovery for other purposes. The report of a government Working Party on Refuse Disposal in 1971³⁹ was ambivalent about incineration and more so about DH based on it. It considered that 'on a national basis heat utilisation is not of importance'; it did not consider a uniform policy on heat recovery advisable, but advocated assessing each case on merit with disposal considerations uppermost. DH should be considered where there was a suitable nearby development, but 'possible difficulties in timing the consideration of two otherwise unrelated projects, each subject to political and financial pressures, should not be underestimated.'

One of the major existing refuse-based DH schemes serves the Byker redevelopment in Newcastle.⁴⁰ Though it is now regarded and rationalised as an important pilot project in rational and environmentally acceptable practice in energy use, resource reclamation and refuse disposal, its actual interrupted and hampered development illustrates the misgivings of the Sumner Committee and indicates why other authorities probably avoided such ventures. A joint committee of Tyneside and Wearside local authorities decided in 1967 on six incinerators to serve the region. After a report by NIFES in 1969, it was decided to replace the two intended for Newcastle by a single plant to serve a DH scheme for Byker. Tyne and Wear County Council took over responsibility for refuse in 1974 and suspended plans for the fifth incinerator to maximise use of the first four, leaving Newcastle to supply a part-finished DH scheme at Byker from increasingly expensive oil HOBs. The City decided to complete the scheme with coal-firing, and in 1975 the County opted for a government subsidised trial refuse reclamation plant on the site, producing refuse-derived fuel. From 1980 the 27MW_h scheme burned coal and RDF pellets in a standard solid fuel boiler.

Nottingham

The largest existing DH scheme in the UK, in Nottingham, was designed to incorporate both refuse incineration and coal-fired CHP.⁴¹ In organisational terms it formed a prototype joint public sector venture. Three motives were behind the City Council's exploration of DH in the

mid-60s: an acute refuse disposal problem; plans for extensive redevelopment schemes in the inner city; and support for attempts by the NCB to find large-scale outlets for locally produced coal. The original feasibility study by AHS in 1968 identified a potential 130MW_h and $1100\text{TJ}_h/\text{y}$ load, of some 6000 new local authority dwellings and public and commercial buildings.⁴²

The scheme proceeded, with early load supplied from temporary oil HOBs. The two final heat stations, commissioned in mid-1973, consisted of a new 32MW_h refuse incinerator, and 43MW_h of coal-fired boilers with two small BP turbines nominally totalling 3MW_e , these last being part of an industrial CHP station bought from the Boots company in 1969. The electricity output of the turbines was initially consumed within the scheme.

In terms of organisation the scheme was affected by the involvement of different interests. It was launched as a joint venture by the City and AHS; AHS withdrew in 1970 and the NCB replaced it; and in 1974 Nottinghamshire County Council joined as the new refuse disposal authority under the local government changes.⁴³ The County, able to use lower cost tipping in places, was less committed to expanding incineration capacity. With three parties, decision-making became 'lengthy in the extreme'.⁴⁴

By completion, the estimated connected load had reached about half that envisaged, with 4300 dwellings accounting for some 60%.⁴⁵ The shortfall was attributed to a number of reasons: a decreased housing density from the planning stage; the shelving of part of a polytechnic and a high-rise housing development; delays in extending the system to an industrial area; and finally the limited quantity of refuse available after 1974, leading to the abandonment of a proposed extension. These setbacks were partly compensated by additional housing and industrial loads and by sale of surplus electricity to the Area Board after refurbishment of the BP sets.⁴⁶

Some of the planning estimates were later seen as 'optimistic',⁴⁷ and the early economics of the scheme was adversely affected by the sharp rise in interest charges in the early 70s; by increased rates; by the rising price of coal and greater reliance on it than intended during early problems with the incinerators; by underutilisation of mains sized for a

larger heat load; and by high repair costs for leaking mains. The problems could in large part be attributed to a lack of shared experience and information in the UK.⁴⁸ Total capital costs reached £5m.⁴⁹

By 1981, the incinerators were supplying nearly 90% of the heat sold,⁵⁰ and with the costs of this largely met from the local authority refuse disposal budget, the figures improved. So with 'teething troubles' over, the City's consultants deemed both the technical performance and economic results 'very encouraging'.⁵¹ The NCB, however, remained more critical and was pressing in the early 80s for restructuring and expansion using more coal.⁵²

Gas Industry

Aside from the economic advantage in most conditions of gas CH, with the influx of cheap natural gas at the same time as DH was expanding, the commercial and political behaviour of the gas industry towards DH throughout this period was controversial, and remains so. DH schemes of a wide range of sizes were supplied with natural gas, from Bretton and Thamesmead, both over 50MW_h, down to numerous small GH schemes put in GLC housing developments in the late 60s and early 70s. Gas-fired DH accounted for about 450MW_h, some 35% of the total and over twice that of coal, and a further 40MW_h used dual oil/gas firing.⁵³ The industry devoted considerable research and design effort to representative and specific schemes.⁵⁴

Yet it was widely criticised, when prices increased in the mid-70s, for not offering discounted prices for bulk supplies.⁵⁵ In places it was accused of refusing to offer to supply to planned CHP or DH schemes, as at Telford;⁵⁶ of threatening high connection fees for gas to new developments where the space heating load would be taken by DH;⁵⁷ of offering low charges for installing gas mains and CH in new developments;⁵⁸ and of abusing its greater statutory discretion over prices - 'it establishes different prices for different reasons for different markets'⁵⁹ - and charging DH schemes at a higher rate than individual domestic consumers.⁶⁰ Its behaviour was widely interpreted as intended to favour gas CH.⁶¹ True to earlier form, it had indeed criticised DH from the mid-60s, this time round as inferior to gas CH because of its

inflexibility and lack of consumer control.⁶² The BGC claimed, however, not to discriminate against DH, pointing to its growing share of this market.⁶³ Reviewing the evidence on its conduct, the Select Committee on Energy concluded in 1983 that the BGC had both penalised DH compared to individual heating and had overcharged schemes using gas-fired generators by basing prices on that of the alternative oil fuel. Both practices were considered 'iniquitous and not in the national interest'.⁶⁴

MPBW: Research and New Town Plans

Besides the local authorities and fuel interests, initiative also came from the MPBW, with its experience of dozens of block and group heating installations in military and government establishments particularly during the early 60s.⁶⁵ In March 1964 it set up a Working Party of representatives of the Ministries and energy industries to look in particular at the application of DH to the third generation of new towns.⁶⁶ The Ministry conducted its own research, including a study of long distance heat transmission and a study tour of Soviet schemes, and commissioned work through the Building Research Establishment.⁶⁷ Its review of 55 existing schemes found that consumers and local authorities were generally at least not dissatisfied; it concluded that 'district heating is reliable and economically viable and will provide an enhanced standard of heating and hot water supply at a cost equal or less than any other alternative method.'⁶⁸

Much of the MPBW's work and the wider discussion on heating in the new towns focussed on plans for a town of 250 000 in north Buckinghamshire.⁶⁹ Various energy interests were asked for proposals and their character demonstrates both the importance being attached to DH and the relation of each to the revived notion. The heat load was given as 880MW_h and $7950\text{TJ}_h/\text{y}$. The MPBW itself favoured a CHP station using a 550MW_e cross-compound set - an ITOC arrangement with steam taken from the crossover between the high and low pressure cylinders - plus heat accumulators.⁷⁰ The NCB proposed either coal HO/DH or a combination of 180MW_e of BP sets and a 60MW_e condensing set. Shell-Mex and BP favoured a CHP station of five GTs. The Gas Council advocated natural gas supply for individual CH possibly with small gas generators for local electricity production. The Electricity Council advocated all-electric

provision, with storage space heating.⁷¹ The plans for a new town at Bletchley were subsequently abandoned. DH was discussed in the early 70s for its replacement, Milton Keynes, but never adopted.⁷² A second MPBW study looked at a proposed extension to Northampton for London overspill. It assessed eight methods of energy provision, including cross-compound turbines, GT and diesel CHP. It showed a substantial advantage for coal CHP.⁷³

The DHA

Secretary of the MPBW Working Party, Ernest Haseler, a senior engineer at the Ministry, was to become a key figure in the period, as instigator of the foundation in 1967 of the District Heating Association.⁷⁴ It was conceived with the general aim of promoting DH. This would include providing information and a lobby on the subject in parliament, and to the press and the public, stressing its various benefits; encouraging education and training in DH; providing for exchange of information between interested parties in Britain, and dissemination of information from abroad; and pressing for executive action by the government to promote DH. It also announced more specific objectives.⁷⁵ It sought a change in the statutes of the ESI. It pressed that DH should become the responsibility of one government department with regional organisation. And it advocated general powers for local authorities for DH undertakings.⁷⁶ The DHA set up a structure of regional branches and various levels of membership to suit the variety of bodies it hoped would join. Its early initiatives included the First International District Heating Conference in London in 1970.⁷⁷

Government Statements

The Labour Government started making favourable noises on DH from 1967. It considered it 'an extension of a rational fuel policy' and 'an adjunct to improving the environment'.⁷⁸ Reginald Freeson, a Minister at the Ministry of Power, appeared at several meetings on the subject, stressing that the MoP wanted 'more adequate evaluation of total energy and particularly district heating schemes,' explicitly so that coal was not excluded from the domestic market.⁷⁹ The MHLG, after pressure particularly from the GLC, revised their hitherto restrictive cost yardstick

and loan sanction systems, allowing extra capital for DH schemes provided their cost-in-use could be shown to be lower than alternative methods. It continued to exclude the schemes from the subsidy available to housing, however.⁸⁰

The incoming Conservative government asserted the efficacy of free market allocation of fuel use and reminded local authorities of the primacy of 'freedom of choice'.⁸¹ This could have made little difference, however, to their pragmatic decisions on specific schemes. What mattered far more were changes in financial conditions and technical guidance. The government's practical work was continued by an interdepartmental DH Panel⁸² and culminated in the circulation to authorities in 1971 of a comprehensive Department of Environment circular, District Heating: a Checklist and Commentary.⁸³

Legislation

A further 19 district authorities, including Liverpool, Leeds and Newcastle upon Tyne, and two counties, obtained powers in Local Acts for DH undertakings between 1956 and 1973 (App. 5). The GLC obtained powers for the outer London boroughs in 1969.⁸⁴ Other authorities continued to have the limited powers of the early Housing Acts as retained in that of 1957 (App. 6). The Leeds 1956 Bill did not include the hitherto standard provision for counter-notice of heat supply and the CEA decided not to petition for it.⁸⁵ Thereafter, though virtually all the Bills included powers for electricity generation, the counter-notice clauses were omitted. One authority, Southend-on-Sea, had DH powers rejected by Parliament in 1959 on the recommendation of the MHLG, as it had no plans for a specific scheme and the Ministry would require convincing of the economics of any scheme it might be asked to sanction.⁸⁶ By the time Oldham and Liverpool sought powers in 1966, the Ministry acknowledged the resurgence of DH and accepted its general viability given higher density housing, advances in technology and the adoption of the Parker-Morris heating standards.⁸⁷ A batch of six Bills in 1969 omitted the consultation and protection clauses for the ESI, which had to petition for their inclusion.⁸⁸

Pressure mounted again for general legislation to give all local

authorities DH powers. The DHA put proposals to the MHLG and MinTech in the late 60s,⁸⁹ but their 'sympathetic consideration' produced no quick results. An attempt, again inspired by the DHA, was made to get an amendment to the Local Government Bill of 1972, but it was withdrawn on a promise of general powers in a future Bill.⁹⁰ Eventually in 1975, Freeson, then Labour Minister for Housing and Construction, announced at the DHA's first conference what was to be the Local Government (Miscellaneous Powers) Bill.⁹¹ The Act of 1976 finally superseded the many Local Acts, with clauses derived from them. All local authorities, including new town development corporations, were empowered to generate heat, electricity or both, and to lay networks, subject to the approval of the Secretary of State; plans to generate electricity required consultation with the ESI; surplus electricity had to be sold to the ESI and it was obliged to buy such, on agreed terms; and separate accounts had to be kept for a DH undertaking (App. 6).

Results

The rate and extent of DH introduction in the 60s and 70s is difficult to estimate with any accuracy, mainly because contemporary accounts often optimistically mixed proposals and actual installation and subsequently little reliable data has been produced on the latter. While exceptional schemes expanded beyond original plans, like the Sandy Lane Development, Mansfield, which more than tripled its load,⁹² others were cut substantially from ambitious plans. At Oldham, for example, only a few hundred houses of the 7000 envisaged were connected. Several announced appear not to have been built at all.⁹³

The coal industry claimed a steadily increasing number of schemes installed or at an advanced planning stage from the mid-60s to the mid-70s: from 15 in 1965 to 90 by 1974.⁹⁴ By 1970 the industry was claiming that 'an additional and growing market (had) been established' and that DH provided 'a very valuable additional means of maintaining the solid fuel trade'.⁹⁵ But even the 50 schemes listed by the DHA in 1975, with capacity totalling some 320MW_n, would represent about 150 000t/y.⁹⁶ This was about 1% of the NCB's domestic sales in 1975, and only some 10% of the average annual fall in domestic sales over the previous decade and a half.⁹⁷ Oil- and later gas-fired schemes rapidly overtook coal. One

survey suggests that of 2.8MW_h total capacity now, 1.3GW_h uses oil, 1GW_h gas, 0.4GW_h solid fuel, and the remainder refuse or CHP heat.⁹⁸

The rate of installation of GH and DH schemes peaked in the mid-70s.⁹⁹ By 1981 very few schemes were being introduced.¹⁰⁰ One survey has identified over 400 non-military schemes of capacity over .3MW_h, with residential load, and estimates that 1.5-2% of the UK's 20 million dwellings are now on GH/DH.¹⁰¹ Nearly 100 000 of these are in London, with large concentrations in the Inner London Boroughs; nearly half of the 36 000 public sector dwellings in Camden are on some 200 GH/DH schemes.¹⁰² The GLC itself adopted a policy in 1970 favouring GH/DH for new housing developments.¹⁰³

Outside of government and military complexes with heating schemes run by the DoE Property Services Agency, some of the largest are in universities and hospitals.¹⁰⁴ Of DH schemes serving housing, the central Nottingham scheme, the GLC's Thamesmead, and Bretton, Peterborough, all have heat loads over 50MW_h.¹⁰⁵ In Northern Ireland, where limited supplies of only naphtha- or LPG-derived gas makes gas central heating expensive, the NIHE has 18 GH/DH schemes, four of them over 10MW_h.¹⁰⁶ Major schemes using refuse included Sheffield's early scheme for Hyde Park and Park Hill, converted from oil in 1976, Nottingham, Byker, Mansfield, and Lisson Green, Marylebone, all over 10MW_h.¹⁰⁷ As well as its central 16.4MW_h oil/refuse scheme for public and commercial buildings, Mansfield had also installed 15 coal-fired residential schemes by 1980, ranging from 25 to 1400 houses and with a total load of about 30MW_h.¹⁰⁸ But outside coal-producing areas, gas and oil predominate, especially for smaller group heating systems. In London, for example, of 198 schemes over .3MW_h listed as operated by the GLC or transferred by them to the Boroughs, 79 were oil-fired, with a combined capacity of 260MW_h; 117 used gas, totalling 230MW_h; and only two, totalling 6MW_h, used solid fuel.¹⁰⁹ Not all new DH systems were fitted in new housing developments; at Coalville, Leicestershire, for example, 1920s houses were connected to a 2.8MW_h system during refurbishment.¹¹⁰

Many of the schemes ran into problems, in terms both of technical performance and of operating costs and hence charges. Technical shortcomings have been widely attributed to limited experience and

cost-cutting, in design, maintenance and installation.¹¹¹ At the same time the government exhorted authorities to keep standards high, and made Parker-Morris heating standards mandatory in 1968, there was pressure to keep capital costs down. As one engineer observed, 'cost yardsticks dictate economy and, when ingenuity is exhausted, create bad engineering.'¹¹² Many schemes, as well as having no consumer metering, had poor consumer control. The need to demonstrate low operating costs was counterproductive as well, leading in some cases to poor heating levels.¹¹³ The oil price rises of the mid-70s, and more seriously those of 1979 (App. 12), removed the cost advantage of many schemes established on the basis of cheap bulk fuel supplies.¹¹⁴ In places this rise was compounded by a move away from high sulphur heavy oils to more costly but cleaner light oil. Gas price rises, at the end of anti-inflation price restraint in 1974, and in 1977 to reduce the PSBR to help meet the conditions of an IMF loan to the government (App. 11), were allegedly compounded by the deliberate disadvantaging of DH schemes by the industry. Thus heating charges for London consumers probably increased by three times in real terms between 1973 and 1981.¹¹⁵

There remained a remarkable dearth of systematic data on performance. Two limited BRE studies in the mid 70s showed problems both in design and performance.¹¹⁶ The first covered three schemes from the mid-60s, the second fifteen schemes from the early 70s. In both cases heat sources were grossly oversized. At Billingham, for example, demand on the 14MW_h capacity boilers never reached 8MW_h. Heat mains losses were higher than assumed, especially in networks using ducted mains with loose-fill insulation, and ranged from 10-40%. Heat output meters were often inaccurate and prone to failure. Other studies indicated GH schemes had greater energy consumption than houses heated individually to the same standard, possibly largely from the washing water supply.¹¹⁷

Unreliability, technical failings and consequent costly repairs; high charges and accumulating debt; the additional tasks and problems for housing managers in administering the only utility service not vested in another state body; the lack of consumer control and of an acceptable heat meter; all combined to engender widespread dislike of DH among consumers and authorities. They produced, as one observer commented, equally fervent opponents to match the advocates of the technique,¹¹⁸ and

became major issues among tenants groups.¹¹⁹ Several authorities adopted policies of excluding DH for their new developments, some from a previous position of no explicit policy on heating installations.¹²⁰ The GLC decided in 1976 that new DH schemes should be exceptional.¹²¹ Some authorities by the early 80s were planning to dismantle DH systems and install individual CH.¹²² Haringey, for example, allocated £3m to replace oil-fired GH fitted in eight developments in the late 60s and early 70s.¹²³ Glasgow was altering its only two extant DH schemes to block heating.¹²⁴

The resurgence of DH from the mid-60s, then, had largely declined again by the early 80s, with worsening economics, unfavourable experience and consequent reputation, increasingly stringent financial constraints on local authority capital projects, and a drastic reduction in the number of new housing developments (App. 14). The extent of introduction; the technical, economic, administrative and social problems associated with the schemes; and the attitudes thus engendered; strongly influenced the response of local authorities to the idea of city-wide CHP/DH, revived and pursued at the same time as the actual installation of DH declined.¹²⁵

7.2 THE ESI IN THE 70S

External Pressure

The ESI thus found itself having to react once again to renewed interest in DH. Although the form of DH being installed assumed HO sources, CHP was raised again, as a possibility for eventual connection rather than as part of specific plans.¹²⁶ It thus faced criticism at a general level for its lack of pursuit of the option,¹²⁷ the possibility of erosion of its domestic heating markets, and the possibility of being obliged to take up CHP. Even editorials in the electrical press - though with by no means a coherent position on the subject - urged the ESI to get involved, if only to protect its interests and to bring what it saw as some reality to the discussion.¹²⁸ It was challenged at least to argue its case for not actively pursuing CHP.¹²⁹

Much of the criticism, especially from independent consultants, was channelled through the DHA, as at discussions with industry representatives which the Association organised.¹³⁰ The Association also pressed for changes in the ESI statutes, asking for stronger clauses on CHP to be added to the ill-fated Electricity Bill of 1970. Though the Electricity Council took membership of the Association in 1970,¹³¹ individuals in the CEGB argued it was not in the interests of the Board to join, and there was a general reaction against the outspoken criticism of the industry by key members. The Board finally joined in 1974.¹³²

From the early 70s the CEGB found itself doing more assessments of proposals from outside, finding few of them worthwhile, and came under pressure to publish them. Attitudes within the industry varied, partly precisely because CHP was marginal to its main activities.¹³³ Some regarded the increased activity as an inconvenience, viewed schemes outside the industry with scepticism, and saw their role in the debate as correcting prevalent misconceptions propagated by DH advocates and taking root in government. Some saw a need to show willing to avoid criticism. A few, particularly among CEGB engineers, were genuinely interested in possibilities. But pessimism about the chances of viable schemes, and caution because of bad experience of Spondon and Battersea, were

pervasive. Its public statements on the subject in the 60s and early 70s reflected this and often prejudged its viability and appropriateness.¹³⁴ A paper by an Electricity Council representative to the IDHC in 1970 stressing the unlikelihood of connection to CHP - because of the remote siting of large stations and the poor economics of older small stations - was seen as an inappropriate damper.¹³⁵ Papers in 1972 were frank about the marginality of CHP to the industry and stressed the dubious economics of even those schemes which had been implemented and the 'very special circumstances' needed to achieve high efficiency.¹³⁶

Probably the most ambitious scheme proposed to the industry was put forward by Kennedy and Donkin in 1973, for an area of Manchester city centre around the CEEB's Stuart Street station.¹³⁷ The consultants had assessed gas HOBs to serve some 7800 dwellings plus industry within a mile radius, a heat load of 47MW_h, and requested a price for heat, possibly from GTs. The CEEB NW Region dismissed the idea, criticising the network costings and declining to consider retention of existing plant at Stuart Street, to investigate the GT option in detail since the Board only used them for peak supply, or to offer a price for heat.¹³⁸

The CEEB's general attitude, apart from reflecting the neglect of options outside the main thrusts of its development programme since the 50s, seems to have been strongly conditioned by its bad experience at Spondon and particularly at Pimlico.¹³⁹

Pimlico

By the early 60s, with twenty years of the agreement for heat supply to Pimlico between the Westminster City Council and the CEEB still to run, the problems with the heat source and charging methods were clear.¹⁴⁰ The boiler efficiency assumed by the London Power Company had been 'hopelessly unrealistic in practice'.¹⁴¹ That of 'A' boiler had declined significantly, seriously worsening the economics of heat supply from the 'H' turbines. There was no arrangement for review of the fixed element of the charge and the discrepancy which had become apparent in the first years of generation increased steadily. It had been assumed that Battersea 'A' would be on base load for most of the duration of the agreement; but out-of-merit operation was to become a further source of

loss. So that the 'H' sets could be shut down at night and for prolonged periods, arrangements were made to supply the BP sets from the 'B' boiler, which was projected to be needed for daytime running in the merit order for a further ten years.¹⁴²

By 1968 both the WCC and the CEEB privately acknowledged the burden of the costs.¹⁴³ The City Council had attempted to maintain its policy of no subsidy, but it was barely covering costs and not reducing at all its cumulated deficit. The CEEB own losses were projected to increase through the 70s. Because of the terms of the agreement, the CEEB assumed it would be unable to renegotiate the basis of charging with the WCC, and it did not consider raising the matter with the Council until 1972.¹⁴⁴ It considered suggesting informal discussions about the problem, hinting that the Board's statutory obligations might have rendered the agreement void, but it could not itself construct a reasonable case for this. It was anticipated that the matter would have to be arbitrated by central government, and individuals in the Board less favourable to DH considered this would be beneficial, finally demonstrating the poor economics which the industry had tried to argue over the years.¹⁴⁵ After hints from WCC officials that no such changes would be passed at member level, and advice from its own legal department that there was no basis for renegotiation, the Board continued to hold back.¹⁴⁶

The CEEB's losses remained steady through the early 70s, but Battersea 'A' was scheduled to close in March 1975 and 'B' would start to run out of merit soon after.¹⁴⁷ The Board considered several technical options, all expensive. Without generation, it would have had to burn lighting-up oil at 25% efficiency and 6 times the cost of out-of-merit running. Another possibility was a GT with waste heat boiler and two 'package' HOBs for standby. In 1978 the Board explored the possibility of DEu grants under the Energy Conservation Scheme, which had provision for support for private CHP replacement schemes which had failed on a 5% rate of return, but it was advised a grant was unlikely to be given for a supply industry scheme.¹⁴⁸

It was 1978 before the Board finally raised the question of early termination of the agreement with the WCC. It suggested the end should be brought forward two years, to March 1982. The WCC as expected

challenged the validity of the move.¹⁴⁹ Argument continued through 1979 until eventually a compromise was agreed to avoid litigation: the obligation would end in March 1983, though the supply would be continued until Battersea 'B' closed in October 1983. The CEGB considered the feasibility of purpose-built CHP for Pimlico but doubted its economics and in any case had no wish for any further involvement. Associated Heat Services took over responsibility for the scheme in April 1983, installing coal-fired HOBs to the west of the Battersea site.¹⁵⁰

Area Boards and Total Energy

On the recommendation of the Herbert Committee, the Area Electricity Boards were given powers to generate electricity in the 1957 Act, explicitly in part to allow for 'small scale electricity generation ... coupled with the sale of power station heat, thus securing higher thermal efficiency.'¹⁵¹ The Committee considered there was 'scope for a far more energetic approach to the possibilities of selling heat than the industry has so far shown.'¹⁵² The Area Boards, with local knowledge and contacts, would be better than the new generating body for this:

It may well be worthwhile for an Area Board to seek out the possibilities of small-scale generation combined with the sale of heat for housing estates, schools, public buildings and factories, whereas there is less likelihood of the generating authority doing so.¹⁵³

It hoped the ABs themselves might produce 'novel ideas on generation', and thought 'a little rivalry in the industry would do no harm', reducing 'the risk of complacency' on the part of the generating authority.¹⁵⁴ There was, however, little enthusiasm for CHP among ABs.¹⁵⁵ They showed little interest in generating themselves for any of the reasons suggested by the Herbert report, and there was a strong disincentive from encouraging private industrial CHP schemes, which might remove a major electricity customer in any one sub-area. This in any case would have gone against decades of attempting to get industrial electricity users to take a public supply.

The exceptions to this lack of interest were the London and Midlands Boards. Although by that time their efforts could have no significant effect on the steady centralisation of generation, they did, in the 70s, as

the Herbert Committee had hoped, provide a challenge to the CEEB's monopoly and orthodoxy.

Rather than the rebirth of DH, it was increased interest among firms with large London properties in 'total energy' - separate small CHP systems - which brought the subject of CHP to the attention of the LEB.¹⁵⁶ The Board was concerned about loss of sales, but the economics of the schemes for the firms were rarely satisfactory. Reviewing one such plan for Shell's London building, LEB staff could see that connection with the grid could solve the major problems of the installation and thereby improve the economics substantially, and operation by the Board itself could make the scheme more attractive to the consumer and allow the Board to retain control. Connection to the grid removed the problem of balancing heat and electricity loads, allowed the CHP plant to be sized according to the base heat load, obviated the 100% standby plant otherwise necessary, and gave automatic stabilisation of frequency and voltage. Returns produced on hypothetical schemes for GTs and small reciprocating engines were shown to be much higher. Moreover, operation by the Board itself would relieve the consumer of the capital investment, problems of fuel sources, the need for specialist staff, and other problems of an incidental activity - heat companies were offering these benefits for HO plant but not yet for CHP - and also of the problem of negotiating purchase and sale of electricity to balance the loads. The LEB's thinking on CHP developed to the stage of considering 30MW_e 'local' generating stations operating in parallel with its main substations.¹⁵⁷ Though the Board did not develop or take over any TE schemes or build its own CHP stations, the approach was essentially that which LEB Deputy Chair Geoffrey Shepherd took to the Midlands Board and inspired the Hereford and Fort Dunlop schemes, described later. It also encouraged the LEB to embark on a major DH project for the South Bank, which turned out disastrously and reinforced the antipathy of sections of the industry to the technique.

LEB: Bankside

In late 1969 when plans for the development of the South Bank were taking shape, the LEB began exploring the possibility of district heating with Southwark LBC and the CEEB.¹⁵⁸ The LEB wanted to keep other

energy suppliers out of the development. Their own calculations had showed that the differences in cost of heating from conventional methods were small; with no decisive advantage, a mixture would be adopted, depending on the preferences of developers and the marketing drive of each utility. Unwilling to accept this 'stalemate', the LEB thought DH would allow them to gain exclusive control, and engineers who had been considering TE schemes were keen to try an exercise in load-building.¹⁵⁹ Southwark's consultants' plans envisaged some 0.46Mm² office space, 10 000 hotel beds and 'high class' accommodation for 7000 people. The maximum electrical demand would be about 100MW_e; the heat demand was at first estimated at 70MW_h, and later revised to 100MW_h. The LEB stressed the advantages of DH in space-saving; in reduced building costs; in giving freedom from the architectural constraints of flues and boilers; as well as the other advantages identified for total energy schemes earlier.

In late 1970 the LEB started exploring technical options for a heat source at Bankside with CEGB SE Region staff.¹⁶⁰ At the time Bankside had one 120MW_e and three 60MW_e sets, and was operating a 2-shift system using its full capacity only at the two daily demand peaks. The station auxiliary boilers did not have sufficient spare capacity. Steam bled from the turbines did not appear attractive; although the heat from one of the smaller sets would have been more than sufficient all three sets would probably have had to be converted for security of supply. Heat only boilers on the Bankside site and sharing fuel and effluent facilities with the main station seemed the simplest and cheapest option, giving heat some 20% cheaper than extraction.¹⁶¹

Doubts were raised about the powers of the Board under the 1957 Act - a supply from HOBs might be construed as not 'in connection with electricity supply' - and so CEGB engineers suggested using a small quantity of live steam from the common main steam range. Initial costings showed that if spare steam was available from the boilers, heat could be supplied 30% cheaper than from the HOB arrangement, and even if the station's electrical load had to be reduced, it would still be 10% cheaper. Problems would arise if the station boilers would not otherwise have been running; out-of-merit running would make the price prohibitive. It was not clear at the time what Bankside's future operating regime would be beyond a few years; fuel prices were unstable and the CEGB was about

to change the basis of its merit order from station marginal costs to system marginal costs.¹⁶²

The arrangement finally decided in mid-1971 envisaged steam from the main range supplying 1514MW_h, some 85% of the load on an average day. HOBs totalling 87MW_h would be built abutting the station stack base and using common fuel facilities and the station flue. The size of the flue was the limiting factor but this would allow 100MW_h capacity. The arrangement thus had several degrees of flexibility to achieve a reasonable cost of heat under different conditions, using live steam from the Bankside main boilers when possible but having sufficient HOB capacity to avoid the expense of out-of-merit running.¹⁶³

The scheme was made public in September 1971, with the LEB anticipating revenue of £0.6m/y when the scheme was complete in 1980.¹⁶⁴ At the same time the LEB applied for the necessary Heating Order under the 1957 Act.¹⁶⁵ The publicity for the scheme proved embarrassing for the ESI as a whole; it revived criticism of its lack of interest in CHP in general. Publicly, then, the LEB had to stress that conditions were exceptional, and that the scheme did not in any way contradict past statements of ESI policy but was quite consistent with these: the industry was willing to embark on DH ventures when they showed good economics.¹⁶⁶ But the officials involved in the scheme still saw it as a pioneer scheme indicating opportunities for the industry; it might 'pave the way for a new outlet for electricity boards in the field of energy sales.'¹⁶⁷

Meanwhile the LEB and CEGB had to work out heat tariffs, operating arrangements and a division of responsibility. The CEGB had cooperated initially without commitment and without much enthusiasm for the project. Critics doubted the profitability of the venture, anticipating hidden costs.¹⁶⁸ The CEGB's unsatisfactory experience with heat supplies was reflected in the stringent terms it sought, charging the LEB for every conceivable expense and attempting to protect itself from any expenditure, loss or inconvenience from the operation.¹⁶⁹ Much of the agreement had to be worked out ad hoc since the CEGB had few precedents to draw on; the agreement had still not been settled in February 1973 when the first equipment was ordered. The LEB, entering into commitments with

potential customers, was anxious to settle and conceded terms much to the CEEB's advantage.¹⁷⁰

The possibility of bled steam from the turbines was revived in early 1974, with revised operating schedules giving estimates of cost appearing favourable, with HOBs to cover the total heat demand at all times and to reheat bled steam if necessary. The bled supply would be interruptible for the few hours in a year when maximum output was required from Bankside. Preliminary estimates showed lower capital costs than the live steam arrangement. The LEB was keen on the idea, as the negotiated conditions for live steam supply had been shifting the anticipated operation of the scheme so that the HOBs would be supplying most of the load instead of being just for top-up and intermittent supply.¹⁷¹

The first DH mains were laid in May 1974, at the same time as doubts about the scheme grew. The price of delivered heat had risen and the capital costs then stood at £2m, roughly half on plant and half on distribution. The distribution costs only remained acceptable because of the exceptionally high heat load density.¹⁷² The development of the South Bank area had been severely curtailed by the withdrawal of commercial development permits by the Conservative administration and little change was expected with the change of government. With two consumers already being supplied from temporary HOBs, the LEB was sufficiently discouraged to decide to suspend installation and not to enter into any further commitments. The refusal of developers to put any time scale on their work meant that continuation of the scheme would be an open-ended commitment with disastrous results on the economics of the scheme for the Board. After informing the Department of Energy, in the hope of some sort of intervention, the LEB finally abandoned the scheme in mid-1975.¹⁷³

MEB: Telford, Redditch and Hereford

The MEB actively pursued opportunities for CHP in Midlands new towns and for industrial loads. It proposed a CHP/DH scheme to Redditch Development Corporation in 1973, initially for a site with some 2800 dwellings and six schools.¹⁷⁴ The MEB would be responsible for investment and operation to a bulk supply point. The Board's proposals met opposition

from the CEEB, which regarded the costings as unrealistic and one of the suggested plant configurations in particular - seven 5MW_e diesels - as having capacity far in excess of that required for heat supply.¹⁷⁵ Though Redditch DC officials were keen on the scheme, the idea was rejected by local authority members on the grounds that it would preclude gas heating and restrict householders' choice of system.¹⁷⁶

The MEB tried again in 1974, cooperating with Telford Development Corporation in a plan for CHP/DH to cover the new town's central services and some residential areas. It sought a supply from West Midlands Gas for a 6MW_e GT and two 12MW_h HOBs. WMG refused to quote for a supply on the grounds that the MEB intended to use the GT for peak-opping at times of the gas system's own peak load. Disputes continued over WMG's reasoning, the MEB's intentions, and the contradictory accounts of the negotiations.¹⁷⁷ The MEB considered distillate oil but escalating oil prices ruled this out. For a while Telford DC kept open the option of HO/DH for later connection to CHP, but the scheme was eventually abandoned.¹⁷⁸

The only scheme to materialise from the ABs in the 70s was the MEB Hereford CHP project. It exemplified Shepherd's approach to CHP, worked out at the LEB: to concentrate on industrial loads, design the CHP source to suit the base heat load, and demonstrate the economies of connection to the grid and operation by the AB.¹⁷⁹

The Hereford station had to be tailored to the process heat needs of two factories on an industrial estate, with a maximum demand of about 40MW_h, a daily demand cycle with a base of 20MW_h, and a steam pressure dictated by existing equipment. The plant was constrained by a combination of these requirements, the electrical load limits of the local circuit, the relative prices of fuels and the value of the heat and electricity produced. This precluded a BP turbine, because of the low electrical output from the low pressure difference across it.¹⁸⁰ GTs were ruled out because a gas supply could not be obtained, by the high cost of the alternative premium fuels, and again by a low electricity output. Diesel engines, though giving a lower overall efficiency than a GT, used cheaper fuel and gave a higher electrical output. Two diesel engines with two 7.5MW_e generators and waste heat recovery could thus provide a base

heat output of 15MW_h in steam and hot water and feed electricity at a steady power to the Board's 11kV network. Four boilers fired with the same oil would provide peak supply and standby.

The Hereford project met scepticism within all parts of the industry.¹⁸¹ The economic evaluation, which envisaged a 15-20% return for the Board on a capital cost of £3.4m, was criticised as unrealistic. However, Shepherd's persistence, and lack of formal mechanisms to oppose it, meant that the scheme went ahead. It was approved by the Secretary of State in 1977.¹⁸²

Generation Economics and Interchange Arrangements

The question of prices paid by the ESI for electricity generated outside its system had figured prominently in the early postwar CHP/DH negotiations and had remained contentious in relation to private industrial CHP schemes exchanging power with the public system. It was given added publicity as outside proposals for CHP increased. With the increased sophistication of electricity system economics and in particular the use of system costs instead of individual station costs, the subject had become much more complex, with many more potential points of misunderstanding and disagreement. General and specific accusations surfaced repeatedly that the prices offered disadvantaged outside generators and had thwarted schemes.¹⁸³ During the 1969 study of refuse incineration for Newcastle, for example, the Area Board allegedly offered .1p/kWh, about 40% of the daytime BST unit charge, and the idea of incorporating CHP was dropped.¹⁸⁴ Critics also claimed that the secrecy of the basis of the tariffs and the protracted negotiations required for standby and buy-back themselves acted to deter private schemes.¹⁸⁵ The ESI continued to deny that its pricing policy had affected CHP; in none of the proposals it assessed was the price offered the main reason for failure.¹⁸⁶

The Electricity Council laid down a policy for buy-back in 1967 which held throughout the 70s.¹⁸⁷ It was reviewed in 1974 when proposals for refuse incineration raised the issue again, but was broadly reaffirmed. The ESI should seek the 'lowest possible price' for units and only in exceptional cases agree to a price above the mean of the supplier's and the CEB's marginal costs; it seemed reasonable to split the benefit - a 'windfall' from

the industry's point of view - between the parties. Capacity credits should only be made in exceptional cases, because of the difficulty in establishing corresponding savings in the CEEGB's investment.

In 1975 the policy was reviewed again as discussion of CHP revived and the ABs anticipated negotiations with outside developers or the possibility of running their own plant.¹⁸⁸ The CEEGB argued for 'a more flexible policy' because of the 'crucial effect' of buy-back terms on the economics of CHP/DH schemes; the cost of heat at which schemes could be viable was thought to lie between the extremes of zero revenue from electricity and purchase at rates equal to the BST unit and capacity charges. While the CEEGB continued to argue against a capacity credit so long as it had excess capacity itself, it proposed that the maximum unit credit be changed to 90% of the BST unit rate. The Council rejected the proposal. With no changes forthcoming from the industry, the issue remained contentious and was to be raised more forcefully a few years later.

The complexities of system economics also led to problems within the industry itself. The Redditch scheme and the MEB's unprecedented keenness to pursue its own generation alerted the CEEGB to a conflict of interest with the ABs.¹⁸⁹ By taking winter supplies from private sources or generating themselves, the ABs could avoid the peak capacity charge in the BST. Another scheme of 8MW_e then mooted by the MEB might thus have saved it £100 000 a year.¹⁹⁰ The CEEGB could not in the short term save on its capacity costs and the saving to one AB would be passed on in higher charges to the others. What was economic for one AB was thus not so for the industry as a whole. From the CEEGB's point of view, the 'correct' costing should be based on its long run marginal costs. While a few such schemes could be accommodated, the CEEGB was concerned that the ABs might exploit this loophole in a big way, with serious effects on the supply system.¹⁹¹ It regarded this at first as an anomaly in the tariff structure which implicitly ought to be corrected. It was, however, inherent in the BST as an interface between two organisations operating independent commercial assessments, and therefore only resolvable by political means. In 1975 the CEEGB thus sought a number of measures to protect itself and control the potential problem, including greater formal consultation, a division of responsibility such that schemes over about

30MW_e would be jointly evaluated and negotiated, and a limit to the total of each board's supply from smaller sources, of 10% of its peak demand from the CEGB. The moves were formally rejected, but improved informal consultation and the failure of significant exploitation to materialise made them less necessary.¹⁹²

Increased Activity

With the shock of the oil price rises of 1974 the CEGB, largely at the instigation of Chair Arthur Hawkins, increased its effort on CHP, designating a full-time investigator in a policy branch at headquarters and establishing in April 1974 through the Electricity Council joint Area Board/CEGB Region teams to look for and assess CHP opportunities.¹⁹³

The level of activity in these regional teams varied, some actively seeking possible loads, others simply assessing possibilities brought to them. The MEB, which already had similar cooperation, continued to lead the way. It investigated some 20 schemes through the 70s, and conducted design work of its own fluidised-bed coal CCGTs.¹⁹⁴ There still appeared little interest at senior levels in other Boards, and the collapse of the Bankside scheme reinforced their reluctance to pursue their own schemes. They were at best prepared to let the MEB pioneer such work.¹⁹⁵

The industry certainly claimed to be processing a large number of enquiries and evaluating several proposals for schemes, and was keen to publicise the fact.¹⁹⁶ About 100 were at least considered, and 21 DH and 10 industrial or commercial schemes were 'under serious consideration' by early 1975.¹⁹⁷ Among the possibilities assessed were:¹⁹⁸

- a supply from GTs at Bulls Bridge to existing DH networks in the Hounslow area or to Heathrow;
- a 4500-dwelling DH scheme at Uskmouth, where consultants assessed supplies from HOBs, a steel works, and conversion of sets at the CEGB's Uskmouth power station, and the CEGB considered bled steam, new BP sets and GTs;
- a scheme supplying factories in Croydon;

- an additional supply to British Celanese from Spondon based on GTs;
- GT and GT combined cycle DH schemes at Leicester;
- a 5-6MW_e/19MW_h GT scheme at Aston University, Birmingham;
- an industrial scheme around Warrington power station;
- a large scheme including industrial, commercial and domestic loads around Hawley power station on the north side of the Mersey;
- and a 65MW_h DH scheme based on conversion of a 30MW_e set in Wakefield power station.

Few of the possibilities reached the stage of detailed evaluations, and very few were published. The CEGB published two. At Peterborough it considered various alternatives for supplying two new townships: Bretton, largely built and already supplied with gas DH, with a potential heat load of 50MW_h; and Castor, to be started at the turn of the decade, with a final load of 135MW_h. The study compared HO/DH, BP sets, GTs, and ITOC conversion of the old Peterborough power station. The capital costs - on the basis of the Corporation paying for bulk transmission - and the eventual heat cost favoured HO/DH.¹⁹⁹

The second published CEGB study considered using new CHP plant at Battersea 'A', which closed in spring 1975. Consultants assessed heat loads within 5km of the station. They identified an area on the north side of the Thames, covering Pimlico, Victoria, Whitehall and most of the West End, which alone would require 800MW_h, considered the maximum Battersea could supply. The Board devised a combination of oil-fired plant to suit the load curve, with BP turbines providing base load. The capital costs for the scheme, to be built in only four years from 1981, were put at £70m, with roughly equal amounts for generation and distribution. Heat could be supplied at 190p/GJ_h at a 10% rate of return, or 240p at 15%. The report concluded that the scheme was technically feasible, but that

the heat costs could not be made attractive to potential consumers unless a low rate of return was accepted.²⁰⁰

In Scotland the SSEB published a joint study with Kennedy and Donkin in 1976 for DH in Glasgow based on its Pinkston power station, closed in March 1975. Of nine alternative combinations of fuel and plant for supplying a peak demand in 1990 of 210MW_h - oil, coal and gas, for HOBs, GTs or BP turbines - only the two using coal or heavy fuel oil HOBs gave cheaper heat than conventional methods assuming a 10% rate of return. The study was widely criticised, including within the ESI, for its negative presentation and its inadequate assumptions and methods.²⁰¹

Despite the increase in investigative activity and publicity the attitude of the industry in the mid-70s was still widely perceived to have changed little. It remained defensive - the activity was as much to deflect criticism as for its own merits²⁰² - and pessimistic about opportunities for CHP.

Experience has shown that combined power stations are only likely to be viable where the heat requirement is continuous throughout the year. Increasing fuel cost and recent indications of lower reliability of prime movers adversely affect economic viability. Unless fuel becomes such a scarce resource that conservation becomes the principle criteria it is not envisaged that combined schemes will increase in the future.²⁰³

Critics considered the industry expended most effort on devising arguments and definitive calculations to show the infeasibility of the option.²⁰⁴ Heat supply from major stations was still rejected as impracticable.²⁰⁵ The industry maintained, with support from government pronouncements, that energy saving could only be justified to the extent it was economic,²⁰⁶ avoiding the question of a disparity between costs to the industry and costs to the nation. It advocated 'rigorous economic appraisal using proper rates of interest, economic appraisals which have not been blurred by social considerations.'²⁰⁷ To burden the industry with fuel saving schemes which were not economic would penalise the electricity consumer.²⁰⁸ Moreover, there were cheaper ways of saving fuel, through, for example, insulation or extending the use of nuclear power.²⁰⁹

The CEEGB maintained that its judgement on the viability of private or joint schemes was usually shared by other parties involved,²¹⁰ and the

buy-back and standby terms it offered were not the main reason for rejection.²¹¹ The ESI's own CHP projects continued to be assessed as optional investment on a 15% rate of return and as such were subject to limits on capital, in competition with other projects, and vulnerable to cuts.²¹² The industry maintained its reluctance to become involved in heat distribution.²¹³

CHAPTER 8 CHP AND DH IV: FROM THE MID-70S

8.1 CONTEXT AND ACTORS

Introduction

The energy price rises and crisis of 1973-4 had some immediate effects on CHP and DH activity, through the economics of existing or proposed schemes, and through increased activity in the ESI to find and assess opportunities for CHP. But more significantly, through the deeper and longer-term effect of opening up debate on energy, making conservation and efficiency central concerns, and throwing into question many assumptions and practices, it raised again the idea of city-wide DH fed from CHP sources. It led to a new phase of activity which, although it overlapped by a few years with the events described in chapter 7, was significantly different in character.

Activity since 1974 divides conveniently into two periods: up to 1979, and since, corresponding to the periods of office of Labour and Conservative governments. The division is partly fortuitous in that a major assessment of the national potential of CHP/DH was completed in 1979, so that the character of the activity was different: up to 1979 it was general discussion and appraisal, and thereafter more programmatic and site specific investigation. But it also allows separate consideration - without denying elements of continuity - of the two regimes' significantly different approaches to energy policy as applied to these two phases.

Department of Energy

In January 1974 the Heath Government concentrated responsibility for energy in a new department, removing it from the DTI, partly because of the oil crisis and partly because of the miners' strikes.¹ This reorganisation acknowledged the newly perceived importance of energy issues. The Department of Energy was intended to look after energy interests and activities as a whole. Rhetorically at least it was supposed like its predecessors to work towards a coordinated energy policy; according to its official definition, it was responsible for 'the development

of national policies in relation to all forms of energy'.²

Understanding the actual role and character of the DEN as mediator between government and the sector is constrained by access to information. Comments by observers focus on resource constraints relative to the tasks it supposedly has and the investment programmes of the industries it oversees. Pearson points out that it was small by civil service standards at the outset.³ In relation to the nationalised industries, Williams sees the Department being 'left to umpire, though without the capacity to be truly even-handed.'⁴

The Electricity Division, for example, is structured according to a conventional and passive perception of the industry's mechanisms of accountability and its key problems - very much a product of the establishment through the 50s and 60s of the relationship between government and the industry. Its four branches dealt with pricing policy; investment programmes, energy policy and EEC matters; corporate planning; and pollution, amenity matters, appointments and consumer relations.⁵ With limited power and resources, in practice it is only capable of reviewing cursorily the programmes of the industry; it is considered to act largely as a communication channel, following and defending the industry's line. Unless given explicit political directions for reform, it would not be expected to produce wider critical views of the industry's structure and activities, or proposals for significant change in the established pattern of supply.

Its conservation functions have remained relatively weak. It was some time before a separate conservation section was set up at all. It was slowly and belatedly given more status and treated as a policy area rather than just a technical one, but it remained doubtful how much actual change was represented by several renamings.⁶ After an external inquiry into the government's conservation effort, the DEN set up an expanded Energy Efficiency Office in October 1983, but a recommendation that it should integrate conservation activities of all government departments was rejected, and it was subject to continued criticism for its weakness.⁷ The DEN's admitted lack of information on energy use patterns, a strong ideology of non-intervention in energy use and of conservation as largely a matter of influencing individual consumer behaviour through publicity, and

a relatively fragmented external institutional base or lobby for conservation, all reinforced this weakness. The Department has consistently avoided confronting the central question of the relative merits of investment in supply and investment in conservation, even when that conflict has been raised internally.⁸

Government Policy

Again in part because of the large scale of CHP/DH activity being discussed, and the context of radical changes being suggested and implemented in the energy sector, the character of broad government policies for the sector had a much more profound effect on CHP and DH activity than in the 60s and early 70s, when the most significant actions of central government consisted of technical support and minor improvements of legislative and financial conditions.⁹

Much of the visible activity on energy policy of the 1974-9 Labour Government, particularly under Tony Benn from June 1975, was to promote open discussion and publish a larger volume of material, in order to work towards a 'soundly based and widely accepted framework of national energy strategy'.¹⁰ A national Energy Conference in 1976 and a broadly based Energy Commission - an advisory body which met from late 1977 and contained management and union representatives from the energy industries and conservation, environment and consumer group representatives - formed part of this effort.¹¹ Attached to government there was also a number of advisory bodies either specifically on energy issues or which looked at such during the period: the Advisory Council on Energy Conservation, comprising DE officials, academics and industrialists; ENCORD, the Interdepartmental Committee on Energy Conservation R&D; the Advisory Council on Research and Development for Fuel and Power; and the Central Policy Review Staff. There was a spate of reports from these, from parliamentary groups such as the Select Committee on Science and Technology, and from groups outside the state presenting alternative views. Their general approach and within this their treatment of CHP and DH are considered in 8.2.

In 1978 the IEA could state that 'the UK has probably done more than most IEA countries to promote public participation in energy policy formulation'.¹² The climate of open discussion deliberately fostered during

the five years certainly helped to question the existing pattern of energy provision, to raise alternatives, and to produce, even from within the governmental and parliamentary sphere, recommendations for quite dramatic changes. The impact of this enlarged debate on government action and intentions in the sector was limited, however. On the supply side, the government's developing 'energy strategy proposals' contained in the Green Paper Energy Policy: A Consultative Document still assumed high demand levels, a high nuclear component and little contribution from renewables.¹³ Public statements stressed flexibility and pragmatism within its overall objectives 'in order to adapt to changing circumstances', and the need for rapid development of North Sea oil and gas resources for self-sufficiency.¹⁴ The DEN declined to specify demand and supply targets for the IEA.¹⁵ The only significant changes in direction during the five years, besides the displacement of imported oil, were an attempt to exert greater state control over its production,¹⁶ and a large investment programme in the 1974 Plan for Coal intended to maintain production levels and keep coal central to the primary energy mix.¹⁷ The other important but unsuccessful attempt at reorganisation in the sector, the Plowden inquiry into the structure of the ESI and Benn's 1978 Bill, were considered in 4.5 and their treatment of CHP is taken up again in 8.6.

On conservation the government did after much delay follow up the interim measures of 1974¹⁸ and limited legislation in 1976¹⁹ with the launch in December 1977 of a substantial 10-year programme.²⁰ It covered information, grants and subsidies in all sectors and measures in public sector building and housing; but it neglected key areas like industrial processes. It was based on voluntary measures and was characteristically aimed at individual consumers, using exhortation without substantial incentive. Moreover, it came when increasing constraints on general public spending worked against capital investment in conservation. The government rejected the major recommendations of the Select Committee on Science and Technology in 1975 for stronger action.²¹ The ACEC, while noting some progress in its five-year review in 1979, was still pressing for stronger measures and greater effort.²² In any case the programme had little time to take effect before the change of government in May 1979.

A large part of the reduction particularly in domestic consumption in

the late 70s came instead from dramatic price increases consequent on the lifting of anti-inflation price restraint and the phasing out of subsidies to the nationalised industries (Apps. 11 and 12). Increasing fuel poverty is one important element of background to the response of local authorities to energy problems in the 80s.²³

With the change of government came significant shifts in intentions towards the energy sector,²⁴ consistent with the Conservative neo-liberal approach and a commitment to restructuring in favour of capital:

- in its general attitude towards state intervention versus market mechanisms for allocation of energy uses, with a reassertion of primary reliance on market forces and supposedly minimal state intervention;
- in the framework of control of the nationalised industries, and on issues of private and public sector control;
- in constraints on public spending, especially by local authorities;
- and in a reduction in conservation programmes.

The government did 'not see its role as being to try and plan the future shape of energy production and consumption nor to try to balance UK demand and supply ... (but) primarily to provide a framework which will ensure that the market operates in the energy sector with a minimum of distortion ...' The main objective was thus 'to set the right conditions to enable the supply side of the economy to operate more competitively and efficiently.'²⁵

This doctrine of primary reliance on market forces meant initially a strengthening of surrogate market disciplines for the nationalised industries. Investment decisions were to be taken 'not with a view to balancing supply and demand of energy, but rather to obtaining an adequate return on capital.'²⁶ Prices were to be set by the market where a free market existed, and where not by long run marginal costing. In addition, Ministerial control was exerted in directing the nationalised industries' chairs towards objectives consistent with this approach.²⁷ Further, the

government set about changing the boundaries of the public and private sectors, particularly in the energy industries, by enacting liberalisation - the removal of monopoly powers and the introduction of opportunities for the private sector to compete - and privatisation - the sale of sections of industries or complete industries to the private sector.²⁸ The four stated objectives of this shift towards the private sector were:

- stimulation of competition and provision of incentives for efficiency;
- reduction of the size of the public sector;
- reduction of the public sector borrowing requirement (PSBR);
- and reduction of government 'interference' in the energy sector.²⁹

In addition it was clear that privatisation would raise funds by the sale of state assets. Liberalisation and privatisation would have different effects in reducing the scope of policy instruments available to government for influencing activities in the sector.³⁰ Paradoxically the intention of withdrawing from state involvement in the sector has required in the short term a coherent and strongly interventionist strategy.

In terms of supply options, the government strongly favours a several-fold expansion of the nuclear component, a direction reinforced by a motive of ensuring the political security of the electricity supply system.³¹ It has maintained an emphasis on North Sea oil development as much for its maintenance of the economy and the balance of payments, and its state revenue, as for independence from imported supplies. Stated intentions to regulate depletion of reserves have been abandoned; the objective is 'to maximise the return to the nation over time ...'³²

On conservation, serious doubts about its commitment surfaced rapidly, despite a reiteration of targets for reduction in demand and assurances that conservation was still central to its policy.³³ Even the traditionally polite ACEC identified 'a number of areas in which (it was) disappointed with the Government's response' to its recommendations.³⁴ The

government reduced expenditure, retreated from financial incentives and mandatory measures, and asserted the primacy of pricing backed by publicity as the main stimulus to energy saving.³⁵

Energy Industries

That CHP/DH was evaluated in terms of national potential and as part of wide-ranging debate on energy futures meant that the stance the existing energy industries took depended on and reflected their view of their long-term role and objectives. The gas industry, for example, by then dominating the domestic heating market with cheap natural gas largely supplied to individual central heating units (App. 13), faced declining supplies of natural gas and the need to develop SNG production to use existing distribution and end use structures.³⁶ The NCB entered the period with a much reduced involvement in DH, less enthusiastic in its advocacy but still generally supportive to the idea.³⁷ With the possibility of large-scale schemes, CHP would offer to the coal industry 'the opportunity to penetrate the commercial, institutional and domestic markets in major city centres in a most environmentally acceptable manner.'³⁸ In the ESI the momentum of the nuclear programme had remained effectively unchecked by the Labour government. The Conservative government endorsed its massive expansion in the 80s with plans for PWRs. The industry remained largely untouched by external criticism of its general programmes and performance and by attempts in the 70s to reorganise it. Specifically it avoided measures to impose a stronger obligation to pursue CHP, and its own efforts to find expedient opportunities for its application had produced little.

Besides the technical directions of the competing industries, the beginnings of a national programme of introduction of CHP/DH in the early 80s has also taken place in the context of reorganisation and other effects of the changes in government policy described above. As will be seen, it has been caught up with them in various ways. Indeed it is argued in the later sections of this chapter that CHP/DH has increasingly moved to a central position in energy politics in the 80s, as a testing ground for Conservative government policies in the sector as well as a focus for alternatives.

Though the account still focusses on the same key actors as before, the scale of the activity envisaged and the political development to be described draw in other private sector interests for reasons to be explored later: the power engineering industries, companies supplying DH equipment, and general engineering and construction companies.

Local Authorities

Local authorities continue to be central to the account, though the scale of activity envisaged and the motivations for involvement effectively singled out certain large metropolitan authorities. General changes affecting local government organisation, functions, and legal and financial framework, were outlined in 4.6. Important here are the organisational reforms of the 70s which gave major urban authorities a more integrated and strategic approach to policies and programmes; and the severe constraints on finance from the mid-70s, and hence in particular the decline in public sector house construction, halved between 1976 and 1979 and halved again by 1982 (App. 14). The issue of major CHP/DH development is indeed closely tied in with some of the key problems of inner cities, with the position of local government as a focus and channel of discontent, and with the strategic objectives of Labour controlled urban authorities and their role as political centres of opposition and attempts to assert alternative priorities in major areas. It is argued in 8.7 and chapter 9 that their role in CHP/DH activity in this period is in important respects significantly different from that in the two previous periods.

Despite the minimal control which local authorities could exercise over its provision, energy was still an important issue for them

- as major consumers of energy in schools, public buildings, etc.;
- as planners and coordinators of local land use development;
- as administrators of council housing;
- and because of the significance of energy production and use in the local economy, environment and transport.

Total energy costs in local government were estimated at around £1b/y in the early 80s.³⁹ A typical city would spend several million alone, of which building heating would account for 75%. Newcastle's heating bill was £2m/y.⁴⁰

Consequently the events of the mid-70s brought energy conservation back onto local authority agendas.⁴¹ The pattern of activity since then is important in two respects: in the way it affected the response of authorities to a programme of site-specific investigation of CHP/DH initiated by the DEN; and in the attempt of certain authorities to develop some control over energy provision and use in their areas.

Central stimuli were significant but often contradictory.⁴² The Select Committee on Science and Technology exhorted planners in 1974 to consider energy conservation, and the Labour Government in its response and its subsequent attempts to formulate an energy policy stressed that energy implications should not be separated from other considerations in local government decisions.⁴³ The DoE, on the other hand, had not encouraged energy initiatives and had deleted items from local authority plans which did not follow narrow land-use definitions of planning responsibilities. It was slow to change this attitude when the GLC, for example, mooted changes to the Greater London Plan of 1969 to include energy matters. The Council was forced to draft alterations to the Plan in land-use terms, and was limited to providing a context which would operate as little as possible against its developing energy policy objectives.⁴⁴ The national local government structure was important in encouraging and informing authorities, with initiatives like LAMSAC in 1978 and reports and studies by the Society of Local Authority Chief Executives, the local authority associations, professional bodies with members in authorities, and European bodies like the Standing Technological Conference of European Local Authorities.⁴⁵

As with general reforms the extent of change varied greatly between types of authority. The larger city authorities are acknowledged as being far in advance of the shire counties and smaller districts, because of the size of their commitments, their political alignment and their attempts to develop a strategic role. According to Sheldrick's survey in 1983, only a quarter of authorities had adopted energy conservation policies, and fewer

more comprehensive energy policies. About half the metropolitan districts and counties and London Boroughs had adopted conservation policies. Very few councils had policies on alleviating fuel poverty, and little connection was made between energy issues and wider social objectives. While most urban authorities set up energy conservation units and appointed officers, many saw no function beyond saving energy in their own properties, and much activity was to take advantage of central government incentives, declining sharply when these were withdrawn in 1980.⁴⁶

8.2 ORIGINS OF INITIATIVES

Energy Debate in the Mid-70s

The voluminous public and professional debate on energy issues in the mid-70s was undoubtedly wide-ranging and raised fundamental questions, even if, as has been argued, the changes it produced in the patterns of energy provision and use were limited and the problems it acknowledged effectively displaced rather than tackled. One direct outcome was a thorough assessment of the national potential of CHP/DH. It is instructive to consider how the option was treated in the various studies, and how the debate shaped a conception of its role, the terms of its evaluation and possible introduction, and its espousal by groups outside.

Treatments ranged widely, from omitting the option altogether or taking a conventional view of its very limited applicability, through to according it a central place in future energy provision. Where conservation was seen as a matter of influencing the behaviour of individual consumers, the possibility of much greater savings by changes in the pattern of energy use by major industries, including the energy industries themselves, were largely overlooked. Generally the more radical the conservation measures advocated and the general changes envisaged as necessary in the sector, the greater was the role for CHP/DH.

NEDO

Coverage in the 1974 NEDO report Energy Conservation in the UK was fragmented and generally unsupportive.⁴⁷ It mentioned continental experience and the Electricity Boards obligations under the Electricity Act, but emphasised a number of difficulties in both economic assessment of schemes and in their integration into the grid. It claimed that because of demand matching problems, 'an average thermal efficiency of 45% is more likely than the theoretical 70 to 85% that might be achieved under ideal conditions.' Separate production might give better efficiency. 'In practice, the total economic costs and benefits have to be taken into account.' With higher fuel prices it might 'turn out that the optimal future use for coal-fired power stations could involve some small schemes associated with

total energy systems. However, the major part of future electricity generation will need to be based on nuclear power stations.'

Select Committee on Science and Technology

The first report of the Select Committee on Science and Technology for 1974-5, Energy Conservation, was both comprehensive and forthright in its recommendations. It was highly critical of the limited measures taken by then. It delved deeper into the basis of policy and action.⁴⁸

Hitherto successive Governments have been broadly content to allow the fuel industries to present their own plans for meeting the estimated growth of energy demand. Where these have appeared too ambitious in relation to the Government's own estimates of energy requirements and the resources available, investment programmes have been cut accordingly. It remains true, however, that the approach to national energy planning has been "supply" orientated. Henceforth the government should consider the extent to which increases in energy demand should be met by investment in additional energy supply capacity, or avoided by investment in energy conservation measures.⁴⁹

It also recommended: 'effective central coordination over the supply and use of fuels';⁵⁰ a 'continuous assessment of energy saving options in terms of more economical resource management', especially looking at alternatives to increased supply in particular areas;⁵¹ a new interdepartmental body in charge of conservation and other changes in government advisory and decision-making organisation;⁵² the use of tariffs to promote efficiency rather than to increase consumption;⁵³ financial assistance to local authorities for energy saving measures, and removal of financial disincentives and constraints; and for the DoE to 'review urgently ... all those areas where the longer term national interest in energy saving is being threatened by short-term restrictions on finance and manpower.'⁵⁴

Despite very few of its witnesses mentioning CHP/DH,⁵⁵ the Committee identified quite effectively the key issues surrounding it, including some of the organisational and political problems.⁵⁶ On its national potential the Committee recognised problems caused by remote siting policy and load matching, but felt that 'potential energy savings are of such significance that apparent difficulties should not discourage further exploration of such schemes.' It noted that

the CEGB have usually emphasised their statutory obligation to

generate electricity as cheaply and efficiently as possible and they have not been encouraged to do otherwise by successive governments which have sanctioned the CEEB's investment proposals.

This 'ingrained attitude' and low fuel prices in the past had discouraged interest in CHP. In spite of the statutory obligation to find a use for waste heat 'little if anything has been done about it.' Even with a change in attitude 'technical problems' and 'time lags' meant that CHP could make a significant contribution only in the longer term.

Specifically it suggested that old power stations, scheduled for retirement because of their poor thermal efficiency, might be converted, 'where appropriate', for CHP/DH; recommended removing financial constraints and disincentives which affected local authority implementation of DH; and advocated an expansion of private industrial combined generation capacity, considering it perhaps 'necessary to encourage sharing arrangements between the private user and the public supply system.'

ACEC and CPRS

The Advisory Council on Energy Conservation, set up by Varley in June 1974 'to advise and assist the Secretary of State for Energy in promoting economy and efficiency in the use and consumption of energy',⁵⁷ pressed for wide-ranging conservation measures through the late 70s and was gently critical of the government's efforts. It gave CHP belated and rather brief treatment,⁵⁸ but its recommendations were nonetheless forceful. Its Industry Group recommended in 1976 that the ESI should have its duties extended and 'should take a much more positive lead' in developing industrial CHP schemes.⁵⁹ The Committee's second report in 1978 noted the DEN's own investigation of CHP/DH and considered the option 'potentially so important that the obstacles in the way of its development should be continuously kept under review.'⁶⁰ Its five-year review later expressed the hope that it would be 'vigorously pursued'.⁶¹

The Central Policy Review Staff, a body of advisers based in the Cabinet Office and reporting directly to the Prime Minister and Cabinet, produced a report on conservation for the Labour Government in 1974, brief but ranging widely over 'how energy conservation might be achieved both now and in the future.'⁶² While the bulk of the report assessed

technical measures, it also laid out briefly but thoroughly the economic and political issues and problems of conservation. Significantly, it asserted that

the price mechanism may not work sufficiently well to ensure the optimum use of fossil fuels, and Government action, by regulation, subsidies, taxes or publicity may be needed to stimulate even that degree of fuel conservation which could be shown, on the basis of cost-related prices, to be economically justified.⁶³

It assessed the forms of action open to government, and among other things recommended elimination of remaining under-pricing of coal, gas and electricity; improved building standards and incentives for insulation; and information for energy users of all types.⁶⁴

As well as undoubtedly being a strong influence on subsequent government action on conservation, the CPRS report led directly to the setting up of the Marshall Group investigation of CHP/DH. It showed a much better understanding of the issues, and of the significance of technical developments. Above all, it resisted the orthodox preconceptions about its potential and the usual list of difficulties in its economics and implementation, and instead established the view that it warranted a thorough assessment as a major option. It recommended a

comprehensive study of combined energy schemes (which provide heat and electricity simultaneously) ... as a matter of urgency. It should include assessments of the economies of such schemes, including the cost of any standby facilities required and the value of any surplus electricity generated.⁶⁵

It mentioned the 'relatively slow' development of DH in the UK, 'in part because of the mild climate and the domestic heating preferences of the population as a whole'.⁶⁶ Among the merits of DH it listed fuel saving; space-saving in dwellings; use of lower grade fuels; better dwelling environment for 'the handicapped, the old and low-income groups'. As disadvantages it mentioned possible breakdowns, disruption during installation and the absence of a satisfactory heat meter. It estimated that 4 million dwellings could be connected to HO/DH systems by 2000, saving .75Mtce per year. The 'really significant savings to be made' were with CHP. While remote siting made it difficult to use the waste heat from large power stations, smaller CHP plant should be considered. It cited a possible combined efficiency for a 50MW_e BP turbine of 84%,

compared to 61% for equivalent separate condensing plant and HOBs. Similarly it considered a 1MW_e diesel with heat recovery might achieve 68% combined efficiency. If 25% of the 4 million dwellings on DH were connected to CHP sources instead of HO, a further 2Mtce/y could be saved. It drew attention to a lack of data on both load patterns and the performance of existing systems. It also singled out the potential role of combined cycle generators, recognising the disadvantage of high fuel costs but foreseeing use in 'stations designed to operate at load factors of 15-40%', should the need for more fossil-fuel plant arise.⁶⁷

Alternative Energy Futures

The Royal Commission on Environmental Pollution Sixth Report on Nuclear Power took wide terms of reference and included consideration of the effects of various energy strategies on the environment.⁶⁸ Advantages of DH and CHP in energy savings and pollution control were outlined and the contrast pointed out between its widespread use in other countries and its absence in the UK. The Report's alternative energy strategy was one of the earliest attempts to incorporate a large contribution from CHP/DH in an energy scenario. Heat from CHP would start in 1985 and grow to about $1.4 \times 10^{18} \text{J}_h$ by 2025. It pointed out that the argument that CHP did not look economic with a 10% discount rate could equally be levelled at the fast breeder reactor 'whose economic benefits will be most apparent when uranium is very expensive.'⁶⁹

Contributions to the debate on energy futures from outside the state were also enthusiastic in their support for CHP/DH.⁷⁰ The IIED's low energy future again contained a large element.⁷¹ Both of its scenarios allowed for 20% of low temperature heat to be produced by CHP, organic wastes and coal, and 15% of high temperature heat by industrial CHP. 60% of electricity would be from coal including CHP schemes. Friends of the Earth's mix included 18% of electricity from public supply CHP and 10% from industrial CHP. The NCAT and the OUEG advocated 65% of electricity from coal, mostly as local CHP.⁷²

Waiting for Marshall

From the establishment of the Marshall Committee in late 1974, government comments on CHP/DH merely referred to the existence of the investigation and awaited its findings, so that the future of CHP increasingly came to be seen as dependent on its recommendations. The government's reply to the Report of the Select Committee merely noted the Group's study and promised to investigate 'the position on the interconnection of outside plant with the public networks' in the light of its findings.⁷⁴ The Working Document on Energy Policy which formed the basis of the Energy Commission's deliberations contained a synopsis of EP20, but it was considered premature for it to look at the topic in depth until the final report had been produced.⁷⁵ The 1978 Green Paper, based on the Working Document ... and the Energy Commission's comments on it, likewise contained one apparently enthusiastic paragraph summarising the findings of EP20 and stating that the government would be 'considering its future policy towards all forms of combined heat and power in the light of comments on the Working Party's report and the final report of the Group.'⁷⁶ It remained sceptical about a significant future for the option. On the RCEP's alternative energy future the Green Paper considered that '... there is considerable doubt that the contribution from combined heat and power can reach the level suggested by the Commission.' Its assumption of 35% of space and water heating by 2025 - 25% from CHP and 10% from waste and HO/DH - was 'a very ambitious target'.⁷⁷ As the first part of what was intended to be a continuing review by the Energy Commission, its Comments on the Green Paper on Energy Policy contained a few fragmented observations on its treatment of CHP. Several bodies becoming aware of the option by then supported detailed examination and a lead city scheme.⁷⁸ Thus while the continuing investigation excused the continued marginal consideration of CHP/DH and its omission from forecasts, discussion of organisation, and other central themes in government documents on the sector, the idea of large scale introduction was taking root more widely.

8.3 THE MARSHALL GROUP

Establishment

In late 1974, mainly in response to the recommendation of the CPRS, the Secretary of State for Energy set up a CHP Group under the DEn Chief Scientist Walter Marshall,

to consider the economic role of combined heat and power in the UK and to identify technological, institutional, planning, legal and other obstacles to the fulfilment of that role and to make recommendations.⁷⁹

Marshall and DEn officials put the Group together from representatives of those groups which they considered would inevitably be involved with implementing any programme, plus some independent experts. They deliberately avoided DH advocates or others seen as partial, to enhance the credibility of what needed to be seen as an objective appraisal.⁸⁰ DoE representation was supposed to cover the views of the local authorities as well as other DoE functions such as planning.⁸¹

Approach

The Group was struck by what was regarded as a lack of informed opinion and the emotive and unscientific nature of much of the arguments of CHP/DH, with little quantification and much prejudgement.⁸² 'Most discussions of the subject are either qualitative or simplified, and ... such discussions have had little, and sometimes negative, value.'⁸³ One working party was set up to undertake a quantitative appraisal of the economics of CHP/DH, another to study heat load densities in cities, and a third to consider industrial CHP.

The DH Working Party set out to use standard economic analysis based on discounted cash flow techniques as applied to national resources. It was 'guided by the Government's policy that all resources are valuable and should be used to best effect energy should not be saved by incurring disproportionate cost in other resources.'⁸⁴ It acknowledged the main uncertainties as in

- the future costs and availability of fuels
- the choice of an appropriate discount rate or social time preference rate
- the development of alternative technologies such as heat pumps.⁸⁵

Discussion Document

The DH study was published in early 1977 as Energy Paper 20, a 'discussion document'.⁸⁶ Three notional schemes were studied in the medium term:

- a new development or redevelopment, effectively a 'greenfield' site, for 10 000 people, with a peak heat load of 20MW_h , supplied by a local power station with HO standby boilers
- the conversion of a small city or large town of 100 000 people, with a peak load of 200MW_h , supplied from a converted central power station
- the conversion of a large city of 1m people, with a peak load of 2GW_h , supplied from large power stations.

CHP/DH and HO/DH were compared with gas CH and the existing fuel mix. Fuel costs used attempted to reflect marginal costs to the nation rather than consumer prices. Two future patterns were used: prices remaining constant in real terms; and doubling every 18 years. The study ignored heat storage and HO supply of winter peaks. The reference study assumed a 10% TDR; 45GJ_h per dwelling per year; an equivalent density of 0.48 dwellings per person to take into account commercial and institutional loads; linear growth of the network over 15 years but with a five year lag between first investment and first load. Sensitivity studies were carried out for discount rate, heat load per dwelling, build up period, time lag between investment and load, and fuel price differentials. A number of other 'largely unknowable' parameters were identified to which the analysis would be sensitive:

- standards of heating and insulation;
- siting policy for nuclear and fossil-fuel power stations;
- and changes in population distribution affecting city centres

In the longer term - beyond 2000 - CHP and HO/DH were compared with several alternatives: SNG, electric heating from new plant or with off-peak storage from existing plant, electric and SNG heat pumps. Electricity was compared from coal and nuclear plant. Again 5, 10 and 15% TDRs were taken.

The central conclusion of EP20 was that while CHP schemes 'would undoubtedly save energy,'

(with) present fuel prices and availability, and with a ten per cent discount rate, there is no economic incentive to pursue such schemes in the United Kingdom except in particular circumstances.⁸⁷

However, rising fuel costs in real terms or a lower discount rate would make the case for CHP 'much more attractive'. In the longer term as gas and oil became depleted, 'the situation is expected to move more in favour of combined heat and power.'⁸⁸ An early start was needed for CHP to play an important role by the turn of the century, but the absence of immediate need meant 'a grave danger that decisions ... will be postponed until it is too late.'⁸⁹ CHP/DH was 'a capital investment made in the near future to obtain a return in terms of fuel saving in the longer term.'⁹⁰

EP20 reviewed organisational forms in other countries but largely avoided consideration of them for the UK. It merely acknowledged that 'significant problems would have to be faced in arranging for a suitable organisation to be set up to handle the development.' However, '(w)ithout strong Government initiatives CHP will not develop to any significant extent in the UK.'⁹¹

Response to EP20

EP20 was circulated to a wide range of groups for comment. Marshall suggested a range of issues for discussion, including assumptions and methodology in the studies, organisation, technical questions, implementation and public acceptance.⁹² 25 organisations or individuals submitted formal contributions and extensive discussion took place at conferences, in the technical press and at meetings with the CHP Group.⁹³

The comments ranged widely. Most attention was given to specific criticisms of technical and economic assumptions and calculations. The Group divided them into those accommodated within the sensitivity studies or otherwise not thought significant, and those which would produce changes in the results of the EP20 calculations.⁹⁴ A number of major features were contested. The 10% TDR was widely felt to be too high; it was suggested that 5% or 7% - the required rate of return at different times on overall investment in the public sector - would be better. Exponential growth in fuel prices was thought by most respondents to be the appropriate reference case. The load model was heavily criticised - in particular, using a uniform heat load density and ignoring industrial space and process heating loads, both to the disadvantage of CHP/DH. Many felt the study to have overestimated the costs of the distribution network. The assumption of large plant size giving economies of scale was also contested; small plant was claimed to have been underrated for several reasons.

The Group considered the generic analysis of EP20 to have 'stood up well to the discussion.'⁹⁵ It conceded that the treatment of heat loads needed improvement, and set up a working party and commissioned studies of several conurbations to provide better figures.⁹⁶ The fuel price reference case was taken as a linear doubling by 2000, bracketed by constant and trebling prices. Some factors lowering distribution costs were also incorporated.

Final Report

The altered technical and economic assumptions were introduced into the DH Working Party's model and the revised results included in the Group's final report, published in 1979 as Energy Paper 35.⁹⁷ EP35 was considerably more enthusiastic about the prospects of CHP/DH. In the medium term analysis CHP had an advantage over alternatives particularly at low discount rates and for the bigger schemes. In the longer term comparisons CHP looked 'a good economic front runner' for large schemes in high heat load density areas. Again the report emphasised the economies inherent in large CHP plant.

With the results from the working group on heat loads in British cities,⁹⁸ the Group could give an indication in EP35 of national potential for CHP/DH. Taking high density heat load as above $20\text{MW}_h/\text{km}^2$ it estimated the national HDHL as $32.2 \pm 4.8\text{GW}_h$, about 50% of which was in Greater London and 79% in the five largest conurbations: London, West Midlands, Greater Manchester, Glasgow and Merseyside. Another 15% of the national HDHL was in 13 smaller cities of population over 335 000 and HDHLs over 200MW_h . Another 6% was in cities with populations of 196 000 - 335 000 and HDHLs of $50\text{-}200\text{MW}_h$. The national HDHL varied greatly with the minimum density accepted. Taking a lower limit of $15\text{MW}_h/\text{km}^2$, the national load would be 45GW_h , some 35% of the total domestic, commercial and institutional load in the UK.⁹⁹ Meeting 30% of that load would save between 6 and 30Mtce/y over the alternatives - 2-9% of the total national primary energy consumption - and would entail capital expenditure of some £17b for coal CHP plant, network and internals.¹⁰⁰ Marshall himself by then considered CHP 'probably the largest single energy conservation measure which could be taken in the UK'.¹⁰¹

The Group considered it 'desirable for a substantial part of the space heating and hot water load in towns and cities to be met by this means' and recommended that 'one or more lead city schemes should be started as soon as practicable'.¹⁰² It stressed the need for an immediate start, even though the economic incentive was absent:

CHP cannot be expected to take off on its own accord on any scale ... if nothing is done to encourage CHP/DH now, we shall not, because of the long lead times, have a CHP/DH option when

we need it.¹⁰³

It was 'almost inevitable' that government financial assistance would be needed.¹⁰⁴ 'Freedom of choice' for the consumer ought to be retained - that is, DH should be introduced in competition with other means of heating - but the gas and electricity industries would have to 'exercise restraint'.¹⁰⁵

A majority in the Group recommended the formation of a National Heat Board with a number of tasks:

- 1 carry out strategic national studies, and identify lead city schemes
- 2 set up local organisations at the earliest possible moment
- 3 carry out detailed studies of other cities and towns
- 4 set aims and objectives for the district heating industry and all concerned in the implementation of CHP/DH
- 5 work closely with the Government on the coordination of CHP and national energy policy, including advice on legislation
- 6 co-ordinate their plans with other energy industries, and in particular to liaise with the Electricity Supply Industry in the planning of CHP schemes
- 7 co-ordinate strategy with local CHP organisations
- 8 organise the raising of capital for CHP schemes
- 9 establish standards
- 10 carry out R and D and other studies.¹⁰⁶

It was also seen as protective; without its own institutional base, CHP/DH would be an 'obvious target' for cuts. Some members dissented on the Heat Board; three members, not from the ESI, thought the ESI should take the national lead. This alternative was opposed within the ESI, especially by the Area Boards which would have to take on heat distribution.¹⁰⁷

There had been more serious differences of view within the Group, likewise corresponding to institutional position, and although Marshall succeeded in steering it to produce acceptable material, disagreements over recommendations were not resolved. The gas industry pursued its case for

SNG and SNG heat pumps as alternatives against general scepticism.¹⁰⁸ Finally the BGC representative disagreed with the majority recommendations altogether, favouring further detailed study before any commitment to proceed.¹⁰⁹

With the CEGB performing much of the research for EP20, the results were seen by some as betraying strong ESI influence in presenting too pessimistic an assessment of CHP.¹¹⁰ Though there was pressure from the industry to take conservative assumptions on, for example, a high TDR, it maintained that it could not have dominated the deliberations and was exploring the economics with an open mind. It did strongly contest the comparative cost of electric heating but this had no significant effect on the ranking of CHP.¹¹¹

8.4 DEN PROGRAMME

Government Response

In April 1980 the DEN under the new Conservative Government responded cautiously to the proposals of EP35, saying that CHP/DH was an energy option that should be 'kept open'.¹¹² It declined to make a decision in principle to embark on a lead scheme. Agreeing that the main criterion was economic, it considered further investigation was necessary to establish: costs for specific locations; the extent of disturbance during introduction; and whether financial assistance would be necessary to allow DH to penetrate the domestic market in the shorter term. Thus its acceptability and viability could only be determined by detailed examination of specific locations.

The Government rejected as unnecessary the idea of a National Heat Board, preferring to keep the next stages of work within the DEN. It was justified by the DEN as a practical move: the next stage of investigation was necessarily a locally based one, and a national body would have little to do; and the question of organisation should be built into the investigations and considered later rather than prejudged.¹¹³ It was widely seen as consistent with the new Conservative Government's opposition to further new public bodies, and was at least intended to defer the question of organisation so that alternatives could be found if necessary.

The DEN announced a programme of work. The first stage would

- examine the prospects for commercial viability of a major lead scheme and compare the most appropriate locations;
- refine estimates of the national potential for CHP/district heating;
- clarify related issues that would need to be considered in any decision to proceed ...¹¹⁴

With suitably promising locations and a decision to proceed, the second stage would 'produce a full financial engineering and organisational proposal for the one or two most appropriate locations.'¹¹⁵

Local Authorities

The Marshall Group, though considering local authorities could not in themselves act as lead bodies for CHP/DH, had still deemed their involvement vital in any widespread development. Their reasons included:

- the large consumption of energy by local authorities;
- their concern with the welfare of low-income households and other social policy matters connected with energy;
- the local employment effects;
- the importance of energy issues in the development of towns and cities;
- the stimulation of local industrial specialisation;
- local planning, installation of schemes and responsibility for any disruption;
- and maintenance of housing stock.

The Secretary of State specified that areas to be investigated had to have local authorities which were enthusiastic.¹¹⁶ The initial stage of the DEn programme was therefore to present the results to authorities and invite responses. Communications were sent out via the DoE, the Scottish Office and the Northern Ireland Office, and thence the authorities' associations.¹¹⁷ Some thirty authorities volunteered to receive more information. A small team of DEn and DoE officials with consultants from WS Atkins visited these authorities, meeting with delegations of greatly varying size and seniority, reflecting the significance with which the authorities regarded the programme. Except in London and some of the large metropolitan areas, where some authorities had anticipated the DEn programme with their own responses to EP35, the team found little prior knowledge of the topic and some antipathy to it.¹¹⁸

The way authorities responded to and dealt with the DEn invitation varied widely (App. 7). The extent of rejection and reasons for it indicate the approach was unsatisfactory even allowing for the stipulation of local approbation. This confirms the misgivings of the Watt Committee that

concentration on separate studies ... where the particular authorities' enthusiasm for district heating and/or CHP is the criterion for determining choice ... could well lead to it being a substitute for positive action to implement CHP in the areas where it would be most effective.¹¹⁹

Few dealt with it as a significant policy issue or gave it thorough discussion among departments on which it would impinge. Most referred it to technical officers, and it was widely rejected because of their judgement of opportunities and problems - rather than leaving these as questions for investigation - and in some cases because of opposition to DH based on bad experience. Much of the positive response which was forthcoming relied on key authorities persuading others.

In the stated motivations of the authorities which became involved in the DEn programme, energy conservation and wider social objectives in the regeneration of urban areas, featured prominently:

- stimulation of the local economy, especially through employment generation;
- reduction of energy costs, particularly for low-income households;
- general concern for energy conservation;
- and concern to prevent deterioration of housing stock from condensation and poor heating.

In its initial response to the Marshall report, for example, Newcastle City Council considered 'the most important gain that will accrue from investment in CHP/DH will be the effect on the creation and maintenance of jobs within the local economy' - in this case the power engineering industry as well as the construction and manufacturing industries which would be involved in installation - and attempted to quantify this effect. It also outlined the extent of problems with its housing stock.¹²⁰ The

Council team later developed a fuller picture of the 'wide ranging and potentially profound' implications of such development, involving:

- direct employment generation;
- stimulation of local industrial specialism;
- enhancement of industrial and other physical development in the conurbation;
- benefits to housing stock and heating standards;
- and benefits in reducing fuel poverty.

It urged that economic assessments of CHP/DH be broadened to take into account these local benefits.¹²¹

Shortlisting

By August 1980, 19 authorities largely from metropolitan areas, had expressed interest in participating in the DEn programme.¹²² Two London boroughs, Croydon and Westminster, withdrew, and six more authorities asked to be added. The final list thus contained 24 authorities and covered 15 areas.¹²³ WS Atkins were appointed to perform 'a pre-feasibility study to identify the most likely sites' for a lead city CHP/DH scheme - effectively 'a short-list of locations giving the highest expectations of early and economic development'.¹²⁴ The production of a shortlist, of four to six, required preliminary estimates of heat loads and identification of heat sources and mains routes. The local authorities supplied information to the consultants, and on the basis of typical heat demand characteristics and other basic criteria such as time scale and site size and access supplied by Atkins, the CEGB, SSEB and NIES identified power stations and sites in the candidate areas, for conversion for use during the development of the heat load and for new plant for final sources.¹²⁵ The industries agreed on coal-firing and on four sizes for new CHP plant, from 50MW_e/105MW_h to 277MW_e/481MW_h.¹²⁶

In December 1980, Atkins presented its Interim Report,¹²⁷ shortlisting

six cities for the next stage: Glasgow, Newcastle, London (Central and East), Sheffield, Belfast and Liverpool. Glasgow, Newcastle and London appeared the most attractive sites. Selection was mainly based on the size of potential heat load; the availability of a suitable power station or site; and local approbation. Rochdale, Southampton, Wakefield and Barking were ruled out as having too small a HDHL ($>20\text{MW}_h/\text{km}^2$), i.e. $<200\text{MW}_h$. Cardiff, Leicester, Edinburgh and Portsmouth were thought to have no suitable power station or site. Manchester was deemed to have shown 'a significantly lower level of commitment' than the other authorities and neither the Greater Manchester Council nor the adjacent districts containing much of the HDHL for the conurbation had given support.¹²⁸ Cardiff had support from the County but not the City.

Three other authorities from the original 24 lobbied for inclusion in the list - Lothian RC for Edinburgh, Manchester and Leicester - through representations to the DEN and via their MPs, and persuaded the DEN that their areas could satisfy the criteria on which they had previously been excluded.¹²⁹ Tower Hamlets was persuaded to join with the other London authorities, and Edinburgh City Council likewise became involved.¹³⁰ Several of the other authorities attempted to persuade adjacent authorities or their county councils to support their applications at least in principle, mostly with success.¹³¹ In March 1981, the government announced that given 'a high level of interest in the subject' it would be 'appropriate to carry out the more detailed feasibility work in more areas than was originally envisaged ...'; all nine cities were to be included.¹³²

Site-Specific Studies

The next phase of the work involved detailed engineering studies of the nine areas, subcontracted to consultants; market surveys in each of the areas; and further refinement of the estimates of national potential for CHP/DH. The ESI was asked to select sites and appropriate plant configurations for the final CHP source, and to produce preliminary designs for each, covering standby/peak HOBs, water treatment and heat storage.¹³³ The heat load estimates had been revised, downwards for Glasgow, Manchester, Merseyside and Tyneside and upwards for the rest, and the CHP plant configuration was revised in most, mainly towards the use of the larger units. The CEEB and SSEB used two of the BP designs

they had submitted: 155MW_e/275MW_h with reheat on all the sites except Sheffield, for which site constraints dictated 2 x 44MW_e/105MW_h non-reheat units. For the Belfast West site the NIES suggested two 156MW_e ITOC sets with 210MW_h of HOB capacity. The significance of this plant selection is considered in 8.6.

Atkins reported in July 1982, finding all nine sites technically feasible and commercially viable.¹³⁴ The report included financial evaluation on DCF, phased implementation programmes, and suggested sources. The schemes ranged from 400MW_h to 1100MW_h with capital costs from £346m to £825m. On two different bases of assessment, the schemes would deliver heat at 10% below the cheapest alternative and show annual rates of return around or above 5%. Sensitivity analyses for key variables showed 'economic robustness'.¹³⁵ Only the ESI's long term demand forecasts and the extent of its future nuclear programme would affect the economics strongly; if the planned increase in nuclear capacity was not achieved, CHP would be more attractive.¹³⁶ The results were significantly better than for EP35.¹³⁷

Atkins found the selection of one or two locations from the nine difficult, and accordingly 'concluded that the concept of a lead-city scheme requires reconsideration'.¹³⁸ It recommended the preparation of full project plans for two or preferably three cities showing higher rates of return, sufficiently detailed to enable phased implementation. It recommended, however, a more pragmatic approach to selection on financial grounds: to get each local authority to prepare finance and organisation proposals according to the response to a prospectus aimed at attracting finance for its scheme. If the programme were to be limited, Belfast, London and Edinburgh would be the best prospects.¹³⁹

Atkins was also keen that the narrowing terms of reference of the 'lead city' programme should not be allowed to discourage development elsewhere, now that the general economic viability of CHP/DH appeared better. It wanted the definition of 'a policy for CHP/DH in the United Kingdom' and a 'work programme' for its general development within an 'overall strategy'.¹⁴⁰ The Government should 'make available the findings of the Stage 1 studies to local authorities ... and actively encourage the consideration of extensive development of CHP/DH wherever it has a

prospect of viability.¹⁴¹

Further support for the improved view of the economics of CHP/DH came from the BRE studies on the factors affecting the assessment, published between Atkins preliminary report and Stage 1.¹⁴² It likewise found that the Marshall Group's estimates were substantially reduced by taking into account inhomogeneities in heat load density and by optimising supply and return temperatures. In addition it found that the Group had overstated the effect of uncertainty in other factors.

Selection

It took 19 months for the Government to produce a response to the Atkins report. According to the DEn official centrally involved, there were a number of reasons.¹⁴³ The report and its associated studies were treated as an external consultant's work and were subjected to detailed checking. The programme was approaching large scale investment with 'major political ramifications' and committing cities to disruption, and extensive consultation was needed; there was nothing exceptional in a protracted decision process. A wide range of options for Government action were explored. The DEn also decided to wait for the Select Committee on Energy report on CHP. In addition the Department itself was undergoing internal change with a change of Minister and a Rayner scrutiny, and the general policy of the Government on energy was being given expression in the Energy Bill and other moves to increase private sector involvement. Significantly in September 1983 NEDO issued a market briefing on CHP/DH aimed at stimulating interest among manufacturing and civil engineering firms.¹⁴⁴

The delay was widely seen as indicative of the Government's reluctance to commit itself to supporting further work and its embarrassment at the favourable findings and strong recommendations of the Atkins report. There was certainly disagreement about the number of cities to be included in the next stage.

The eventual pronouncement in April 1984¹⁴⁵ represented in part a victory for advocates within the DEn who had argued for more than one 'lead city': the Government would support the preparation of detailed

studies and prospectuses for three cities - preferably one in each of England, Scotland and Northern Ireland - providing £250 000 for each, to be matched by a consortium for each area. The prospectuses would have to cover staged development, organisation, legislative needs, finance and marketing. It was made clear that the extent of private sector involvement was to be a major criterion in selection, on the assumption that 'any subsequent further development of CHP/DH would be a viable private sector investment.'¹⁴⁶ The framework was thus an attempt to put into practice the Government's increasingly explicit approach to the energy sector, and it was also interpreted as an 'attempt to distance the Government from any scheme that goes ahead.'¹⁴⁷ As one commentator observed, there was 'no sign of how far the Government would go in funding any subsequent project.'¹⁴⁸ Cities were given less than four months to put together local consortia and submit a proposal.

Ten consortia applied - two for the London Central and East area and one for each city (App. 8). The extent of private sector involvement, the extent of commitment from participants, and the detail in the proposals varied. A local authority acted as coordinator in some of the proposals. In Glasgow, Balfour Beatty were the prime movers, and in Belfast and one of the London bids, private consultancies. Other organisations, particularly the NCB and sections of the ESI, indicated support but their role and the extent of any commitment was left vague in the proposals.¹⁴⁹

The DEN decision on funding was announced in January 1985, with Leicester, Belfast and Edinburgh chosen.¹⁵⁰ Commentators speculated on reasons for the selection of Leicester, which had a less favourable rate of return because of its size, and had not committed significant resources to CHP investigation. It was suggested that Leicester was chosen so that its rate of return would not compare favourably with Sizewell 'B', and that Sheffield, Newcastle and the GLC had made sufficient progress in parallel with the DEN investigation that their schemes would be likely to go ahead anyway.¹⁵¹ The CHPA noted the possible consequences of the choice:

While a successful outcome to studies in Leicester would indicate that the other English schemes should be even better, an unsuccessful result could jeopardise the development of schemes in the other, larger and potentially more attractive, English cities.¹⁵²

Pattern of DEn Programme

The pattern of DEn activity was widely interpreted as procrastination and unnecessary delay, based on an unwillingness to give significant funding or policy support.¹⁵³ Marshall himself had anticipated that leaving a decision till after detailed studies 'would simply be a recipe for indefinite delay.'¹⁵⁴ This reluctance became more apparent as economic assessments improved, consultants recommendations became stronger, political support broadened and implementation approached. Members of the Select Committee on Energy, scrutinising the programme, commented on 'an amazing lethargy',¹⁵⁵ 'the Department and the Ministers moving at a snail's pace'¹⁵⁶ and despite the speed of the consultants' work a 'general impression that everything is moving very slowly when it is moving at all in the Department.'¹⁵⁷ Some witnesses 'believed the Department's official policy was designed principally to avoid taking decisions', and it had embarked on 'a course of endless economic assessments'.¹⁵⁸ The concept of a lead city and its appropriateness for the option were disputed.¹⁵⁹ Despite the insistence in EP35 that 'a lead scheme is not a prototype or development scheme in the technical sense',¹⁶⁰ the government was considered to be trying in practice to limit support to one city. Its intention in 1981 was to 'examine the prospects for commercial viability of a major lead scheme ...'¹⁶¹ The framework encouraged competition between the candidate authorities and much of the early investigative work and calculation of rates of return was explicitly comparative.

It seems likely that ministerial intervention in line with Cabinet policy increasingly overrode the impetus produced by the efforts of DEn officials. The effect was to narrow down the activity from a national programme to a handful of individual schemes, and to delay introduction beyond the schedules envisaged and advocated in assessments. Superimposed on this reluctance to fund development itself was an increasingly apparent attempt to enforce private sector involvement as an application of the government's strategy for new developments in the energy sector and elsewhere.¹⁶²

A number of problems in obtaining adequate private sector funding were suggested early on, arising from the anticipated perception of such projects by investors: the risk associated with the involvement of local authorities and possibly changing local political support; delays and risks

from the need for government approval; the relatively low rate of return; the vulnerability of schemes to energy price changes and government policies in the sector; and the contradictory signals to the private sector from the government's approach - trying to encourage involvement but at the same time showing a lack of commitment itself.¹⁶³

The response of two key local authorities to this pattern as it affected their own proposals is explored in 8.5. Collectively the authorities in the nine candidate cities formed among themselves in 1981 a National CHP Liaison Group under the auspices of the DHA.¹⁶⁴ This was intended not only for information exchange and practical mutual support, but also to lobby for the continuation of the programme and to influence its shape, effectively to counter the pressures towards competition inherent in its framework. Representatives of the three cities selected and those subsequently pursuing schemes outside the programme continued to meet after the 1985 selection, and tackled questions such as the heavy rates to which it appeared CHP/DH schemes would be subject.¹⁶⁵

8.5 MAJOR SCHEMES

Introduction

Three groups of local authorities - in London, Sheffield and Newcastle - stand out as having pursued CHP for their cities with greater vigour, both in pursuing their candidacy within the DEn programme and in initiating and maintaining their own work in parallel. This section analyses the efforts of Sheffield and Newcastle in particular to devise feasible and fundable schemes within the various constraints operating on them, both in their general resources and powers, and as imposed specifically by the Government in relation to this programme.

Newcastle: Investigations and Core Scheme

Newcastle took up the issue of CHP for its area before the DEn programme was announced, largely at the instigation of the Joint Trade Union Committee at NEI Parsons which had raised and promoted the issue from 1978 as a response to the problems of the power engineering industry.¹⁶⁶ The City produced its own response to EP35 in September 1979¹⁶⁷ and a proposal to the DEn for a jointly funded study of CHP on Tyneside in February 1980.¹⁶⁸ As well as cooperating with the DEn and its consultants in the DEn studies, it made several submissions to the DEn to support its case.¹⁶⁹

Its early position was that it was inappropriate for it to involve itself with 'technical aspects' - 'it was simply not our business, but the business of central government, energy economists and scientists.'¹⁷⁰ It was 'necessarily in a responsive situation, taking a lead from Central Government.'¹⁷¹ It sought instead to put forward a distinctive local authority perspective on the evaluation of CHP, identifying direct local economic benefits and longer term less specific benefits which ought to be included in economic assessments; there was a need to undertake 'cost/benefit analyses that complement and extend the examination undertaken by the CHP Group who were primarily concerned with national energy resource considerations.'¹⁷²

It started its own work early on and commissioned research - starting with a study funded by the Inner City Partnership from October 1980¹⁷³ and one funded by NEI from November 1980¹⁷⁴ - concentrating on related local issues over which it had control, such as the potential for smaller DH schemes which could be linked together later, and problems with its own housing stock and existing DH schemes. It made a submission to DG17 of the CEC in pursuit of European funding but this produced no outcome.¹⁷⁵

It also set about building institutional and political support for the venture. It sought the cooperation of the County Council and other district councils on Tyneside. North and South Tyneside MBCs dropped out when preliminary studies favoured concentration on Newcastle and Gateshead, but a Joint Working Group at member level was formed between Tyne and Wear, Newcastle and Gateshead Councils in July 1981, and the three authorities subsequently pursued CHP for Tyneside jointly in terms of funding and political action.¹⁷⁶ More than any of the other cities, and in large part because of the early and continued involvement of outside groups, it publicised the initiative locally and encouraged wider interest.¹⁷⁷

Newcastle was still essentially, however, following the DEN's schedule, 'extending and complementing' Atkins' work. Thus following the Atkins Stage 1 studies in the summer of 1982, and the Tyneside authorities' submission in November 1982 urging the DEN to proceed to a second stage,¹⁷⁸ the group felt unable to take any major initiative pending a decision. A further document in April 1983 suggested a programme for Stage 2 and sought to demonstrate Tyneside's readiness to proceed.¹⁷⁹ Instead they were encouraged by the DEN to do further detailed studies to show how the first stage of a scheme might be developed and how the private sector might be involved, and they assumed such advance work would improve their chances of selection.¹⁸⁰ The group commissioned Atkins to undertake a further 6 month study in September 1983.¹⁸¹

The study was intended to move on from Atkins' vague phasing in Stage 1 to a more detailed and specific plan of implementation, and in particular to define a first phase: a 'core scheme' with readily available guaranteed and concentrated loads, low capital outlay and quick return, and

a demonstration effect for subsequent development. Work on this core scheme included collection of data on existing heating patterns, and identification and interviewing of potential major commercial and institutional consumers. The attempt to demonstrate the more favourable economics of a core scheme would it was hoped appeal both to prospective investors and hence to the DEN. Atkins looked at heat source options both for the core scheme and for the city-wide scheme.

The study of loads showed the dependence of the core scheme economics on the detailed heating patterns and plans of the various potential consumers and revealed some encouraging and some discouraging factors. There was a good response in the form of interest and cooperation. The exercise thus had some political value, publicising the plans and eliciting a statement of support from one major potential industrial consumer. The constraints revealed, however, were disappointing, in that heating patterns and costs appeared to provide less incentive than thought to consider connection. Large shops had relatively low heating loads and a short season. In many office blocks heating charges were a small part of standing charges which were low relative to rent and rates, and important neither to tenants nor to managers. Most interest came from organisations forced to consider replacing or repairing heating plant because of its age or high fuel costs, particularly a brewery and a hospital with oil-fired systems, the university on a mixture of fuels, and two office blocks with electric underfloor heating. The connection of Newcastle's civic centre, polytechnic and arts college, under local authority control, would depend on a policy decision by the Council taking into account the economics of early replacement.¹⁸²

Atkins' study of heat sources ruled out conversion of Stella power station for the large scheme. It showed the attractions of refuse incineration for the core scheme. This option, however, was already contentious: the County Council were responsible for refuse disposal and resolutely opposed to incineration because of bad experience. Without a change of policy incineration would only become possible with the transfer of disposal responsibility to the district councils on the dissolution of the metropolitan counties.¹⁸³

The completion of Atkins study coincided with Walker's announcement

of the Government's response to Atkins Stage 1 study and recommendations. While the Tyneside group might otherwise have continued with further refinement of Atkins' Tyneside work, their efforts were immediately 'sent off on another track':¹⁸⁴ the establishment of a consortium and the preparation of a legal agreement within the four month time limit. The resulting consortium, the Association for Tyneside CHP, contained the three local authorities; NEI, AHS and Mainmet, which were involved in most of the ten consortia; and two engineering/construction companies (App. 8). Its submission to the DEn,¹⁸⁵ outlining a work programme for 18 months, stressed the advantages of the Tyneside area: the strength of the Association, with substantial private sector involvement and the 'positive attitude' and 'impressive record of achievement in civic enterprises' of the local authorities; the work already undertaken; the favourable characteristics of the commercial and domestic heat loads; the need for new coal-fired generating capacity in the region at the turn of the century; the authorities' pursuit of energy conservation; and the specialisms of local industry. It outlined the core scheme based on Atkins' study as a first phase, of some 96MW_h peak load, but stressed the ultimate objective of a large CHP/DH scheme of about 530MW_h fed by a purpose built CHP station. The refuse option for the core scheme had to be omitted because of the disagreement between the district and county authorities.

The Tyneside authorities were optimistic about their chances of selection. The outcome was a shock and caused resentment: it appeared that the authorities had been encouraged to pursue CHP actively and then excluded at least in part precisely because they were more advanced and could be expected to proceed independently. The six months when activities were more or less suspended waiting for the decision 'could have been spent more productively'.¹⁸⁶ The consortium was assembled to pursue the DEn funding, and the agreement to proceed conditional on obtaining it. The consortium decided, however, to attempt to continue its work.¹⁸⁷

With the loss of the Government funding, attaining a feasible and fundable initial scheme was then seen as dependent on: further reducing the scope of the core scheme to start with the most favourable loads; the development of the refuse incineration option; satisfying private sector financiers of an acceptable rate of return; and the pursuit of other

funding. The consortium sought funding from the European Regional Development Fund and the European Community, but neither saw the project as suitable. Lack of money became a major constraint on progress. Tyneside starting reassessing the core scheme in 1986 to look for possible improvements and following the abolition of Tyne and Wear County Council opened negotiations with neighbouring authorities on refuse incineration. The further concentration on the core scheme reinforced the worry that the network might develop no further, producing 'another Nottingham' - worthwhile in itself but 'really missing the point'.¹⁸⁸

It was thus ever more important to keep the goal of the city-wide scheme in mind, and in particular to keep alive discussion with the CEEGB on CHP sources. At the same time the consortium was being assembled, the CEEGB reassessed the possibilities for CHP heat sources for the core and complete schemes.¹⁸⁹ It looked at conversion of one or other of the two Stella stations, new coal CHP plant - one 170MW_e or two 99MW_e turbines - at the Dunston site, or new CC plant at Stella. Conversion at Stella offered low capital costs for the core scheme but could not undercut refuse-based heat. The results were discouraging but remained contentious as compared with those from Atkins and were not accepted as final.¹⁹⁰

Newcastle: Local Organisation

Newcastle assumed initially that the CHP scheme would be developed and operated by a local heat board as recommended in EP35.¹⁹¹ The local authorities were taken as a natural focus: they had actively pursued other major projects and particularly energy conservation measures; there was initially little spontaneous private sector involvement apart from the interest shown early on by NEI;¹⁹² and they were aware of the pattern of CHP development in Scandinavia. Essentially it would be a 'municipal development'.¹⁹³ The erosion of that assumption was partly a recognition of the limited resources and severely constrained financial position of the authorities, and partly a response to signals of the government's intention to stipulate private sector involvement, eventually made explicit in Walker's 1984 statement.

In 1982, when the authorities discussed with the DEN ways of

strengthening its candidacy, the Department started to make clear the Government's position on private sector involvement. The DEn

made it very clear that if we were putting something forward which was totally local authority, totally public sector, we could forget about it. We had to start exploring ways of involving the private sector ... So it was really a shift in response to the Government ...¹⁹⁴

They felt it necessary to start asserting rather than assuming their role: '... it is essential that local authorities have a prominent and continuous role in local development.'¹⁹⁵ There would be a 'flexible approach to the involvement of private sector interests' but it was only referred to in terms of 'technical, financial and consultative issues'.¹⁹⁶ It was still seen as essentially a public sector project; development would require 'that the local authorities work directly with the Government and the electricity supply industry to secure progress'.¹⁹⁷ By 1983, in their response to the Stage 1 results, the authorities had conceded that 'private organisations providing funding' would 'have an active part in the local CHP/DH organisation',¹⁹⁸ and of three options - a joint local authority committee, a statutory joint board, and an independent company limited by guarantee - the last was put forward as a 'good model'.¹⁹⁹

The authorities were sufficiently committed to developing CHP that they were prepared to comply with the Government's framework insofar as it was necessary.

... we wanted to stay with this, and progress it as far as we could, and be in a good position either to take advantage of anything which is actually forthcoming from the private sector, or alternatively to be able to respond if there is a change of policy from the Government in one way or another. We did not want to put it on the shelf and miss out.²⁰⁰

Though there was some opposition to this effective enforcement of the Government's line, there was a pragmatic acceptance that the dependence of the authorities of central help meant resistance would exclude the city from the programme altogether. An entirely municipal development was unrealistic:

In the situation we are in now, there is no way that is going to happen. If we take a hard line on that, then we can effectively forget about it until there is a change in government or a change of policy within the Government, and I think the members

recognised that and did not want to do that.²⁰¹

In Tyneside's case, there are two perceived safeguards against exclusion or loss of control. First, the core scheme may well be based on refuse incineration. With the transfer of refuse disposal to the districts on the abolition of the metropolitan counties, they could legitimately put capital allocated to that function into incineration-based DH scheme as a way of saving on other disposal methods. Second, as well as controlling some of the institutional loads in a core scheme, the local authorities as housing authorities control the council housing which would make up a substantial part of the load of the next phase.

Sheffield: Investigation and Core Scheme

Sheffield likewise started discussions on the Marshall report in advance of the Government's response, and responded enthusiastically to the DEN programme.²⁰² There was all-party support - in the various perceived benefits there was something to appeal to a number of interest groups - and the Energy Panel and Employment Committee were strong advocates.²⁰³ The City involved South Yorkshire County Council and Rotherham in discussions at an early stage. The County Council continued its involvement until its dissolution; Rotherham commissioned its own study and decided not to pursue a scheme in its own area, though it continued to cooperate with Sheffield when required, and the possibility of ultimate connection to a network in Sheffield remained.²⁰⁴

After the results of Stage 1 the City felt confident enough to continue its own programme in parallel with that of the DEN, the objective being

to implement a CHP scheme in Sheffield which meets the Council's aims and policies for the regeneration of the inner city urban area through the provision of lower cost more efficient and more plentiful heat to all users and to meet the desire to ensure rational use of primary fuels.²⁰⁵

It engaged a university professor as consultant and set up a research project based in the university on several aspects of a possible scheme.²⁰⁶

One major disadvantage contributed to the relatively low 4.8% rate of

return estimated by Atkins in Stage 1. The constraints of the Neepsend power station site on the north-west edge of the city forced the use of small CHP sets - two 49MW_e non-reheat BP turbines together giving 210MW_h. These would give expensive heat - 1.5 times the price of that for Leicester and 2.75 times that for London - and low electricity sales revenue, and require 341MW_h of HO sources.²⁰⁷ Sheffield thus considered two alternative sites to the east of the city and then the Blackburn Meadows CEGB site to the north-east which the Atkins report had mentioned but excluded in favour of Neepsend. Sheffield initiated direct negotiations with the CEGB over Blackburn Meadows in October 1982, and the Board produced a report in October 1983.²⁰⁸ It found the use of the site 'technically and environmentally feasible'. The proposed configuration of plant however - one 170MW_e/275MW_h BP set and four 50MW_h HOBs - produced a capital cost of £199m for the station and heat at the power station boundary at 236-708p/GJ_h depending on the background scenario. It also considered CGCC, GTs and heat transport, with equally discouraging results.

Still with no response to Stage 1 from the DEn in 1983, and feeling increasingly that only one 'lead city' was likely to emerge, Sheffield engaged Atkins to continue the work, in an attempt to keep up the momentum of its efforts. It was decided to produce a design outline and brief for a core scheme based on the SYCC Bernard Road incinerator. It 'would form the basis of a full Sheffield CHP scheme and ... would enable CHP/DH technology and market take-up to be demonstrated in advance of a decision to proceed with the development of the full CHP/DH scheme.'²⁰⁹

Atkins' report to Sheffield in October 1983²¹⁰ envisaged a core scheme of 80MW_h peak load, covering 224ha in two separate zones of the city centre - one containing commercial and public buildings, and the other the university plus private and local authority housing. The zones included some 10 000 dwellings, and two existing district heating schemes - one already supplied by the incinerator - which together would account for 30% of the peak heat load. The scheme would produce a modest 3MW_e of exportable electricity but its viability was not dependent on its sale.²¹¹ The full scheme as envisaged in Atkins Stage 1 would cover 2080ha and some 40 000 dwellings.²¹²

The Sheffield work had by this time developed into a coherent programme with a number of clearly defined objectives - to refine and assess the core scheme, to produce a development plan for progression to the full city scheme, and to define financial and organisational requirements - with appropriate investigations and negotiations for each.²¹³ At the same time as the prospects of the core scheme improved, Sheffield started considering alternative CHP technologies and investigating CGCC plant in particular. With the formation of a consortium in 1984 the City also formalised its relations with the university and the polytechnic as advisers. It started a research programme in the latter which included procurement schedules, assessment of existing distribution technologies, and design work on areas like remote metering and modular consumer connection units.²¹⁴

In pursuit of larger funding, Sheffield approached DG17 of the EEC for an Energy Saving Demonstration Scheme grant, but found the regulations governing funding virtually precluded a coherent application in terms of the work needed. Following representations the rules were amended to allow feasibility studies in exceptional circumstances, and in early 1984 the Sheffield consortium received the first such grant of £290 000 towards a study to concentrate on the CGCC option.²¹⁵

The City's work to date also formed the basis of the consortium's bid for the DEn funding. It considered itself well placed, having done the most preliminary work of all the nine sites. The submission also stressed the commitment of consortium members, and the breadth of their interests and of support for the scheme from elsewhere. Its rejection was less of a setback, as the City had long planned to be able to by-pass the DEn if support was not forthcoming. It would seek support from the EEC and the ECSC for the first stage of implementation.

Sheffield: Local Organisation

Sheffield conceded early on that its 'preferred option' of a local authority venture was unrealistic, recognising its inability to fund a scheme in the existing financial constraints. The core scheme alone would cost £30m, and the peak capital outlay projected for the scheme in Atkins

Stage 1 was £51m. Like Newcastle, it considered 'the package as a whole had too much to offer Sheffield to kill it on a principle like that.'²¹⁷

The city was reluctant to consider a private development; it 'would not place itself in the position of being the major facilitator and customer and leave all the benefits to a private operator.'²¹⁸ It favoured a joint public sector venture:

... the option most likely to succeed would be a partnership or consortium between the Local Authority and, say, the County Council, the CEEB, the Electricity Board and other statutory bodies such as the Area Health Authority. A local authority pension fund or nationalised industry pension funds may also be acceptable partners in this arrangement. A local authority's reservations about entering into a consortium agreement with private interests would be the potential loss of democratic control over the scheme.

It would be possible, however, providing satisfactory long term agreements could be reached with the CEEB and other interested statutory bodies, to form a Community Heating Enterprise run substantially through the local authority.²¹⁹

Initial discussions with the CEEB produced a 'broad understanding ... that if the CEEB decided to join in with the CHP scheme for Sheffield they would do so on the basis that they would finance and operate the power station and the City Council would provide the distribution network.'²²⁰ Board representatives agreed in principle to join a joint venture company with the city, but the Board later withdrew.²²¹ The collapse of this agreement was seen as ending the possibility of limiting outside involvement to public sector bodies.

Anticipating the need for private financial backing and Government insistence on private sector involvement, Sheffield publicised its intentions and initiated discussions with a number of British and international companies, exploring their interest in the scheme and the terms on which they might participate. With no comparable experience of a major joint public-private venture, the City approached the negotiations cautiously. It rejected both suggestions of a complete private package of finance, installation and operation,²²² and also the involvement of major construction and engineering firms on a purely contractual basis:

... it would be possible for them to introduce false economic

factors into the equation, whereby they produced information which resulted in a decision to go ahead, they would take their fee, make their profits off the contract, and leave, with no real interest in the long term operation and viability of the scheme, leaving whoever to pick up the tab.²²³

High level contact enabled the city, however, to establish 'surprisingly fruitful'²²⁴ relations with private companies on unprecedented terms, particularly by appealing to a common interest in and loyalty to the city. Foster Wheeler, for example, were prepared to take an equity stake in the venture.

Sheffield 'narrowed the field' to AHS, Mainmet, Rolls-Royce, Foster Wheeler and British Gas, with the last three interested in developing Lurgi CGCC-based plant. BG considered the gasification plant could act as a demonstration project between its Westfield prototype and proposed larger schemes, and the complete station could be offered as a package internationally.²²⁵ The city approached Lord Ezra to chair the consortium. The consortium was thus established in late 1983 and early 1984, in advance of the Government announcement that this form of organisation was a condition of eligibility for selection in the next stage of the DEn programme (App. 8). It made the successful bid for EEC money, and the members committed a further £600 000 to that feasibility study in the form of cash, staff time and secondment of staff to Atkins.²²⁶ Following the rejection of its bid in the DEn programme, the consortium, like Tyneside's, decided to continue its work.²²⁷

Core Schemes

Thus the authorities have attempted to pursue CHP development for their cities within stringent economic and political constraints. The nature of these constraints, the requirements of CHP development and the strategies of the authorities have combined to direct them towards a specific pattern of development and organisational forms. Several key issues have emerged: the extent and effect of private involvement; the financial structure of the development of the scheme; and the degree of control exercised by any interest, particularly the local authorities as initiators. The resolution of these will have significant effects on the chances of introduction, the form and extent of development, and the objectives and criteria which determine them. As at mid-1986, the pattern

is still unfolding; the objective here is to indicate possible effects and explore the local authorities' approach to dealing with them.

Three factors have combined to produce concentration on a core scheme. First is the generally accepted need to build up a city-wide scheme incrementally with each stage probably economically viable in itself, and demonstrating the merits of the system to consumers and backers. Second is the need to produce a pattern of outlay and revenue acceptable within tight limits, for example to fund at least the capital charges from revenue as soon as possible. This is crucial in early years when outlay is large and revenue small or lagged. In this case the major constraint is the need to produce a rate of return acceptable to private investors and, to the extent that participation in the DEN programme was competitive, in competition with other cities. The core scheme is thus planned to include large individual loads with quick connection - existing DH schemes, or large commercial and institutional premises where a single agreement guarantees a substantial take-up or where loads are under the control of the local authority; as much existing plant, networks and internals as possible; and the minimum of new equipment. The viability of the core scheme thus comes to depend strongly on the decisions of major institutional or commercial consumers on heating. The need to offer attractive rates of return to private investors may lead to subsidy of returns from public money which does not need to earn interest insofar as sums from local government sources could legitimately be put into the project.²²⁸

The need for private funding and the stipulation of private sector involvement bring with them the problem of devising an organisational form and detailed terms which accommodate different interests. The local authorities have had to explore different arrangements and think through their implications with no real precedent for such joint ventures in Britain for guidance. From their point of view the balance is between providing terms acceptable to private interests so that a scheme can go ahead, and retaining sufficient control over the development and operation of the scheme to fulfil the social objectives articulated at the outset. The groups of authorities in both Sheffield and Newcastle perceive an attempt by the Government to squeeze local authorities out of the projects and are trying to think through stage by stage the implications for control of the

various elements of organisational arrangements which are being negotiated.²²⁹

Several possible consequences of these developmental and organisational patterns can be suggested. There may be a reluctance to extend the core scheme to areas with less favourable economics, so that commercial loads are served at favourable rates and provide good quick returns for investors but that local authority housing further afield is never reached. The ultimate goal in terms of energy conservation of connection to a major CHP station may then be lost.

The social objectives may be lost as commercial criteria for development or extension become predominant. Already the assessment of individual schemes has become based on commercial tests and the wider criteria of the local authorities' original submissions - employment effects, local regeneration, environmental improvement, etc. - or of the Marshall Group's cost-to-the-nation evaluations are no longer explicitly considered, except insofar as the continuation of the scheme as a commercial venture continues incidentally to offer these possibilities. That is to say, were the purely commercial assessment to go against development or extension, then there would be a conflict rather than a coincidence of objectives. Thus the total effect of individual city consortia decisions could be a level and form of development very different to that which would be indicated by other sets of criteria.

Local government officers involved have taken and defend a pragmatic approach of assessing arrangements as they evolve rather than attempting to articulate firm principles on which to base their approach or to devise a blueprint at the outset. They rather advocate assessing the 'package' of arrangements as they have developed at any stage, to see if the original objectives are still in sight. This comes partly from a recognition of their limited power - that their ultimate choice may be 'no scheme or some scheme'²³⁰ and uncompromised or inflexible principles might produce the former; partly from the complexity of the position authorities occupy - both with their general varied responsibilities and in their role here as initiator and coordinator; and consequently partly that such principles may be misleading on specific issues.

The authorities see several sanctions. In controlling the initial assembly of the consortia, they have been able to select firms, assess their motives and negotiate terms of participation. As housing authorities and owners of various civic buildings, they are major customers for the undertaking, particularly in its later phases. As planning authority and landowner they have control over substantial areas of land and their use. They have powers of compulsory purchase and to break up streets for laying mains which are not yet available to private companies. They have control over existing plant which will be essential for the core scheme. They own and operate district, group and block heating systems which will provide ready made loads. They control the refuse incinerators on which core schemes could rely for cheap heat, and could legitimately provide capital for incineration in discharge of that separate responsibility and from the appropriate budget.

The authorities want to incorporate safeguards against loss of control. Guarantees could be written in to the articles of association of the heat company so that certain principles are incorporated and cannot be changed without their consent. A 25 or 30% voting share would thus effectively control the retention of these principles. Shares should be nominal for the purpose of defining the composition of the board rather than based on contribution of capital. Other forms of relationship between the authority and the heat company besides representation on the board could be established.²³¹

8.6 CHALLENGES TO THE ESI

Introduction

The ESI has faced increased criticism and challenge through the late 70s and early 80s over its record and position on CHP. This section analyses the sources, forms and channels of these challenges, and the industry's responses. Critics have been increasingly frustrated at the lack of progress especially since the mid-70s, at the industry's defensive justification of its role, and at its apparent continued insulation from criticism and lack of accountability.²³² Even inquiries which failed to uphold accusations of misconduct remained uneasy.

Challenges took the form of increased attempts to establish CHP outside the ESI; to improve the conditions for such projects insofar as the ESI had control over them; to involve the industry in specific schemes; and to change its framework to induce greater activity. These were to differing extents caught up in, or attached to, more general attempts with different political motives to reorganise the industry. As described in 4.5, while criticism of its practices had increased, no significant legislated change had been implemented since 1957.

Legislation: Plowden and Benn

Though some of the official groups reporting on energy conservation in the mid-70s accepted the ESI's account of reasons for the lack of progress with CHP, others suggested a need to amend the industry's statutes. The ACEC considered that the duty in section 50 'should be extended to include other applications of waste heat, and should go further than mere investigation.'²³³

The matter thus surfaced in discussions on reorganising the industry. Despite limited terms of reference, the Plowden inquiry considered and reported briefly on the implications of the ESI's structure for CHP, inside and outside the industry.²³⁴ Its conclusions appeared initially to reflect a view that the industry's main rationale conflicted with energy efficiency, with the implication of a radical shift:

At present the industry's statutory duty is to provide "an efficient, coordinated and economical system of electricity supply". This duty should be changed to take into account the importance of energy conservation.²³⁵

But it can be argued that the changes it considered necessary - eliminating two ways it identified in which 'the statutes are an obstacle to the most economical use of all national resources'²³⁶ - were not sufficient to ensure the reorientation it appeared to want. First the ESI should be allowed 'to purchase electricity from a combined heat-and-power scheme at a price higher than the CEGB's marginal cost of generation.'²³⁷ Second it should be allowed to sell heat from other than CHP sources.²³⁸ It suggested 'the responsibility for identifying opportunities for (CHP) schemes and for initiating them must rest with the distribution side', and that it might also operate them.²³⁹ Both provisions were permissive, and CHP would remain incidental to the industry's main activities.

Nevertheless, these recommendations did represent a significant break with the terms under which the industry assessed schemes and decided and justified its involvement in them. The industry objected to them and to the incorporation of clauses based on them in the Electricity Bill of 1978 (App.6). It considered both to result from too little consultation with the industry itself. Though still only for enabling powers, the clauses would have increased the pressure for it to accede to arrangements which it viewed as incompatible with commercial operation. It regarded the objective of the most economic use of national resources as demonstrably inconsistent with paying more than its own marginal costs.²⁴⁰

Neither the Plowden report nor pre-legislative hearings on the Bill²⁴¹ considered whether and how the proposed new structure of the ESI would conflict with the intention to facilitate CHP schemes. Part of the argument of sections of the industry which advocated greater devolution of responsibilities to regional level or the establishment of integrated power boards, was that such arrangements would allow and encourage innovation and adaptation to local conditions, and conversely that uniformity of generation practice in a centralised industry operated against CHP.²⁴² The arguments over structure continued after the shelving of the Bill, but were overtaken by different proposals from the incoming Conservative government. The specific provisions on CHP were to reappear.

Legislation: Energy Act 1983

The ESI was challenged again over CHP in similar terms in the Conservative government's Energy Bill, introduced in November 1982 and enacted in May 1983.²⁴³ Though its CHP provisions were likewise incidental to its main purpose, the topic assumed greater importance in the justification of the Bill. As part of the government's measures to allow private sector involvement in activities in the public sector, thereby to 'encourage competition' and 'reduce the nationalised industries' monopoly power',²⁴⁴ the Bill included clauses to

- allow private generators to use the public transmission and distribution system to transmit electricity;
- oblige Electricity Boards to offer to buy electricity from private generators and to supply them and their customers;
- allow companies to supply electricity as a main business, removing the statutory prohibition under the Electric Lighting Act 1909;
- and oblige Electricity Boards to publish tariffs for the purchase of electricity from private generators and for the use of the grid by them.

The Labour opposition opposed the Bill on the grounds that no demand for private generation powers had been shown, that guaranteed access to the grid gave a guaranteed share of the market rather than competition, and that the measures gave a 'disguised subsidy' to large consumers at the expense of the rest. If the expected private response to the Bill was small, it was unnecessary; if large the public electricity supply system would be disastrously affected.²⁴⁵

There was also considerable opposition within the ESI to the main purpose of the Bill, which was seen as ill-conceived and a product of too little consultation. While accepting the determination of the Government to enact it, the industry intervened continuously in its formulation and passage to minimise its impact and obtain a result which it regarded as at

least workable.²⁴⁶

Throughout the passage of the Bill, the supposed encouragement the measures would offer to CHP, particularly in industry, was used by the Conservatives as a major argument. It would, according to Peter Rost MP, remove 'institutional obstacles and statutory restrictions' and 'encourage the private utility, in partnership with municipal authorities and industry, to develop lead city large scale district heating.'²⁴⁷ The Labour opposition pointed to the absence of any reference to CHP in the Bill, and asserted it had 'nothing to do with CHP'; in particular they saw private generation as irrelevant to the lead city CHP/DH schemes. CHP was being used as 'a window-dressing for other purposes'.²⁴⁸ In the absence of demonstrable demand, the Government 'filled the ideological and intellectual vacuum which the Bill leaves with the concept of combined heat and power'.²⁴⁹ It was not until the Committee stage that a group of amendments was put forward to change the ESI's obligations on CHP. Rost in particular had to admit that the Bill, while promoting industrial CHP, did 'very little for the larger scale district heating, which many of us have thought needs some promotion as well'.²⁵⁰ An opposition MP remarked

Any layman listening to the Second Reading debate on the Bill would have thought the entire Bill was about combined heat and power. It was a curious state of affairs that we had to wait until the fag-end of the 13th sitting of the Committee to debate new clauses tabled by Government back-benchers and the Opposition Front Bench before we actually started to say anything constructive about combined heat and power.²⁵¹

The Government recommended acceptance of an amendment tabled by Rost:²⁵²

(1) For subsections (1) and (2) of section 50 of the Electricity Act 1947 (use of heat from generating stations) there shall be substituted -

"(1) It shall be the duty of every Electricity Board to adopt and support schemes -

(a) for the combined production of heat and electricity, and
(b) for the use of heat produced in combination with electricity, or incidentally from its generation for the heating of buildings or for other useful purposes.

(2) Nothing in subsection (1) of this section -

(a) shall remove the need for an Area Board to obtain the approval of the Secretary of State under section 6 of the Electricity Act 1957 to proposals for the generation of electricity

by the Board, or

(b) shall require an Electricity Board to undertake expenditure in connection with a scheme which does not meet the financial criteria applied by the Board in relation to other expenditure of the Board."

(2) In subsection (3) of section 50 for the words "the last foregoing subsection" there shall be substituted the words "subsection (1) of this section".

The amendment was intended to 'remove any existing doubt about the attitude that boards should adopt towards combined heat and power schemes and the use of heat from ordinary power stations.'²⁵³ Attempts, however, to strengthen the wording - 'promote' instead of 'adopt and support' - were resisted²⁵⁴, and subsection 2(b) was included at the insistence of the ESI. The government rejected an amendment to allow the Boards 'to pay more for supplies of electricity resulting from schemes of combined heat and power than those supplies would have cost the boards if generated by the generating board itself.'²⁵⁵ The clause was essentially the same as that in the Plowden report and the 1978 Bill to which the Board had objected earlier. It had been mooted for the 1982 Bill itself until after strong pressure from the ESI the government had accepted its argument that 'there must be no subsidy on either side and no adverse effect on a board's other consumers.'²⁵⁶

Thus on CHP the two most important provisions in the Energy Act were section 19, the duty to 'adopt and support' CHP schemes but with the financial escape clause for the ESI, and the obligation to publish tariffs for buy-back. The letter of the legislation on CHP was widely regarded, including within the industry, as no significant change and at most a slightly firmer statement of what had previously applied. The duty to 'adopt and support' was still open to interpretation, and s.19(2)b allowed the industry to continue assessing CHP schemes as before, including comparing them with other investment options. The industry's attitude was that it had already acknowledged the political pressure which the enactment of s.19 reflected and already felt an increased obligation to develop its policy and work on the subject. The wording itself did not change its attitude or the amount of its effort on CHP.²⁵⁷

But the existence of the clause, however ambiguous, was certain to be used to put pressure on the industry. Moreover, in trying to project s.19

as the fundamental change critics of the ESI had sought, the government added statements which would reinforce this. The Act gave 'the electricity boards a new duty to promote economic schemes ...';²⁵⁸ and 'the Board should treat combined heat and power schemes on the same economic basis as other projects - no more and no less.'²⁵⁹ It was now 'beyond doubt that such schemes are to be considered part of boards' normal operations.'²⁶⁰

Tariffs

With the revived examination of the ESI's record on CHP, the contentious question of buy-back prices for electricity generated outside its system appeared again. The subject was of immediate concern to private industry or institutions operating or contemplating installing CHP plant, but it also raised questions of importance to possible CHP/DH schemes outside the industry. Protracted discussion in the Marshall Group failed to resolve differences of view, and it was suggested the DEN should undertake or commission further work on the problem.²⁶¹ Marshall considered the principles and actual terms negotiated fair, but exhorted the industry to give a greater part of potential benefits to outside generators to encourage schemes.²⁶²

In response to the Marshall Group recommendations, the industry moved in 1979 to a policy at least producing better hypothetical prices, with a maximum unit price of around 90% of the BST unit price and a capacity credit of about 80% of the BST capacity charge.²⁶³ Critics maintained, however, that few prospective generators were actually offered anything near this maximum. The prices paid to the 12 generators in 1980/81 who provided over 90% of private purchases ranged from 25% to 78% of the BST.²⁶⁴ The GLC claimed the price paid for electricity from its Edmonton plant was less than the CEEGB's marginal fuel cost.²⁶⁵ The industry was thus seen to be making a substantial profit at others' expense.

The Select Committee on Energy heard much evidence on the effect of tariffs, but while remaining uneasy about the issue likewise came to no firm conclusions or recommendations.²⁶⁶ The ACEC Industry Working Group concluded that there was 'little evidence to suggest that tariffs were the major reason why financial returns were too low to attract

investment', but considered the inflexibility of the ESI's approach discouraging. It detected 'a tendency ... for discussion to start with two mutually suspicious parties taking up antagonistic positions as a negotiating ploy.'²⁶⁷

As already described, the industry objected strongly to proposals mooted for the 1982 Energy Bill to permit it to buy at rates above its own generating costs, as it had done to earlier such ideas. The government accepted its case.

In 1984, after protracted internal deliberations, the boards published the tariffs stipulated in the Energy Act.²⁶⁸ Controversy continued, critics pointing to various anomalies and ambiguities, and the industry pointing out the novelty of true system marginal costing, and maintaining that the tariffs must be provisional as the method evolves.²⁶⁹ Though the principles of the setting of tariffs were laid down and the price components listed, the actual data and calculations used to arrive at the components were not made public. There also remained considerable discretion in the application of the components and the Boards still considered the tariffs essentially negotiable. It was still contended that the industry was not accounting for all its avoided costs. Some observers considered the tariffs worse for private suppliers than before the Energy Act. The industry claimed they were better, particularly since they incorporated a form of capacity credit in a variable unit rate. Though generators were in a better position to assess their treatment than when the basis of the tariffs was completely obscure, there would still be no impartial check on their construction. A CHPA Tariffs Forum attempted to obtain more detail from the industry and clarify the issues.²⁷⁰

As regards major generating plant outside the public system, it was made clear in 1984 that the Energy Act tariffs would not apply to projects such as the Sheffield consortium CGCC CHP station, though its planners had initially assumed they would. Terms for them would have to be negotiated directly with the CEGB.²⁷¹

Plant Choice and Sites in the DEn Programme

Most of the ESI investigations of specific CHP opportunities in the 70s were for small schemes which might have fitted expediently and peripherally into the technical and economic conditions dictated by the existing system and its projected development. In parallel with this activity, however, the industry was drawn into investigating and planning for CHP/DH on a different scale. Its substantial work for the Marshall Group did appear to shift the industry's view of the scale of possible CHP/DH developments. It was subsequently involved in the DEn programme, represented on its steering group and cooperating in Atkins' site-specific studies.²⁷²

The ESI's near monopoly of resources and expertise, and the implications of any significant CHP development for its operations, meant that its involvement in the Marshall studies and later the DEn work was natural and seen as desirable. However, especially with the government's rejection of a national authority for DH and CHP development and thus its pursuit through existing institutions, the CHP side of the work increasingly came to be placed in ESI hands and the assumption gained strength that it would build and operate main CHP stations. A large CHP scheme would in any case coexist with the main generating system and its configuration be determined as much by the economics of connection with the grid as by the technical needs of the scheme itself. But having the development of ideas for plant performed by the ESI meant that assumptions to suit the industry could be incorporated without challenge. While the need to do basic work allowed its ideas on CHP plant to develop, its choices were indeed clearly determined by its present and projected future generating system, taken as given.

For Atkins' preliminary study, the Boards agreed on new coal CHP plant in four standard sizes.²⁷³ In general debate the CEEGB continued to argue strongly, as the Marshall Group had done, the merits of large turbine sizes for fuel savings and economies.²⁷⁴ BP sets were chosen for a number of reasons indicated by the characteristics of the proposed schemes, such as site constraints and their low capital cost, and of the existing and projected generating system. They would require less space

and no cooling water. They would give a greater output of heat per unit of electrical output, advantageous to the economics when nuclear capacity was cheaper. The Board maintained that diesel and GTs were not suitable.

For the DE_n Stage 1 the industries were explicitly asked to select sites and appropriate plant configurations 'consistent with their future new power station policies'.²⁷⁵ The SSEB did not plan new capacity before the next century, and the CEGB's new nuclear programme would delay the need for new coal-fired power stations till the next century. By the time the final heat sources were connected, coal-fired capacity on both systems would be on intermediate load, so the BP plant they preferred would not be required to run extensively outside the heating season. Only the NIES anticipated needing new coal capacity before the turn of the century. A new station would provide base-load electricity; hence the suggestion of ITOC sets for Belfast.²⁷⁶ Significantly the CEGB independently also studied conversion of specific major stations: 500MW_e sets at Fiddlers Ferry for Merseyside, and the Hartlepool nuclear station for Tyneside; in both cases heat costs were greater than for new local plant.²⁷⁷ The SSEB similarly considered conversion of Cockenzie for Edinburgh.²⁷⁸

Another consequence of the lead city work was pressure on the ESI to retain power station sites which might be suitable for CHP stations, and to consider conversion of older power stations for interim heat sources in major city schemes or main sources for smaller ones. The CEGB agreed to retain specific sites for the lead cities - in particular, Leicester was included in the DE_n programme only after the CEGB was persuaded to retain its Freemans Meadow site - but resisted the suggestion of 'comprehensive retention of sites on the off-chance that a CHP role may at some time arise' because of the expense of such land-holding.²⁷⁹

Investigations and Proposals

With the Energy Act and the Select Committee report in 1983, and after protracted internal deliberation on general approach and the specific question of tariffs for interchange with the grid, the industry as a whole decided to give a higher profile to its CHP work, in part to stem what it saw as unjust criticism of its stance. The Electricity Council issued a formal policy statement and set up a CHP Bureau to act as an initial

contact point for enquiries, to coordinate Boards' responses and to consider organisational aspects of their involvement. A manager in each Area Board and CEEGB Region was designated as a contact for local enquiries.²⁸⁰

The CEEGB rationalised the three CHP routes which it had been investigating, as already described - conversion of old smaller stations, construction of new CHP plant, and conversion of existing large stations - as the range of possibilities through which it was pursuing the option.²⁸¹ The acknowledgement of these as feasible contrasted markedly with its prejudgement and rejection of them in the early 70s. The Board explicitly indicated, too, that it might take on bulk heat transmission from remote stations, rather than delimiting its responsibility at power stations boundaries.²⁸²

The electricity boards continued to have some involvement in the major schemes being developed within or alongside the DEN programme. The CEEGB and Area Boards declined to participate in the lead city consortia bidding for DEN support, cautious about an unprecedented arrangement and unsure of their legal position on financial involvement.²⁸³ The CEEGB did however agree to provide assistance in four cases - London, Leicester, Tyneside and Sheffield - with a view to eventual operation of the CHP stations. The SSEB, by contrast, was a member of both the Glasgow and Edinburgh consortia, and the NIES joined that in Belfast (App.8).

In Tyneside and Sheffield the local authorities, as part of work independent of the DEN programme, asked the CEEGB to look again at plant configurations. In Sheffield the Board reconsidered its Blackburn Meadows site which the Atkins report had mentioned but excluded in favour of Neepsend, looking at a single set, since the two set arrangement dictated by the Neepsend site had given comparatively poor results.²⁸⁴ The heat costs given to Sheffield were prohibitive, however. For Tyneside the Board reassessed various options for interim and final sources, but again produced discouraging results which were considered contentious.²⁸⁵

In both these schemes the involvement of the ESI was seen as crucial but difficult.²⁸⁶ While initial contact with the CEEGB was encouraging,

and the Board nominally supported the bids to the DEN and Sheffield's to the EEC, as negotiations over sites and costs became more detailed, the Board was perceived as less helpful. Though the attitude of the ESI might not be a direct hindrance for the first few years of a scheme, it was seen as essential that problems were sorted out so that ultimate connection to a large CHP source could be assumed in planning. It was considered important to get the industry involved more fully. Sheffield's tactic was to try to convince the ESI that its CGCC scheme could benefit the industry as much as other parties, and thus that it should agree to operate the plant. It was recognised that the CEGB's stance might have to be challenged at national level politically or in the courts.²⁸⁷ In mid-1986, Sheffield threatened legal action based on the Board's obligation to 'adopt and support' schemes, and the industry in turn sought clarification of the clause.²⁸⁸

Outside the major city schemes, the involvement of the industry has followed the pattern of the 70s: with efforts to involve it in local projects initiated by others, and with limited initiatives from one or two Area Boards.²⁸⁹ Kirklees Borough Council initiated short-lived discussions in 1981 on conversion to CHP of the 60MW_e Huddersfield power station, scheduled to close the next year.²⁹⁰ In Brighton community groups and consultants in the CHPA pressed unsuccessfully for the conversion of the 330MW_e power station at Shoreham Harbour to refuse and coal CHP operation.²⁹¹ At Corby, the EMEB, GEC Energy Systems, British Steel and Corby DC undertook a study in 1983 of a 20MW_e/40MW_h refuse-fired CHP station for industrial heat supply, with a view to forming a consortium. The Board, GEC and the Council continued the work, and obtained an ERDF grant of £14m towards an estimated cost of £56m. By mid-1986 an apparently viable scheme awaited confirmation of arrangements for a supply of refuse locally and from urban centres by rail.²⁹² The EEB joined a similar joint venture with Utilicom and Basildon DC, forming the Basildon Heat and Power Company in 1984, to assess a £1.5m 12MW_e/70MW_h coal- and refuse-fired industrial CHP scheme. Initially favourable financial assessments were adversely affected by the oil price drop in 1985-6 and the scheme was shelved.²⁹³ The EEB also considered a DH scheme for Great Yarmouth, based on conversion of two 64MW_e sets in the 256MW_e South Denes power station to ITOC operation. In 1986 work was continuing on a market survey and technical testing at

the station.²⁹⁴

The MEB obtained approval in December 1981 for its second industrial CHP scheme, a $24\text{MW}_e/55\text{MW}_h$ station for the Fort Dunlop factory in Birmingham.²⁹⁵ The plant is a combination of diesel engines and coal-fired boilers in which the former heat the combustion air and the feed water for the latter. The discontinuation of the main heat-using process during the construction of the station has left the MEB to look for other heat customers. Meanwhile the Board's experience with its Hereford diesel station was mixed. There were problems initially with the engine mountings and turbochargers, though it was later claimed to be running at design efficiency, and ran continuously during the 1984-5 coal industry dispute. The economics of the station were badly affected by a fourfold increase in fuel price in the first four years of operation, and by an enforced change in accounting methods. The station was converted to dual oil/gas firing in 1985, following an agreement by British Gas to provide a supply; the subsequent drop in oil prices, however, has again favoured oil.²⁹⁶

In the early 80s the CEGB and MEB studied the conversion to CHP of two serviceable 60MW_e sets in the Nechells station in Birmingham, for heat supply to surrounding industries. After several of the potential heat consumers went out of business and others took up government grants to convert oil-fired heating plant to coal, the CEGB offered the station for sale, but no private purchaser was found.²⁹⁷

Private Generation, Utility Companies and Micro-CHP

In terms of private sector interest in competing with the CEGB's main business, running large generating stations solely for the export of electricity, little response to the 1983 Energy Act was expected or obtained.²⁹⁸ Notable exceptions were proposals by major engineering companies to buy the CEGB's 217MW_e Plymouth and 292MW_e Camarthen Bay stations, both of which produced no outcome.²⁹⁹ But the EC's CHP Bureau was the focus of a 'flurry of interest'³⁰⁰ in smaller scale operations, from equipment manufacturers - some established, some perceiving a new market; from existing or prospective operators, including major firms seeing it as an extension of their activities; and concerning

the connection of small units to the grid which the Act was intended to facilitate. Two potentially significant developments can be identified, both - despite the widespread scepticism about the relevance of the Energy Act to CHP during its passage - based on CHP.

First is the possibility of private utility companies set up to run CHP stations to supply heat and electricity to industry. The ACEC Industry Working Group advocated this arrangement in 1983 and recommended government should encourage it, concluding from an investigation of obstacles to the wider introduction of CHP plant by industry that this would be the best way of overcoming them.³⁰¹ It accepted that the ESI was prepared to cooperate in industrial projects but, with a marked shift from its earlier position, also accepted the industry's reasons for limited involvement: it

suffered from overcapacity and did not possess the right framework for commercial operation of small-scale generating plant. Nor was it reasonable to expect the Electricity Boards to enter the business of marketing and distribution of heat.³⁰²

Private sector initiatives, however, still met with difficulties in negotiation of interchange arrangements with the ESI. Even though, the Group considered, there was little suggestion that tariffs were in themselves inhibiting, the protracted and antagonistic process could still dissuade companies for which energy supply was a subsidiary operation. The Group concluded 'there would be little activity in this area unless sections of industry took it upon themselves to build and operate CHP plants, selling steam and electricity to one or more industrial users'³⁰³ - that is, utility companies would take up the role the MEB had adopted at Hereford, thereby relieving companies of these ancillary activities and associated problems. Negotiations between specialist utilities and the ESI would probably be easier for both sides. However, such utility companies, relying on long-term contracts with consumers, might 'require some sort of safeguard from Government to ensure that (they) will be protected from the effects of changes in Government policy relating to energy pricing ...'³⁰⁴

Existing heat companies, of which there were a dozen in the mid-80s, might extend operations to take up this role.³⁰⁵ A precursor exists in Slough Estates, which supplies electricity and heat to industrial consumers

on a 240ha site at lower costs than public supplies.³⁰⁶ Its power station has steadily expanded since the 1920s and became an anomaly when it was exempted from nationalisation. With the connection of the station to the grid in 1966 and its conversion to dual oil/gas firing in the mid-70s, the company has been involved in disputes with both the gas and electricity industries over pricing; specifically it claimed that plans to install base-load RFO-fired plant in the mid-70s were thwarted by failure to agree terms for export of electricity to the SEB.³⁰⁷

The second trend is the growing popularity in the mid-80s of micro-CHP for large private and public buildings and complexes. These package units, in the range $15\text{kW}_e/40\text{kW}_h$ to $150\text{kW}_e/260\text{kW}_h$, are mainly derived from vehicle engines and incorporate heat recovery from the engine cooling system and exhaust. They run on natural gas, LPG or biogas. Typically the unit is sized for base heat load and combined with existing heat-only boilers.³⁰⁸

Advocates claim that such systems can satisfy private sector investment criteria, with pay-back times of around 3y; that capital costs per unit power are less than half those of the CEGB's nuclear stations, and the cost of electricity produced comparable or lower; and that they provide greater reliability for users and collectively could be treated as providing substantial firm capacity.³⁰⁹ Some adoptions have been supported by a DEN Demonstration Scheme, and grants have been available for feasibility studies.³¹⁰ It was further argued that more rapid adoption from 1980 was inhibited by the absence of technical arrangements and clear tariffs for interchange with the public supply.³¹¹

The significance of these assessments is that private CHP generation would become attractive under a wide range of conditions, rather than in exceptional cases, and that the economic level of adoption could thus remove a significant part of the ESI's demand.³¹² While Areas Boards dealing with parallel running arrangements for individual installations are reported to have been cooperative, the CEGB has publicly remained defensive to accusations of indifference to the option of smaller generation plant which have accompanied publicity for micro-CHP, and sceptical of its applicability.³¹³

While the beneficial effects of the Energy Act on the adoption of micro CHP were generally acclaimed, some critics maintain that the industry is still inhibiting introduction of small-scale CHP through its actual handling since 1984 of the arrangements stipulated in the Energy Act.³¹⁴ With the limited effect of the Act in improving the attractiveness and uptake of private generation - total capacity and output continued in fact to decline³¹⁵ - calls for restructuring of the industry from the private sector and the political Right have increased.³¹⁶

Sizewell Inquiry

Though the activity in the early 80s induced the ESI to take large scale CHP/DH seriously, the pattern of the programme - its fragmentation into a small number of separate schemes - allowed the industry to continue treating the option as peripheral, in two senses. First, schemes would be subsidiary to the main generating system and key elements in their design and economic evaluation would be determined by that relation. Second, the option was not treated as central to the industry's main programme. Though from the early 80s it did include a notional element of CHP in its long-term forecasts,³¹⁷ the industry did not entertain ideas of CHP as an alternative to new condensing capacity. At the public inquiry into the proposed Sizewell B PWR, the Greater London Council made this direct challenge to the CEGB's programme, by attempting to show that CHP/DH for London was a better investment.

The GLC was trying to assert its interests in energy provision and use in London, to establish the elements of control it could have over it, and insofar as it had relevant powers and responsibilities, to develop a strategy for influencing its development. In the 70s its concern

began to broaden from, on the one hand, a concern with energy management in its own operations and on the other, a strategic concern with the environmental impact of major energy supply facilities, into a concern for the potential impact of the increased price and reduced availability of fuels on London as a whole the Council concluded "that the balance of advantage lies on the side of increased conservation rather than trying to increase energy supplies ..."³¹⁸

Specifically, its Planning and Communications Policy Committee, reviewing the findings of a GLC/CEGB/LBA Working Party on Power Generation in London, considered 'that any future power stations proposed in London

would need to be shown to be substantially more cost effective than investment in conservation measures before they could be regarded as acceptable.³¹⁹

The GLC case to the Inquiry on the issues of needs and economics³²⁰ thus centred on four issues: CHP/DH and domestic conservation, both as alternative investments to Sizewell 'B'; the potential for electricity conservation in London; and the macro-economic and employment effects of different energy investment options.³²¹

On CHP specifically, the GLC had, following the Southwark study and the recommendation of the London Working Party of continued study of the issue, adopted a policy of supporting CHP/DH, on the grounds that it could reduce the capital's energy demand; provide cheap heat; create employment; improve housing conditions; and reduce air pollution.³²² It pursued London's candidacy in the DEn programme.³²³ It then commissioned Orchard Partners 'to consider whether a major CHP/DH scheme for London could be evaluated on the same basis as the proposed power station and, if so, whether it would produce similar benefits for the electricity supply industry.'³²⁴

Orchards produced a series of reports on which the GLC's evidence on CHP/DH was based, including engineering aspects, scope, economics and employment effects of a London-wide CHP scheme, and its impact on the electricity supply system.³²⁵ The London scheme would be started in 1985 and completed in 2012, with a final heat load of 2895MW_h. CHP plant - six BP sets at the CEGB Barking site - would generate 888MW_e and 1686MW_h. The scheme was three times the size of that envisaged in Atkins Stage 1, and would cover Newham, Tower Hamlets, Hackney, Hammersmith and Kensington, plus parts of Southwark, Lambeth and Wandsworth. Economies of scale, engineering improvements and more specific data were claimed to give substantially better results than Atkins' assessment. Orchard Partners showed a phased implementation based on foreign experience. The scheme could:

- provide equivalent electrical capacity to Sizewell 'B';

- show better NECs on any of the CEGB's three background scenarios;
- give a 5% annual return on the DH operation;
- and provide heat at a cost 17% below that otherwise incurred.

The conclusions were robust against increased costs of fuel or DH equipment and decreased rates of growth of the network. The net capital cost was £1.73b against £1.17b for the PWR but the pattern of expenditure gave similar net present values for the two projects.³²⁶

Basing its case on these studies, then, the GLC witness argued:

- that CHP/DH in Inner London would be more economic than the PWR;
- that its extension to outer London would also be more economic;
- that the capital outlay would be comparable;
- that the investment risk was lower;
- and that the ESI could take the lead in its development.

The implication was 'that the Board's resources would be better directed towards seizing opportunities for the economic development of CHP/DH than towards constructing a PWR, both now and for an indefinite period into the future.'³²⁷ The Board had

failed adequately in the past to investigate the effectiveness of combined heat and power district heating schemes, and that (had) culminated prior to the Energy Act coming into force in its unwillingness or refusal to investigate combined heat and power district heating as a proper alternative to the construction of Sizewell B.³²⁸

On direction from the Inspector, GLC's consultants met with the CEGB to

attempt to resolve disagreements and establish what differences remained. The former were mainly seeking information; the CEEB, since it had said little on CHP in its case, was largely reacting to Orchard Partners' contentions. Orchards in turn sought to do its assessments on the same basis as the CEEB and accommodate as many objections as possible, thereby making the assessments comparable and meeting the CEEB on its own ground. One particular area of discussion came to predominate: modelling the effect of Orchards' London CHP scheme on the electricity system, and the consequent system savings. Results from the CEEB's own simulation generally corresponded to those produced by Orchards on an independent model.³²⁹

The CEEB's approach to the negotiations was seen to reflect the context: that CHP/DH was being raised by an objector to a major component of its programme as an alternative to that. It was thus extremely cautious. It did, however, do a substantial amount of work on the issues raised. According to the GLC witness:

They were obviously interested in not just saying that CHP was irrelevant, but they had decided they ought to take an interest in trying to show that even if you assumed it was relevant, and did the analysis, it would not come out as good as Sizewell.³³⁰

GLC representatives extracted in cross-examination, and argued against, several reasons why the Board did not consider it necessary or worthwhile to evaluate CHP/DH:³³¹

- that it would not contribute to a diversification of fuels;
- that the scale and rate of development could not match the PWR;
- that the Orchard proposals were not sufficiently precise;
- that the economics of CHP/DH were assumed to be marginal at best;
- that the PWR and CHP/DH were not alternatives in that they were 'pursuing somewhat different objectives', that they were not exclusive since both could be pursued, and implicitly that one

would not 'crowd out' investment in the other;

- that CHP was not perceived as a 'main generation option', as a 'short term option for massive generation for base load operation'.

The debate on the GLC's case for CHP/DH at the Inquiry thus centred on these issues. Though there was no definite resolution and at mid-1986 had been no pronouncement on them, the debate produced some clarification. A strong case was made that capital rationing could occur, had already occurred, and given the marginal treatment of CHP/DH under 'development and other projects', could operate against CHP. The Bloom Street project was conceded as such a victim of crowding out.³³²

The Board challenged a number of specific items in Orchard Partners' scheme in an attempt to demonstrate overoptimism or inadequacy: the cost of flue gas desulphurisation equipment on CHP stations; load factors; the use of selective market-derived pricing rather than uniform pricing; and the separate viability of the CHP station and DH network.³³³ On the first two there was eventually reasonable agreement largely in Orchard's favour. The last challenge Orchard absorbed in accordance with its general tactics, by setting out the economic case in a number of ways to show the viability of the scheme on whatever terms the CEEGB chose to assess it.³³⁴ The Board also stressed, with some success in appealing to the Inspector, the institutional difficulties of pursuing such a scheme.³³⁵

The CEEGB argued that its position on CHP had not been important - that other factors had prevented its development.³³⁶ Though its witness regarded the ESI as a second best choice in the absence of a national body responsible for DH development,³³⁷ the GLC's formal argument for the purpose of its case was that the ESI had the power and ability to pursue CHP vigorously if it chose to do so, and that its choice not to had thus made a significant difference.³³⁸

Effects of the context and framework of the Inquiry have to be borne in mind when interpreting positions and debates. CHP/DH was being raised as an alternative to a development regarded as essential to the ESI's main programme and therefore with great commitment to it. The industry thus

had to attack the GLC proposals and assessments, and its attitude may have at least appeared more negative towards the option. At best it considered CHP/DH a side issue clouding the main purpose of the Inquiry; at worst, a credible proposal posed as competing was an obstruction. This was especially threatening as the GLC witness showed it could be argued that the ESI under its statutory obligations ought to pursue CHP/DH as a better investment option in its own terms. In terms of the ESI's own protection clause in the Energy Act 1983, he suggested setting the cost of heat so that the NEC to the CEEGB was at least equal to that of the best electricity-only investment option.³³⁹

It is highly unlikely that the Inspector's report will favour the CHP/DH option as outlined by Orchard Partners instead of the PWR, though it could contribute to convincing him that the CEEGB had not sufficiently considered alternative investment options. However, the GLC case on CHP/DH was significant in a number of ways. It was the first direct and detailed proposal of CHP as an alternative to the CEEGB's generation strategy in a major public arena and necessarily brought it to the attention of the Board as a whole. The CEEGB was forced to put considerable effort into evaluating and contesting the Orchard work and thus to develop its understanding of the option in a more fundamental way than was the case when assessing smaller peripheral schemes. The CEEGB indeed countered with an alternative scheme for London, based on the conversion of four sets at Kingsnorth power station to ITOC operation and the construction of Sizewell B, giving the same electrical and heat capacity.³⁴⁰ The GLC witness perceived an improvement of attitude to the option in certain individuals. Though there was no fundamental change, the debate forced the Board to elaborate, and on some aspects qualify, its policy towards CHP, adding to the effects of activity and debate on CHP in other arenas.

Second, however, the defensive attitude towards CHP, produced by its role as a challenge to Sizewell B and therefore to ESI strategy, may remain. Third, as was the intention of the GLC, the visibility of CHP as a major option was significantly raised and understanding of it furthered.

8.7 THE BROADER POLITICS OF CHP/DH

Outside the DEn Programme

Activity on CHP/DH in the 80s has been dominated by official studies of national potential and a centrally initiated and controlled programme. The use of CHP/DH as a testing ground for Conservative attempts to reintroduce private sector involvement and control into energy and infrastructure has itself given the option a new political significance. At the same time, however, there have been a number of developments concerning the option outside the mainstream activity. These at first sight appear disparate and of limited impact, but it is argued in this section that they are significant both for the prospects of the option and for the energy sector as a whole. First, they demonstrate the development of a broad and durable consensus on the desirability of introducing CHP. This spans divergent views on the changes to be made in the organisation of the sector, and produces some unlikely alliances. Second, looking at one part of this spectrum of support, CHP/DH has emerged at the meeting point of a number of debates and initiatives in the political Left and the environmental movement, and as an idea and a practical objective has become well integrated into alternative strategies for the energy sector. As already indicated, this axis of support has emerged in a practical form around local authority initiatives.

In part, activity outside the DEn programme is a continuation of that in the 70s - the general concern for energy conservation and efficiency, the trickle of initiatives for CHP schemes involving the ESI considered in the last section, and the pattern and problems of introduction of HO/DH schemes, the significance of which is discussed below. In part it has been stimulated by the increasingly favourable assessments of national potential and the publicity and information associated with central events. And it is also a result of the slow progress and the narrowing down of the scope and terms of the DEn programme, and the government's avoidance of significant central support or public funding. Above all, the activity has been shaped by the interaction of these currents with wider developments in the energy sector and in the relations between central actors. Its significance is a result of a crucial position in this changing context.

Developments in DH and Generation Technique

As the Marshall Committee stressed, the establishment of large scale CHP/DH was in any case dependent on building up load from separate DH networks, and in the specific circumstances of the 80s proposals any new ones, if not actually constrained to be economically viable in themselves, would at least need to provide significant revenue to service capital charges for the overall venture. But the impetus for CHP/DH came when HO/DH introduction had declined. As described in 7.1, few schemes were being installed by the early 80s, and some were being dismantled. The economics of existing schemes for housing loads were seriously in doubt and their reputation in many areas poor. Stopping and reversing this trend would depend on technical improvements, and on persuading both consumers and local authorities that problems could be overcome - specifically that refurbishing unsatisfactory schemes was better than abandoning them.³⁴¹

There has yet been little comment on the general effects of increased information and activity on DH technology as possible large-scale introduction approaches. It seems likely that improvements are a matter of ensuring application of best European practice rather than requiring basic research on technique; much of the criticism of assessments has concerned technical practice which could reduce network costs.³⁴² One major advance, however, in an area which had long been seen as a crucial limit on the acceptability of DH, came with the introduction of better heat meters: first electromechanical devices, still considered limited by operating conditions and maintenance needs, and then in the early 80s fully electronic meters.³⁴³ By the mid-80s electronic metering was being offered to heat distribution operators such as local authorities incorporated in a prepayment heat controller (PHC) which appeared to solve the key technical and administrative problems: it was acceptably reliable and accurate, and used absolute measurement rather than apportionment; its cost was reasonable; it prevented meter theft; it could be programmed for a range of tariff structures and credit provisions; it obviated charge collection and hence consumer debt; and it could be fitted in new or existing networks.³⁴⁴ The impact of this development on the economics and acceptability of DH has likewise yet to be assessed.

The main meter supplier and charging service operator, Mainmet, was involved in the consortia for all nine candidate cities in the DEN programme, and could expect greatly expanded business even with a few major schemes proceeding. Other manufacturers of DH equipment such as prefabricated pipe systems have taken a lower profile, partly because of continuing doubts about major schemes ever starting. Several foreign companies have set up UK outlets to take advantage of such development as may occur, and have been visible at trade missions and conferences, but any likely British market would represent a relatively small addition to their production.³⁴⁵

The prospects for other generation techniques and heat sources can likewise be seen in part as continuations of trends from the concern with efficiency and conservation in the 70s, but boosted by the activity around CHP/DH and caught up in the political and commercial developments analysed in 8.4-8.6. The increasing popularity of micro-CHP units has already been discussed. The gas industry has been more willing to make supplies available for generation and has itself devoted research effort to micro-CHP.³⁴⁶ It has shown interest in combined cycle plant for large scale generation in city CHP/DH schemes like Sheffield. These moves, and a perceived shift in general attitude to CHP since the criticism directed at the industry in the early 80s,³⁴⁷ are consistent with a straightforward commercial calculation that such involvement is the best way of retaining or regaining markets in changed circumstances.³⁴⁸

British Coal by contrast has seemed detached and ambivalent. It has acknowledged the prospect of substantial quantities of coal being used eventually in the major schemes - the nine candidate cities in Atkins Stage 1 would require between 0.3 and 1.5Mt/y³⁴⁹ - and undertook associated investigations on combustion technology and transport systems for fuelling power stations.³⁵⁰ It was, however, pessimistic about the chances of the schemes being financed, and would not include CHP in its long-term planning without government guarantees against loss.³⁵¹ While supporting consortia bids it declined to become a member.

Interest in refuse, and particularly in RDF, as a heat source developed throughout the 70s. The pilot RDF pelletisers at Byker, Doncaster and Eastbourne,³⁵² the GLC Edmonton refuse-fired power station,³⁵³ and the

Sheffield and Nottingham schemes, provided experience. The possibility of refuse-based core DH schemes in major cities reinforced the interest. Heat companies and joint ventures like that at Corby assessed schemes elsewhere. Calls resurfaced for a national policy and programme of heat recovery, based on modification of existing incinerators and construction of new plant. It was suggested that two thirds of Britain's refuse could be incinerated with heat recovery in some form, to give some 5Mtce/y.³⁵⁴ Wider use of RDF would allow both reclamation of materials and physical and organisational separation of the disposal and heat production functions.

DHA/CHPA

As through the 70s, much activity in the 80s has centred on the DHA, which in November 1983 changed its name to the CHPA to acknowledge the importance of CHP for the future of DH.³⁵⁵ The organisation itself, however, remained limited in its direct effect. From the success of its early lobbying, its efficacy as a pressure group appeared to have declined in the late 70s, though it did continue to be effective in stimulating parliamentary activity.³⁵⁶ It was constrained in part by its ambiguous role as a trade association, a lobby and yet also a forum in which were represented groups with different interests and often divergent views on DH.³⁵⁷ Its visibility remained a result of the activity of a few DH advocates among consultant engineers and dependent on their individual efforts, within a framework still dependent on the level of active support or tolerance of the energy industries.³⁵⁸ It did, nonetheless, provide an existing forum and channel in the early 80s for initiatives to coordinate local authorities' information exchange, mutual encouragement and collective lobbying, which as already observed provided useful continuity.³⁵⁹

Parliamentary Support and the Select Committee on Energy

Broad support for the idea of CHP/DH particularly as an energy conservation measure, developed out of the concern for energy conservation in the 70s and the favourable findings and recommendations of numerous reports in the area. As CHP/DH gained wider publicity, it was endorsed at least as a good idea by diverse groups.³⁶⁰ CHP did not accord just with a technocratic view of its rationality and desirability in engineering

terms, and with the social and environmental objectives of the political Left and environmental movements to be discussed shortly. Strong advocates could also be found in the political Right, among those who favoured privatisation and competition as a stimulus to efficiency and regarded the centralised and nationalised ESI as the main obstacle to the adoption of the option. They varied in the degree and form of government intervention they saw as needed to induce significant development.³⁶¹ Probably the most visible and consistent Parliamentary advocate of CHP throughout the late 70s and early 80s was the Conservative MP Peter Rost.³⁶² Though such advocates could reconcile support for general government policies in the sector and for CHP/DH - seeing its absence as a result of state distortion of energy and infrastructure markets - generally the consensus came into increasing conflict with what was seen as the government's retreat from involvement and the resultant slow progress.³⁶³

Both the breadth of this support for CHP³⁶⁴ and of criticism of the government's approach are shown by the proceedings and outcome of a timely investigation of the subject by the Commons Select Committee on Energy, conducted in late 1981 and early 1982 and published in 1983.³⁶⁵ The Committee aimed to 'examine the advice given to Ministers on CHP and to scrutinize Government policy in this area.'³⁶⁶ It considered in depth the Marshall and Atkins reports and the development and current state of knowledge on the economics of large scale CHP/DH, identifying major changes in thinking, the significance of disputes, and from these the senses in which CHP/DH could be considered to be economic. It also reviewed questions of organisation: the role of the ESI; the need for a National Heat Board; and the role of local initiatives and local authorities. It considered the effects of CHP on the energy industries and the role of the government.

The Select Committee's investigations were thorough and wide-ranging, forming probably the most comprehensive airing of the subject ever. It found difficulty in resolving many of the points of controversy on which it saw a need to make a judgement, in spite of long and persistent questioning of witnesses. Its report was able on many of them only to note and contrast the differing points of view and evidence. Its recommendations, however, were strongly in favour of CHP and intended to

remove obstacles to its development. Thus without spelling out more than a few of its judgements in retrospect, the manner of its recommendations for the future gave the impression of implicitly upholding criticisms of both the Government and the energy industries. The Committee supported the Energy Act provisions on CHP and the clarification of tariffs. It explicitly upheld criticism of the gas industry's conduct as described in 7.1, recommending supplies to CHP plant 'at a special tariff ... related to the price of coal', and tariffs in areas supplied by CHP/DH not cheaper than normal domestic prices.³⁶⁷

It accepted that in spite of 'some uncertainties' CHP/DH was 'the best of the options now when economics, comfort, fuel efficiency and long-term environmental benefits are taken into account' and recommended that 'steps be taken to put in hand appropriate Lead City schemes'.³⁶⁸ Seeing the gas and electricity industries at an advantage in being able to promote SNG and electric heating as natural extensions of their industries and in competition with CHP 'against the public interest', the Committee recommended:

In order that CHP/DH should not be placed at a disadvantage, ways should be found by the Government to arrange, assess and finance it on the same terms as the other public supply industries.³⁶⁹

The Government's response to the Select Committee in May 1984³⁷⁰ reiterated its general policy of allowing market forces to determine patterns of energy production and usage, and hence its approach to CHP, limited to removing 'legal financial and institutional obstacles' so that it could go ahead where economically viable. On the first two recommendations, their general phrasing allowed it simply to outline its procedure for 'encouraging' the formation of consortia to bid for contributions to the preparation of prospectuses. On the ESI, it claimed the Energy Act 1983 met most of the Committee's recommendations. On British Gas, the Government claimed it had no statutory powers over BGC's pricing policy, but would 'continue to encourage BGC to recognise the economic value of CHP schemes and adopt a sympathetic attitude to CHP operations in its pricing policy.' Statutes already forbade undue preference.

The response from the Energy Committee³⁷¹ thus found that the

Government's answers fell 'some way short of matching the scope and thrust of our original Report', avoiding addressing directly the report's economic arguments for CHP and avoiding specific problems such as the different criteria for assessment of alternative systems.

Convergence of Debates and Initiatives

A coherent and politically important axis of support has emerged in large part around local authority initiatives. Indeed the Labour metropolitan authorities have played an important role as focusses and channels for this issue and related energy politics, a role it will be argued in 9.3 contrasts with that in the two previous periods. Their central role in attempting to varying degrees to promote locally based economic initiatives, the recognition of the accordance of CHP/DH with their social objectives, and their attempt to maintain control over the form and organisation of its development, have been analysed. But CHP/DH has found an important place in the ideologies, strategies and practical programmes of various groups campaigning locally and nationally on energy issues. Their activity, in alliance on this issue with other sources of support, has been crucial in stimulating authorities' espousal of the option, in maintaining their interest and shaping their approach, and in helping to by-pass the increasingly limited DEn programme.

The personnel in these groups overlap; they include trade unionists, councillors, Labour Party and other activists, FoE, SERA and other environmental campaigners, academics, and workers and campaigners in community and tenants groups and fuel poverty initiatives. Locally they have sometimes grouped in 'Jobs for Warmth' and similar campaigns, promoting and pursuing CHP/DH for particular areas. Tyneside has been exemplary in this respect, in large part because of interest from the power engineering industry unions and well-developed energy policies and activities attached to the City Council. Similar initiatives were launched in Brighton and Ipswich.³⁷²

Nationally besides helping the collective attempt by local authorities to maintain and broaden the DEn programme, they have pursued and obtained at least nominal support from individual unions, the TUC and the Labour Party.³⁷³

The NUM in particular has increasingly taken on a role of advocating the maintenance of the industry and seeking outlets for coal, as the NCB has collaborated in the reducing the size of the industry and its marketing has weakened. While the NCB's support for CHP has apparently weakened, the NUM has taken it up as a central element of an expanded role for coal in the UK. Conference policies of support for CHP/DH in the labour movement and the Labour Party still sit uncomfortably alongside other elements of energy policies without their contradictions having yet been forced out in debate. The NUM's promotion of coal-based energy strategies has, however, required it to break the long-standing consensus of TUC energy policy, previously dominated by the electrical unions and producing programmes for expansion of supply and especially of nuclear power.³⁷⁴ The strengthening of opposition to nuclear power within the Labour Party and unions, particularly after the Chernobyl accident in April 1986, is likely to force more direct engagement with energy issues.

CHP has thus been taken up as illustrative of the issues in a number of overlapping debates:

- energy strategies, the environment, conservation and alternatives to nuclear power;³⁷⁵
- the role of coal in UK energy provision, the maintenance of markets for it, and the defence of the industry against run-down;
- fuel poverty and living conditions;³⁷⁶
- unemployment, problems of the inner cities and local economic regeneration;³⁷⁷
- problems of the nationalised industries, alternative forms of public ownership and in particular the devolution of centralised state functions to regional and city levels;
- and criticism of the ESI over its nuclear programme, overforecasting and excess capacity.

For the groups involved in each, CHP/DH is seen to accord with their objectives and principles, and to provide an opportunity for working out concrete proposals and achieving progress in a time of economic and political constraints. Some proposals for institutional forms for CHP/DH, for example, advocating greater decentralisation and horizontal integration of the distribution ends of energy chains at regional and city level, have consciously drawn on these debates as well as on foreign experience.³⁷⁸

The concrete results of this alliance of groups around CHP/DH and its emergence as a common element in several issues of debate, have been fragmentary. Their significance is rather that a body of support for the technique has been built up and that it will have been integrated into alternative strategies for local government and the energy sector should conditions change.

What would remain, even with a change of government and an increased allocation of resources to local government or to CHP/DH specifically, is the organisation of the energy industries and their commercial framework, and in particular the ability of the ESI to maintain the practices and programmes which have marginalised CHP. Neither their general structure nor the specific mandate on CHP was successfully tackled by previous Labour governments. And of the emerging sets of issues listed, that concerning the nationalised industries, social ownership and the coordination of the energy sector is probably the least developed.

CHAPTER 9 THE TREATMENT OF CHP AND DH

9.1 CHP, DH AND THE ENERGY SECTOR

Introduction

Though the structure of the account and the aspects explored were guided by the framework adopted, analysis in the last four chapters was deliberately limited so as to provide a self-contained narrative not previously available.¹

In this chapter, first, the general character of the activity on DH and CHP in the four periods (I - IV) is compared and contrasted. Second, the discussion deals with three areas suggested both by the characteristics of the technical systems and by the corresponding division of responsibility which became established in this country.

- the treatment of CHP by the electricity industry;
- the development of DH networks, involving mainly local authorities;
- and questions of this division, coordination, and national initiatives, focussing on the role of central government.

This division broadly corresponds to that characteristic of much energy sector politics - interests organised around production and consumption processes, and relations between them as regulated, changed or mediated by the state. It stresses the importance of the different approaches and priorities in energy provision based on each; the different groups of actors, particularly of technical professionals and sections of government, aligned with each; and their differing abilities to secure arrangements to suit their objectives, commercially or politically.

As observed in 4.2, producer industries have generally sought to consolidate and maintain the structure of the sector in vertically integrated chains, with competition over common conversion or end uses,

strictly commercial terms of operation and a commodity relation with consumers. They have sought to minimise the political influence of consumers, so that only the market nexus of pricing and demand, with a constrained choice of energy forms, remains. Most state policy and action has been concerned with primary energy supply. Intervention in energy use has been limited and weak, and mostly achieved through prices. It was argued that this structure, reinforced by closed decision-making and a particular ideology, first acts in a number of ways against energy efficiency and second provides contingent and partial fulfilment of social needs for energy.

With this structure the predominant concern at the consumption end of each chain is cost - hence the usual equation of consumer interest with the lowest price of each separate commodity, and of its expression with demand levels. The broader conceptions of user interests which have emerged in periods of disruption or discontent with the operation of the sector have been based on use-values, concerned with cost but also with adequacy and other characteristics and effects of energy use.

The account of CHP and DH activity supports the general contention of 4.2: the dominance of producer interests has been maintained even when the state has intervened, whether expediently to modify relations in the sector for the specific purpose of encouraging CHP and DH, or more fundamentally to restructure the sector in response to externally imposed or internally generated crisis.

DH and CHP in the Energy Sector

The debates and negotiations on CHP and DH have concerned the design and introduction of systems using component technologies mostly already available. Basic technical feasibility was established early on, and adequate systems could have been constructed at any time. No fundamental technological advances were required before adoption could be contemplated. Only in limited respects has the appearance of new component technologies or a need for research and development work affected the course of the action. Thus the account has dealt mainly with groups responsible for system-building, rather than technological development. The main choice, whether considering national initiatives or

individual sites, has been between introducing CHP or DH and continuing with or introducing separate production of electricity and heat. The debate has been about whether the techniques were worth adopting.

The economic and political significance of the potential adoption of CHP and DH, and the pattern of interests around them, is best understood by situating the systems in the structure of energy chains outlined in 4.2, and relating their political contexts to the arguments advanced there about the general characteristics of the sector.

DH forms an alternative partial energy chain, from a conversion process with a variable scale and degree of centralisation, through a new distribution and end-use system. CHP is an alternative production process with twin products, requiring coordination to allow distribution of these products through their separate systems. At the consumption end, DH would compete with other forms of heat provision.

DH could be and has been administered in the same ways as other energy forms, with heat sold as a commodity; it would fit into the same category as other energy forms in, for example, Dunleavy's scheme of consumption forms.² It has at times been pushed by fuel industries in a conventional framework as it suited them according to the competitive domestic market, and support for CHP from the political Right is based on the assumption that removal of obstacles largely caused by state distortion of energy markets would show the technique to be commercially viable. The only inherent difference between DH and other energy distribution systems is in the coordination needed - for the distribution of joint products if CHP is used, and for the use of heat from multiple sources if this is undertaken.

The distinctive political character of DH derives rather from two sets of objectives with which it is identified. First, in conjunction with CHP, the use of waste process heat or of low grade fuels which can be burnt centrally, or some other advantage of central over individual heat production, is its possible energy savings. Hence its political visibility at times of fuel supply problems or concern for resource shortages. Second, it has been associated with socially defined objectives for energy provision in the domestic sector - cheaper heat, adequate standards, pollution

control, etc.

CHP and DH have thus been inherently associated with a critical stance towards the existing energy sector.³ Support for them has indicated discontent with existing performance in energy saving, adequate heat provision, and other benefits claimed for the techniques. In that their marginal economics within prevailing terms of reference has largely precluded them, advocates have frequently argued - effectively in opposition to those who see them as viable in idealised market conditions - that the value of these benefits is underrated or altogether ignored by conventional economic assessment.⁴ Political demands and much state intervention on CHP and DH, then, have been concerned expediently to accommodate or balance, or more fundamentally to integrate, objectives for production and consumption.

CHP and DH in the Four Periods

Since the basic notions of CHP and DH were established there have existed limited opportunities for their introduction in the energy sector as it developed as described in 4.2. The economic advantages to any of the interests in the sector within their existing terms of reference have at most times been marginal, and the choice of technical options and parameters in possible schemes have been tightly constrained. The growth of DH/GH in period III was produced by a coincidence of interest between local authorities and fuel suppliers because of changes in the domestic market. There was no strong motivation in terms of national energy savings. State intervention in III was limited largely to enacting changes in the detailed conditions of finance and legislation which operated against DH, that is, providing or facilitating some expedient accommodation between the existing structure of the sector and these alternative techniques. There was little possibility of significant change by political means on behalf of domestic consumers in the structures and programmes of energy producers.

In II and IV, economic upheaval in which the energy sector was central prompted state intervention and created political conditions in which an attempt could be made to resolve the division between production and consumption. Similar concern over coal shortages after WW1 produced

debate on energy efficiency and some interest in CHP and related techniques; the scope of state intervention was limited, however, and effort was concentrated on coal savings through rationalisation and concentration of the conversion industries, aims which had strong support from the technical professionals associated with them.

In II the economic incentive from acute energy shortages was combined with political and ideological support for improved domestic heating standards as well as demands for reorganisation of the energy industries for the benefit of the rest of the economy. In IV the immediate incentive of energy price rises was reinforced by concern for global resource limits. In both periods there was thus fundamental questioning of the patterns of energy use and of the organisation of the sector. Both had a relatively fluid phase in which possibilities existed for significant introduction of CHP/DH and for broader changes conducive to it. The nature of political activity in these phases, and the means by which producers maintained their position, were thus quite different to those in I and III.

Changes in organisational arrangements did emerge, but they preserved the basic relations of the sector and the dominance of the producer industries, weakened political control and accountability, and made coordination more difficult. The failure of reforming political action in the sector in II and IV has strong similarities:

- a retreat from state planning, and a reassertion of commercial objectives for the industries;
- associated with this, a change of government, giving more open expression to tendencies growing before;
- a shift from shortages or problems of primary energy supply to the possibility of expanding supplies as a long-term solution to the crisis, and hence a retreat from intervention in end use.

In both periods the attempts at national initiatives on CHP/DH fragmented into individual schemes constrained, as in III, by the existing organisational framework and accommodated only in contingent and unusual

circumstances.

There were also important differences, of course, between the periods, which will be explored further later:

- in the character of government policies for the sector;
- in the physical development of the energy systems;
- in the role of local government;
- in the identity and character of the arenas in which debate and negotiation were conducted.

9.2 CHP AND THE ESI

Explaining the Role of the Industry

The public electricity supply industry would necessarily be central to an account of the treatment of the CHP option in any country, through

- the context provided by its generation system and its programmes for the development of that system;
- its general policy towards CHP and its view of the role to be allocated to it;
- the boundary of responsibility it adopted in heat provision, and the forms of relations with other bodies across that boundary;
- and its actions on specific proposals and schemes.

There is in principle a range of positions on each aspect that the industry might have taken. Its attitude and political intervention might have represented complete opposition to the option as inimical to its objectives, through to support for that route and taking a lead in promoting it. Its form of involvement could have ranged from running complete schemes to leaving them entirely outside its control.

Explanation of the role of the ESI in the history of CHP in Britain is difficult.⁵ The industry has had no significant economic interest in pursuing the technique fully, nor in outright active opposition to it in the same way as the gas industry had for much of the time. Even the direct competition between district and electric heating has been a secondary consideration, qualified for the industry by a number of factors as argued later. Rather, the points of contact of the issue with its main policies and programmes have been contingent; CHP, potential and actual, has existed in or been squeezed out of the interstices of the industry's organisation and programmes.

Industry representatives' account of their own role has a technocratic

basis: that economic assessments of schemes have demonstrated that CHP has seldom been worthwhile and that the level of its adoption is a rationally produced economic - and therefore social - optimum. Certain critics on the other hand have taken a view of the industry's behaviour as malicious: that it has prejudged the issue and where necessary to thwart development has deliberately contrived assessments to legitimate its predisposition against the technique.⁶ Neither view is adequate as a general account - the first because of its positivistic and abstracted view of the nature and role of the economic 'facts', and the second because the motivations and mechanisms of exclusion have been much more complex and subtle, and not amenable to explanation in individual terms.

An adequate explanation of the ESI's role must recognise a number of points apparent from the study. Staff in the industry were aware of the option, the technics involved and the detailed arguments. There has existed at most times machinery within the industry for the assessment of the option in general and specific terms. The industry has produced appraisals and proposals, cooperated in studies and in preparation for schemes, and has operated limited schemes itself. It has at certain times come under considerable political pressure to introduce CHP, change its stance or justify its lack of involvement. It has been sensitive to that pressure. It has seldom resorted to determined overt opposition at a political level by denigrating the technique; most general policy statements have been open-minded if pessimistic. Among staff there has been a diversity of personal opinion about its merits and prospects, often following professional lines or those of divisions of responsibility within the industry.

Yet there has been continued criticism of the industry's attitude and actions, from its general unwillingness to take a lead in promoting the option down to its alleged obstructive behaviour in negotiating terms for specific schemes and its unfavourable assumptions in assessing them. Inquiries have frequently considered its record on CHP and, while having been unable to uphold most allegations of unreasonable behaviour, have continued to see its attitude as tepid and to exhort the industry to reconsider. Legislation on reorganisation has contained repeated attempts to make the industry's powers and obligations on CHP clearer and firmer. Critics have maintained their view that specific positions in negotiations have been unfair, and thus that there has been a discrepancy between

general public statements and detailed action.

Potential competition between electric and district heating has been suggested as a direct interest of the electricity industry in opposing DH. The question has, however, been complicated by several factors, and in terms of the industry's political stance on DH, it has remained a secondary consideration at most times. First, the industry has been ambivalent and opinion divided on the promotion of electric heating: while distribution interests relied on space heating loads for significant revenue, the problems they created through the pattern of demand on the generating system, and a realistic acceptance that relative operating costs to the consumer would remain high, have usually muted that promotion. In periods of widespread use of electric space heating - with radiant electric fires in the late 40s and embedded systems in local authority flats later - there were specific and exceptional reasons for adoption. Only perhaps in the 60s, with enthusiasm for nuclear power strong, were advocates of an all-electric economy confident in presenting electric space heating as competitive and a desirable main future option.

Historical Pattern of Involvement

The position of the industry up to WW2 is difficult to assess, as observed in 5.3. Diversity of circumstance among the many electricity undertakings prior to nationalisation might lead one to expect more proposals and schemes than the few which this research has unearthed. There is also little evidence of support or even discussion in the industries' national bodies, and some indication that they discouraged what initiative there was. Professional debates show considerable hostility to the idea among electrical engineers by the 1920s. A coherent commitment to condensing generation, in which continuous improvement in thermal efficiency was being made, was apparent by that time.

The period of the BEA, immediately after nationalisation, saw considerable discussion of CHP at the highest level. This period of fundamental reorganisation and rationalisation of the industry coincided with increased interest in CHP and pressure from outside to introduce it. The issue was caught up in three overlapping subjects of major importance to the industry's development and programmes:

- the working out of terms of operation of the newly nationalised industry and a relationship to its controlling department and Minister;
- the problem of coal shortages and conservation;
- and the need for an urgent programme to provide generating capacity, after inadequate construction and maintenance in wartime and with demand increasing rapidly.

The BEA considered thoroughly the general issue and specific schemes, in response both to the mandate of s.50 and the growing interest outside. It assessed, for example, the various roles it might take in construction and operation. Elements of a general position were worked out in large part over specific proposals. The wide ranging nature of the discussion reflected the lack of consideration the industry had given the issue previously, and was not exceptional in the context of complete reorganisation and planning for major expansion. With no immediately apparent consensus on how to approach CHP issues and what role the industry should take, it required time to sort out. The action taken over local legislation was not motivated by opposition to CHP but was intended to keep options open and to guard against disparate developments which could present problems later.

There was, however, unanimity on the main objectives of the industry after nationalisation: the need to build generating capacity as fast as possible to cope with the existing and projected shortfall. It was to this main project that policy and specific decisions on CHP were referred, and accordingly that it could be accommodated.

The industry did assume that a number of CHP/DH schemes would come to fruition even if it did not undertake them itself. It identified several points which required investigating, including the long-term effects of large-scale introduction of CHP on the economics of the industry. In fact, it did not pursue these questions explicitly to such depth. The questions posed by a need to respond to specific CHP proposals took precedence. As schemes proposed outside met difficulties and the number dwindled, the issue seemed less important and its stance more evolved

implicitly in the course of negotiations on specific schemes for the first few years. From 1950 it carefully avoided explicit policy statements but took a mildly pessimistic line on general potential. The industry took a minimal view of its own obligations and increasingly regarded CHP as something that if it were to be developed would be initiated from outside.

When it came under pressure again in the mid-50s, as the future of DH was seen to depend heavily on connection to CHP sources, the industry reacted strongly against suggestions for further involvement which it felt would have effects on its main programme. It successfully avoided having to formulate a general policy of its own or having the MFP do so for it. As for coal conservation, the industry was able to argue on the basis of prewar achievements that its own programme served this national interest best: that rationalisation of generating capacity into larger units would contribute more to saving coal and at less capital cost than CHP schemes.

Officials did continue to have the scope and take the initiative in investigating possibilities, but subsequent consideration was entirely case by case. The Authority could better control such ad hoc arrangements and stick to its strict costing; it was rigorous in guarding against any extra expense. Opportunities thus existed only as afforded by the detailed timing and economics of power station construction and operation. In addition to the marginality of the economics of heat supply in such tight conditions, the perception of the cautious attitude of the ESI contributed along with other factors considered shortly to the demise of the early postwar proposals. In short, though CHP/DH had by this time been marginalised, it remained a possibility insofar as it did not encroach on mainstream commitments.

The policies of the first few years of the BEA were based on rapid construction of electrical capacity to meet increasing demand. Its programme was subject to constraints of materials, capital and plant, but in financial performance only to a general obligation to break even. It was the Authority's interpretation - and a generally agreed one - of its statutory duties directed towards fulfilling a social need. If this thrust left little room for CHP, then the position of the option under the commercial terms of operation which were introduced gradually during the 1950s would have been no better. As it was, the industry's programmes

were justified on a mixture of commercial grounds and strategic and tactical political grounds. While mainstream projects like the Magnox programme proceeded in spite of acknowledged poor economics, optional projects like CHP were the first to be subjected to more rigorous investment appraisal and moreover to a higher discount rate.

The technological trajectory of large and remote condensing stations, then the increasing commitment to nuclear power, guaranteed the continued marginal position of CHP, though the CEGB carried on devoting engineers' time to assessing possibilities. Its small actual involvement in steam supply and the Pimlico and Spondon schemes were legacies of early commitments, and their poor financial results made a strong impression within the industry. Pessimism was pervasive and the few general statements which mentioned CHP were discouraging.

The division of generation and distribution functions led to the separation of sometimes conflicting interests in partially autonomous organisations. It does not appear from the experience of the SSEB that integrated power boards would inherently have favoured the introduction of CHP. What might have led to more projects would have been a diversity of operating conditions and experiences, greater scope for the engineering interest in CHP which had been retained within the industry, and the knowledge of local conditions necessary for identifying the specific circumstances in which schemes might have been feasible. This is borne out by the albeit limited results of the activities of Area Boards and regional teams since 1974 and of involvement in specific proposals in the mid-80s as a spin-off from the DEN programme. The initiatives of the LEB and MEB were as much imaginative responses to specific incentives - from their relation either to their markets or to the CEGB - as products of a few individuals' enthusiasm for the technique, and the technical and economic constraints within which they had to be formulated were very tight. Again there were disincentives to Area Board initiatives and a steadily lengthening record of a lack of involvement in generation. Only limited contingent combinations of circumstances might have induced them to try.

In the mid-70s it was again external stimulus that forced the ESI to reassess CHP, albeit resonating with some individuals' better disposition to

it. Specific proposals continued to be evaluated rigorously and conservatively against a largely unchanged background of its existing system and its plans for future generation, and essentially as an adjunct to that system. With greatly increased interest in CHP and continued frustration at the lack of progress and at the industry's perceived indifference, a number of challenges have been made in the past decade:

- in attempts to strengthen the industry's statutory duties on CHP;
- in involving it in proposals and investigations;
- in encouraging and facilitating the introduction of CHP outside the ESI and effectively in competition with it;
- and finally in presenting CHP in political arenas as an alternative to the ESI's main investment programme.

Each has so far had limited results, particularly as the industry has retained control over the terms of evaluation, related to its own system and projected programme. Together, however, and in the context of wider criticism of the industry's programmes and performance and recognition within widely different political strategies of a need to restructure it, they point towards possible significant change in the future.

Marginalisation of CHP

Besides its structure - its organisation in relation to the production and distribution chain, its market relation to users and competitors, and its statutory framework - some other important general characteristics of the ESI were identified in 4.5:

- the elements of the policy paradigm in and around the industry;
- its associated commitment to particular technological trajectories;
- the incorporation of electrical professionals in the industry;

- and some of the ideological elements which justified its position, corresponding not only to the industry's interests but resonating with more general ideology.

It was indicated that this paradigm was reflected in its organisational structure; that the material results of this programme embodied in the generation system then provided various constraints on the possibility of alternative paths; and that the internal coherence of this level was reinforced until relatively recently both by the industry's successful performance in technical and financial terms and by its insulation from effective criticism. The relation between these elements and the exceptional strength of the paradigm warrant much more thorough investigation than is possible in this thesis. The intention was not so much to establish this general characterisation but to allow an exploration of how CHP fitted with it.

The option was already marginal by the time of nationalisation, in that the needed expansion and rationalisation of the generating system which formed the basis of its early policy paradigm was accepted before nationalisation and seen as permitted by it. Subsequent development has reinforced this marginal position both in terms of the constraints imposed by the developing system and in the perception of CHP as a diversion from primary objectives. The points of contact of CHP proposals and general discussion have thus been contingent. This was reflected in an insistence on case by case appraisal, and underlies the importance in the detailed studies of periods II to IV of the exact circumstances of each focus in the fate of the option, the need to go into detail to account for the outcomes, and the limited favourable circumstances in which actual schemes materialised.

This marginal position led the ESI to apply strict, conservative and overall disinterested appraisal, and to show a cautious and critical attitude towards outside proposals. Moreover the evaluation of individual CHP projects as peripheral additions to the existing system, as critics like Lucas have argued, disadvantages the option relative to the incorporation of CHP in the whole system in an optimal mix.⁷ All these features of its treatment contrast markedly with that of mainstream projects. At the

boundary of its involvement, in most cases to leave combined generation in other hands and occasionally to provide heat in bulk for another body to distribute, the ESI pursued hard commercial terms to displace as much of the cost and risk onto other parties. This limited potential role thus left the question of an organisational structure for heat distribution outside, and the division left a need for coordination. The industry could thus reasonably appeal to the lack of ready markets for heat as a disincentive to committing resources to CHP.

The poor findings of the industry's quantitative assessments of CHP thus derive in part from its terms of reference, and thus far can be considered part of a legitimate defence of its interests. In part they result from assumptions and methods which are contestable even within those terms.

As for the industry's qualitative arguments against more general adoption, some have likewise been seen as logically suspect and legitimating its preferred non-involvement. In some cases, reversals of arguments and attitudes have demonstrated their contingency. Conversion of turbines to CHP operation, for example, was summarily dismissed up to the mid-70s, was investigated thoroughly and projected as a key element of the CEEB's policy in the mid-80s, and it has been suggested may be positively favoured over new plant with overcapacity on the generating system.⁸ Similarly it has been both asserted and denied that the merit order of the generating system acts as an obstacle to economic operation of CHP plant.⁹

Because its approach has largely been reactive, the industry has appeared most negative towards CHP when the option has been associated with basic criticisms or opposition to industry programmes. Thus CHP suffered in the early 50s as an issue over which important ground was fought and principles established, particularly independence from Ministerial intervention and the primacy of commercial operation over politically determined social objectives. And in the 80s the option has been presented as an alternative to the CEEB's proposed PWR at Sizewell, and in general has become a central feature of many critics' visions of an alternative non-nuclear energy economy.

Determination of Behaviour

The role of the industry's statutes, both of s.50 of the 1947 Electricity Act and s.19 of the 1983 Energy Act referring specifically to CHP, and of the central duties of the industry in their possible detrimental effect on CHP, has been discussed frequently. Swain, for example, accords primacy to the legislation in explaining the industry's stance, through providing for ultra vires actions against it, and in encouraging 'the pursuit of ever increasing efficiency of electricity generation to the detriment of studying the optimum utilisation of basic fuels ...'¹⁰

Both clauses on CHP were inserted largely without consideration of the extent to which the structure and main objectives of the industry would conflict with it, and their vagueness and limited obligation allowed the industry to interpret them expediently and still claim reasonably to have discharged its duties. Attempts to strengthen these obligations have been successfully resisted.

The account supports the contention of 4.4 and 4.5 that the industry's behaviour cannot adequately be explained by the statutes alone. They have permitted rather than determined it. The selectivity of the industry's interpretation of its mandates must be explained in terms of its context and objectives. The statutory duty on CHP has been interpreted expediently and has presented no constraint and little incentive on the industry to act other than in accordance with its main programme. Similarly the statutory objective of cost-minimisation, while generally being an apt description of its programme, has at times been overridden by directions from government, as with the nuclear programme, and has at times conflicted with and taken second place to strategic objectives, as in the oversized construction programme justified by overestimation of future demand. This suggests that the statutory constraints frequently adduced as presenting an obstacle to CHP would have been no serious problem had the ESI and the government decided specific schemes should go ahead.

It has been asserted that the ESI could have taken a more active role in developing CHP schemes, and that this role could have been sanctioned by government with relatively little change in its terms of operation.

This judgement needs clarification in terms of the constraints operating on the industry. In the short term within the political and financial framework and alongside its main programme, certain constraints cited as preventing specific schemes could have been overridden or circumvented as they have been when it has suited the industry - that is, the constraints were selectively adduced in argument. The prospects for CHP in general would have been very different had a different programme been embarked on at the outset or a major change in direction made at any time, so that the structural constraints presented to potential schemes by the existing system and projected programmes of the industry would have been different. That the industry left CHP in a position of dependence on exceptionally favourable combinations of circumstance, neither accommodating it alongside its main projects nor giving it a central role in generation, was the result of the commitment of the industry to a particular programme, accepted by government and sanctioned by legislation rather than dictated by it.

9.3 DH AND LOCAL AUTHORITIES

Introduction

The politics and economics of heat networks have formed the second focus of the studies, producing a set of issues to some extent separate from those around CHP, but related in a number of ways. District heating is technically feasible without a CHP source and HO/DH has been considered economic in some circumstances. Most of the schemes proposed in the late 40s and early 50s were HO, and the boom in DH in the late 60s and early 70s was entirely based on HO sources. But its widespread adoption has generally been seen as dependent on ultimate connection with CHP sources to take advantage of the greater value of electricity so as to give cheaper heat, and of the savings of fuel over separate generation. Conversely, even a scheme intended from the outset to be connected eventually to a CHP source needs to be built up from smaller HO/DH networks; for a city wide scheme it is economic neither to construct a network fully and provide a CHP source immediately, nor to operate a CHP source feeding only parts of a network under construction.

Hence the key dilemma of the construction of CHP schemes: that an electricity utility requires an outlet for heat or a satisfactory expectation of such before it is worth contemplating introducing CHP plant; but the economics of the scheme may depend on the guarantee of a sufficiently cheap CHP source for it to be worth embarking on. Only if intermediate smaller HO/DH schemes are themselves considered economic or otherwise worthwhile, can the developer of a network be indifferent at least in economic terms to the ultimate source. Otherwise coordination of the whole scheme is necessary so that the risks to the developers of source and network of the other part not materialising are displaced or reduced.

The economics of district heating has obviously been dependent first on the cost of heat production, and second on characteristics of the site and form of settlement and hence the network costs. For a developer, appraisal involves some sort of judgement of the adequacy of revenue against costs, whether as a return on a private investment or for capital repayment and charges in the public sector. The acceptability of delivered

heat costs to the user has been judged relative to other forms of heating with which it would compete, and, where an increase in heating standards has been involved, relative to previous costs. At best the cost advantage of DH has been marginal, and changing prices have often removed it in practice.

The advantage, if any, has thus depended critically on the detail of appraisal methods and the values of parameters such as interest rates, discount rates, and amortisation periods. It has depended on the relative cost of fuels or in the case of a possible CHP source on the cost of heat and thence of electricity credits. Thus both in general debate and in negotiations over specific schemes, these detailed quantities have assumed great importance.

Local Authorities as DH Developers

The development of DH has historically centred on local authorities. Even where initiative has come from engineers or from central government, local authorities have been the channel through which schemes could be implemented. It should be recognised that this centrality and the nature and extent of the local authorities' role is not fixed. Their various functions have developed or changed throughout the century and have varied among authorities, so that their inclination and ability to undertake schemes has varied. The extent of private sector involvement has varied too, from the limited role of design and construction contract work in the early postwar years, through construction and operation by heat companies on authorities' behalf in the 60s and 70s, to the possibility of significant or even exclusive control of schemes in the 80s. The similarities with local gas or electricity production indicate that DH in principle could have been developed by private firms perhaps under similar state regulation. Even within the public sector, DH could have been vested in a separate section of the local state as has other energy provision.

One must therefore look to institutional factors of the sort discussed in 4.6 to account for the actual predominance of local authorities. First has been their comprehensive and developing responsibility for administering services and regulating other local processes. Of importance here are the areas of planning, infrastructure, local economic development, housing,

welfare, environment, and public works. Second, closely related to several of these functions, is authorities' role as a political arena in which consumption issues are raised and consumption forms determined, and a channel through which many dealings with central government on these issues are conducted. Insofar as DH could fulfil objectives in these areas of activity, either locally determined or with local authorities acting as agents for centrally decided programmes, and because its development has implications for all of them, authorities have assumed the role of at least instigating or overseeing proposals. Third is the relation of private interests which undertake public works: for these, local authorities are a source of capital, a means of reducing the risk of an entirely private enterprise, and a means of obtaining indirectly the necessary planning permission, powers to break up streets, etc. Fourth is the difference in criteria which may justify public works. DH was seldom sufficiently attractive to entrepreneurs to introduce, as steam networks had been in the States or electricity in Britain in the late nineteenth and early twentieth centuries, nor to local authorities as a trading function. Rather it has been pursued for social objectives which market criteria did not acknowledge, and as far as such objectives were given political weight and could override quasi-market constraints.

The character of local authority involvement has also been affected by its political relation to central government. From this stems in large part an important difference between periods II and IV. In II their role as implementers of centrally organised schemes of housing and welfare provision was uppermost, even though in detail the lead for many innovations came from the local level. There was little important ideological conflict between the two. In IV urban authorities have acted as political centres for opposition to government policies, as discussed in 4.6 and 8.7. This has included the articulation of alternative priorities for energy provision, with which CHP/DH has been associated.

When local authorities have taken the role of developers or potential developers, then, their economic and political character and position have been central concerns of the account. And because of the marginality of the economics of DH, outcomes have been contingent on the detail of political, legal, financial and other conditions at any time. Local authorities can by no means be considered to have had a clear economic

interest in pursuing the option. Only in the period of late 60s and early 70s, for heating blocks of council dwellings, did the complete installation and in many cases operation offered by fuel companies during a period of cheap fuel provide a clear advantage. As an optional trading function its return would have been small and the risks considerable because of the large capital outlay. As a service for local authority housing, alternatives were available and DH was assessed in competition with these.

Insofar as it did exist as an input to interactions with other bodies, local authorities' objective of pursuing DH must be seen as the outcome of internal processes: a particular response to perceived needs, issues and duties, subject to constraints, in competition or conflict with other objectives or demands on resources, and with all these factors mediated by organisational structure, policy commitments, administrative procedures, and political and professional ideologies. In any matter, the complexity and specificity of influences on the local state and its multiple roles rule out any simple attribution of interest. Here the marginality of the option ensured that an authority's position would be contingent and malleable, and its commitment precarious.

A policy of strong support and pursuit has been exceptional, and the factors behind such should be examined. The social benefits identified with large scale CHP/DH have resonated with objectives accepted by local authorities in general, as with their role in physical reconstruction and the establishment of much of the welfare state in period I, or with the objectives pursued by Labour metropolitan local authorities in IV. A strategic approach with integration of policies and functions was also advantageous, provided in II by ad hoc coordination in the effort of reconstruction, and in IV by the reforms initiated in the mid-70s, carried furthest in the large urban authorities.

Acting against these incentives and tendencies were:

- the assumption or enforcement of financial appraisal tending to exclude unquantified social benefits;
- the marginal economic advantage if any, uncertainty in it, and its sensitivity to changes in contributory costs and revenues;

- stringent conditions of finance, and in II of labour and materials;
- uncertainty because of lack of support, subsidy, technical advice and coherent policy on the part of central government;
- in places inadequate control over physical planning and land use during redevelopment, introducing further unpredictability from private sector development decisions;
- the inflexibility in timing of economic DH development and sensitivity to delays in building;
- in IV, the poor experience of DH schemes, in terms of technical performance and as relative operating costs escalated.

Absence of enabling legislation did not appear to present a significant obstacle in general, though the passage of Local Acts in the 40s and 50s was a major and expensive battle for some local authorities and the conditions of operation and finance imposed in them provided further constraints on the management of schemes which could well have eliminated their advantage.

The account has demonstrated how this institutional framework has affected the extent of introduction of DH and the scale, form and features of particular schemes. A reluctance to embark on schemes in the first place, the abandonment of many which were planned, and the reduction in size and unsatisfactory economics of many of those built, must in large part be attributed to the authorities' weak position: the severe constraints operating on them, the limits to their control over certain local processes, and their limited power to change the ground rules of interaction with other bodies, especially the energy industries. The mechanisms have perhaps been clearest in the ambitious city centre schemes - in Bristol and Coventry in 6.7, and with notable similarities, in the Sheffield and Newcastle core schemes in 8.5.

9.4 CENTRAL GOVERNMENT AND COORDINATION

Effects of General State Intervention

In this section are explored the policies and actions of central government which have affected the introduction of CHP and DH. Some general aspects and their effects have already been discussed:

- relations between central government and the ESI, and between central and local government;
- government structuring of the industries and relations within the sector;
- and government policies for energy, both on supply and conservation.

Government has had a key role in establishing and maintaining the structure of the sector as outlined in 4 and 9.1, upholding quasi-commercial operation for the industries, market allocation, and competition. It has supported the overwhelming supply-side bias, and its actions on end use, efficiency and conservation have been weak. More specifically, government has broadly endorsed the main policies and programmes of the ESI for generation, the effect of which on CHP was considered in the last section. Even crisis in the sector leading to the reorganisation of the industries has preserved its basic relations; government has retreated from coordination of production and planning of end use. Nationalisation, intended explicitly to resolve problems of production in favour of user interests, actually rationalised the division of production and consumption, consolidated the commodity relation, removed the vestiges of local political control, made coordination more difficult, and led to the neglect of areas falling between the existing energy vectors. Reorganisation from the Right in the 80s, based on a reintroduction of market forces into the sector and a withdrawal of state involvement, makes profitability the key determinant of the extent of any operation in the sector and of the prospects of any new development. CHP, for example, though it has played an important ideological role in

justifying this strategy, is essentially incidental to this project.

In the account of chapters 5 to 8, the effects of more general government policies and actions were followed as they impinged on CHP and DH. In particular, the conduct of programmes for new housing and reconstruction were important in periods II and III, and government control of limited finance in the public sector was pervasive.

Specific Actions on DH and CHP

As for government's direct treatment of these options, the dominant feature is the absence of a concerted national programme comparable with that, say, on nuclear power or natural gas. In both II and IV, what started off as evaluation of national potential fragmented into small collections of individual schemes, so that the fate of the option in general became the sum of their fates, left to conflicting influences and the detail of constraints. Perhaps the most significant measure avoided was the creation of a central agency to perform the sorts of functions that the Marshall Group advocated for its National Heat Board. This absence is considered further in 10.2. Thus DH remained at best a fringe or subsidiary function of existing bodies, or suspended between them.

The direct actions of government on CHP and DH, then, have been limited to establishing or changing the conditions in which existing bodies might propose or undertake schemes:

- encouraging or discouraging proposals, through policy statements or informally;
- initiating expert assessments and supportive technical work;
- sanctioning plans and finance;
- regulating relations between the parties or intervening ad hoc with specific directives;
- changing the detailed conditions of appraisal, finance or operation;

- and, of course, not taking such actions.

Left to bodies responsible for individual sites, introduction of DH was most straightforward when least coordination was needed: when a single body had sufficient incentive to take responsibility for both heat source and network. Some local authorities planned to operate complete schemes in the 40s when they had control over generation, and some are trying to retain integrated control within the major city consortia in the 80s. Conversely the ESI itself has had powers if not sufficient incentive to operate whole CHP/DH schemes, and did at least consider doing so in the 40s and 50s; it has been argued, moreover, that it could have taken a national lead in introducing the technique. With a single body responsible locally, political activity consisted mostly of trying to induce government to improve conditions.

Most actual planning and development of CHP/DH in Britain, however, has involved both the ESI and a local authority, though the exact division of responsibility has varied. Each, as discussed in the two previous sections, had different interests, constraints, and power to establish arrangements to suit its own objectives. Much of this account has focussed on relations at the boundary, and on the degree of government intervention in them.

There was explicit encouragement from the MFP in the 40s for local authorities to pursue DH, motivated largely by concern for fuel conservation and coming from the section of the Ministry concerned with efficiency or conservation, but also by the need to improve domestic heating standards. But conflict with other objectives, embodied in disagreements within and between ministries - for example, between the MFP and the MoH over materials allocation and the relative importance of DH for the housing programme - made the signals ambivalent at most times. A refusal to subsidise schemes, alongside the stringent financial terms imposed by Local Acts, contributed not only to removing any economic advantage but also to uncertainty about the option. There was no clear policy statement of support and few specific actions to help. The long wait for technical guidance from the DSIR - and in the absence of direction from central government it was awaited in effect as a policy

document - likewise hindered the initiation and progression of schemes. The encouragement was clearer in the mid-60s and early 70s, when there was more coincidence of view between the ministries, some concessions over finance, and some useful technical work, but these actions probably made only a marginal difference to the extent of adoption.

The DEn programme of investigation from 1980 was initially a much more concerted effort to explore the possibility and potential of large scale CHP/DH in the UK. It at least contributed to setting in motion the lead city proposals and despite its concentration on large cities stimulated other initiatives outside the programme. However, the government's concern to narrow the programme down and limit its involvement and financial obligations soon became clear. The series of investigations was widely interpreted as a stalling exercise. Subsequently it added to its strategy of avoidance an attempt to manipulate the terms of support to suit its policy of introducing private sector involvement into the energy sector and letting private interests determine energy forms through the market - indeed to form something of a pilot project for it. Again the signals to the private sector were contradictory, with attempts to encourage involvement but its own evident lack of commitment causing doubts.

In short, what central government initiatives did exist have been muted, ambivalent and constrained by contradictory pressures. Government has been reluctant to intervene beyond minor modifications to conditions affecting CHP and DH development, to provide a limited accommodation of interests, and has avoided the problems which soon confronted any attempt to go further.

Characteristics of Government Action

Government actions throughout the account display the sort of characteristics modelled by decision theorists: an unwillingness or failure to plan; avoidance of translating general policy commitments into plans; taking a line of least resistance to obstacles; and allowing existing legal, market and bureaucratic relations between organisations to dictate developments, with reluctance to intervene or coordinate.

The relation between elected central government and its bureaucracy varied, however. In II and IV the treatment of CHP/DH was caught up in the working out of more general relations between organisations as part of wider restructuring of the economy: in the 40s and 50s with the terms of operation of the newly nationalised energy industries, and in the 80s with attempts to control local authorities and liberalise or privatise the energy industries. The bureaucracy in the late 40s acted to dampen radical changes and demands insofar as the Labour programme contained such elements, curbing, for example, attempts to get the nationalised industries to extend their functions,¹¹ and favouring the transition to more explicit commercial objectives. In the 80s, by contrast, though a government intent on disengaging from state involvement in production has found greater compliance and encountered less inertia, conflict has been with sections of the administration with a technocratic ethos still geared to public initiatives.

Internal divisions in central government have been especially significant, through

- the division of responsibility between departments, as well as between departments and QGAs;
- the hierarchy of departments, in the priority accorded to each and their relative strength in securing resources and setting policies;
- the neglect of areas not covered;
- conflicts from different objectives and approaches in areas of overlap;
- and the degree of coordination and political unity.

CHP/DH had implications for, or required inputs from, those sections concerned with energy, planning and new towns, housing, local government, public works, and the supply and allocation of finance, materials and labour. Internal divisions have tended to reflect outside structures and divisions of responsibility. DH and CHP have generally been the

responsibility of those sections of the Ministry concerned with energy efficiency or conservation, and enthusiasm has come from these quarters. But the same limitations have applied: a fragmented and politically weak constituency, and a limited mandate and internal support because of a supply biased policy paradigm. Even within departments, actions affecting the option reflected not only a range of objectives requiring ordering in priority, but also different and contradictory pressures. Like the vesting of state functions in separate and remote QGAs, these divisions do not simply reflect an administrative necessity or problem; they are functional in allowing problems and challenges to be diffused, but then make coordinated action inherently difficult.

The characteristics of central government actions - both those which appear consistent throughout the account, and those specific to each period, varying according to the different strategies and programmes adopted - can be related to the general account of state forms developed in 4.3. The significance here of these features is not simply in their contingent or incidental effects on the treatment of CHP and DH. Rather the failure to act coherently, and the manner in which the options were handled, are also indicative of general and systematic incapacities and exclusion mechanisms which operate against certain types of possible development according to their social function, origins, associations, or requirements in terms of policy and organisation. Thus CHP and DH tended to be excluded because of the conditions significant introduction would require and the political objectives behind them, as outlined in 9.1.

CHAPTER 10 LEVELS OF ANALYSIS

10.1 INTRODUCTION

The observations in chapter 9 were divided up according to groups of interests around particular approaches to energy provision and particular technological options. This chapter is organised on the basis of the themes of chapter 3, considering the levels of determinants producing specific social outcomes, and the connections between these levels.

The account of chapters 5 to 8 confirmed the need to pursue an explanation in social terms of the virtual absence of CHP/DH in Britain, demonstrating that it has been a possibility and has come close to significant adoption, that there have existed strong support and favourable arguments and assessments, that there has been considerable activity around the option, and that at times it has occupied a central role in energy debates.

It has been a major theoretical contention of this thesis that the determinants of social phenomena have to be analysed at several levels of abstraction, from broad systemic structures and processes downwards. Significant means by which particular social groups establish and maintain specific arrangements operate at each. It was a basic criticism of the conventional approaches reviewed in chapter 2 that they ignored certain levels and severed the connections between them. The discussion of chapter 3 considered ways of theorising those connections and attempted to derive guidelines for analysis.

In the following sections, then, further observations are made on the account in terms of

- the broad systemic features of the energy sector and the wider society;
- interactions between organisations in different arenas over CHP, DH and related issues;

- and the conceptual form and content of the issues, arguments and appraisals.

The necessity and form of the connections between these levels of analysis are then illustrated from the account. In conclusion, the question is addressed in what sense the outcome can be said to be characteristic of the social context.

10.2 BROAD CONTEXT

Sector Dynamics

Chapter 4 and section 9.1 dealt with the broad structures and processes of the energy sector and their relation to the characteristics of the wider social formation of which the sector is a part. Following the arguments of chapter 3, this analysis stressed on the one hand the continued reproduction of the institutions and, in terms of Benson's model of a sector,¹ the coherence and mutual reinforcement among the surface level features of policy commitments and organisational arrangements, and between these and the underlying structures of domination. On the other hand it noted the importance for understanding change in those institutions of contradictions at all levels.

This general level of explanation is the most appropriate to account for the existing pattern and historical development of the sector, and the basic relations between major actors. But it was also argued that it indicates systemic reasons for shortcomings in the fulfilment of social objectives and needs for energy - particularly adequate provision to certain user groups, and efficiency of conversion processes and end use - and a systematic tendency to exclude organisational arrangements and technological routes more appropriate to such social criteria. In turn these continued tendencies, especially when exacerbated and brought into focus by exogenous shocks to the sector, produce political demands for change. These demands are often associated with the promotion of alternative technologies, especially when, as with CHP/DH, they are seen to be beneficial on several of these counts.

Political Forms

The forms of politics which have been characteristic of the sector have shaped much of the detailed activity to be discussed in the next section, particularly through the establishment of arenas of interaction, their articulation - how the outputs from one form the inputs of another, and so on - and their mix of administrative, technical, legal and political procedures. It has already been indicated that a corporatist form has been

central, with a few key actors deciding and implementing broad policy effectively in one process in the form of programmes, within a loose legislative structure, isolated from parliament and public.

In the case of DH, however, with local authorities acting as initiators and developers in the absence of another state body with these responsibilities, this centralist mode has had to coexist with a more dispersed form of interaction. Here its character has followed the general development of central-local relations outlined in 4.6. In particular, control of local authority initiatives in period II was achieved largely through detailed legislation and financial conditions, whereas by the 80s this had been replaced by negotiated administrative arrangements within a looser statutory framework, albeit combined with more overt political control through ceilings on finance.

Organisations

With the institutional structure of the sector laid down historically in relation to key programmes and administrative needs, there has been no central organisation with statutory responsibility or a primary economic interest in heat production or recovery and distribution. None was developed within or emerged from the ESI; none evolved as an umbrella body from private or local authority undertakings; and none was set up by central government. It seems reasonable to suppose that the absence of such an organisation has continuously disadvantaged the option in economic, political and ideological terms. It has had no unequivocal representative body alongside the other energy industries able and committed to argue for resources, promote its expansion and defend its continued existence against competitors, and hence no strong sponsoring or mediating section in the ministry, nor significant public funding. This absence has reinforced itself, not only through the continued operation of unfavourable conditions for projects, which could have been ameliorated, but also because the option continued to be perceived as risky or difficult in that it had no institutional base. It is significant that the creation of such a central body has been a central demand of advocates of the technique and the need for it has continued to be argued by groups involved in the current proposals despite the government's refusal to establish such.

Thus CHP and DH have been left to organisations for which they were peripheral and optional, and in which support for them was compromised by internal divisions and contradictory pressures. What development has taken place is in part the remnants from periodic surges of general interest, and in part the result of expedient support from the energy industries in particular circumstances.

10.3 ORGANISATIONS, ARENAS AND INTERACTIONS

Introduction

Following the arguments of chapter 3, some of the ways in which activity on CHP and DH was shaped by the institutional context of the energy sector and the wider social formation have been explored in 9.1 and above: the identity and primary objectives of the major actors, the structure and character of the arenas in which interactions could take place, and the associated procedures for treatment. Here the overt political activity - the normal and exclusive focus of much political science and policy studies work - is considered from this starting point.

Organisational Objectives

The guidelines of chapter 3 posed two questions concerning the stances of actors: how policies and objectives on the issues were generated internally; and how their interests were represented in these. Implicit in these questions was a need to consider the extent to which each organisation was internally coherent and the significance of internal divisions. The account has demonstrated the need to analyse these internal processes - if this is possible empirically - both leading up to interaction and during it. There is to varying extents flexibility in the starting position of each actor. This may result from inability to foresee the consequences of particular courses of action or outcomes, and hence its interests in them, or, as with the ESI in the late 40s, because actions have to be taken before internal policy processes can take place. The strategy of the city authorities in the 80s show that an actor may deliberately take a flexible and pragmatic approach as a response to uncertainty about the degree of accommodation of interests which may be achieved, and in particular in recognition of its limited power to influence events. In the course of interactions over the issue, that position then develops, narrows, hardens or shifts.

These processes have been explored in 9.2 to 9.4 for the major actors: central and local government and the ESI. For all of them CHP and DH formed only one of many issues with which they had to deal. Its

marginality at most times affected the way it was treated: with scepticism, little enthusiasm, and strict conservative appraisal by the ESI; with ambivalence and shaky support by the local authorities because of the constraints and risks involved. The position of central government was based even less on principle - contingent on internal divisions and conflicting pressures, dependent on progress outside, and strongly characterised by avoidance of commitment. For the other fuel industries, opposition, or support and involvement, depended on changing market structures and the incidental opportunities seen to be offered by the techniques in particular circumstances.

Arenas

It is clear from the account that interaction took place around a range of issues and subissues:

- on general matters which affected conditions under which schemes were assessed or operated;
- on the establishment of some general principle in which CHP and DH became a test case;
- and directly on the treatment of the option in general or specific proposals.

The last category covered major decisions on whether and how to proceed, and a variety of contributory assessments, decisions and actions.

The actual pattern of these issues, and their allocation to different arenas, resulted from combinations of routine practices, deliberate choice, and overt dispute from challenges to both. The marginality of the techniques to existing bodies, the absence of any with a primary responsibility for them, and the unwillingness of central government to undertake a concerted initiative, tended to push activity into technical and administrative arenas and procedures, and to fragment it into separate sites for individual schemes. Against this, there was pressure to establish a new organisation, to challenge the procedures by which a national programme should be implemented, to reintegrate programmes, and to

repoliticise the debate to keep social objectives in view and counter the tendency for narrow economic criteria to predominate.

As for the treatment and resolution of these matters in the arenas into which they were channelled, first, there existed multiple points at which there was scope to affect the course of subsequent action, where outcomes were by no means totally predetermined, and at which therefore the detail of the tactical mobilisation and deployment of resources for bargaining, coercion or argument, was crucial. This dependence on tactics and actions was probably most pronounced where procedures and rules were least rigid, as in the early negotiations between the BEA and the MFP where no precedents had been established. Second, to varying extents the action in each arena was not just concerned with deciding points within its assumed authority, normal procedures and intellectual framework, but also with challenges to these - that is, attempting to reshape the arena to favour, or at least give more scope for, alternative outcomes. Third, the struggle within some arenas was aimed at changing the constraints at various levels which operated on the treatment of the options in others. Thus the response to restrictions in negotiating specific schemes at a local level, was often collective or individual attempts to persuade government to overrule other bodies or to change financial or legal conditions.

Pattern of Interactions

The general pattern in each of the periods covered was one of a gradual hardening of terms for the appraisal and operation of potential CHP and DH schemes as each degree of freedom and possibility for change was settled. Overt intervention by groups concerned to oppose development or to set conditions to protect their interests thus gave way to an acceptance by proponents of an increasingly fixed set of constraints - aside from the worsening economic conditions caused by changing fuel prices and other external factors. In periods II and IV, when upheaval in the sector as a whole provided opportunities for institutional change favourable to the introduction of CHP and DH, this hardening of the immediate constraints was paralleled and reinforced by the organisation of the sector largely resettling in its established form - preserving and indeed consolidating the basic relations which, it has been argued, tended systematically to exclude these options.

It remains to consider and illustrate the character of interactions in five major types of arena -

- central government policy-making;
 - proposals for specific schemes;
 - professional and public debate;
 - expert committees;
 - and quasi-judicial processes
- and their contribution to this overall pattern of activity.

Central Policy

The discussion of 9.4 concentrated on government as an actor itself. There it was interpreted as pursuing certain courses of action according to its strategic interpretation of the requirements of the economic and social system, with an inherent bias towards certain social groups in intention, but operating within structural constraints and contradictory pressures on its scope and direction of action, and with implementation mediated through its bureaucracy. The consideration here of central policy-making as an arena - undoubtedly the most important outside of individual organisations in terms of its authoritative and allocative decisions - stresses rather those aspects of the state as a site of struggle in which groups actively attempt to secure decisions in their favour, and in which government acts in part as arbiter and in part as an actor with its own objectives.

The corporatist mode of politics established in the sector has made the responsible ministry the focus of activity, much of which has been informal bargaining within a loose statutory framework. Access is thus crucial. Much of the negotiation has been exclusively between government and the centralised energy producers, even after consultation with or representation from other groups. With direct influence thus limited, other

groups have used parliamentary debate and committee hearings to put forward their case; such representation, however, always mediated by government responses, probably only reinforced general pressure for change or for specific measures from public and professional debate.

Government's reluctance to adopt a coherent policy on DH, to intervene in negotiations between the ESI and local authorities, or to restructure the sector to facilitate the objectives with which the option was identified - that is, outputs from the arena consisted largely of non-interventions - thus left outcomes to be determined mainly by existing economic relations.

Proposals

With the avoidance of general policy commitments and concerted programmes on DH, in favour of pragmatic case-by-case treatment, much of what became standard practice was worked out over proposals for specific schemes. The key question became their economics within current financial and organisational constraints, and the marginality of that economics made the outcome of appraisals susceptible to changes in parameters, timing and uncertainty. Government made only minor concessions to change those conditions. Treating schemes individually rather than as parts of a coherent programme left them vulnerable to cutbacks and less easily defended. As initiators with overall responsibility for schemes, local authorities were in a weak position and constrained from taking risks. For them, safer alternatives existed at comparable costs.

In period II key interactions over local proposals in which there did exist some scope for manoeuvre and bargaining were those between the local authorities and the ESI over heat costs and buy-back prices, and with government over terms of finance. Additionally the MoH controlled approval of individual schemes by virtue of its strict control over loan sanction and materials. For the first few proposals the terms of enabling legislation were also unsettled. But other major constraints in the form of the conditions in which the local authorities operated were already clear and in the short term effectively immutable without changes in policy, which the Ministries shunned. For a while the local authorities were able

to pursue favourable values of what were detailed parameters but nonetheless crucial to the economic balance of schemes, as with the amortisation periods of loaned capital negotiated with the MoH, or the effective subsidy from other sources, eventually proscribed by Local Acts. In all the areas with scope, the terms and procedures became increasingly fixed.

The demise of early proposals, and the subsequent decline in their number, were thus in large part determined by acceptance of poor prospects or at least unacceptable uncertainty, and of the impossibility of changing the ground rules. Active intervention by other parties gradually became unnecessary. The detailed studies of schemes showed how the externally imposed conditions were mediated into the internal processes of the local authorities in the form of divisions between different sections with different responsibilities. Thus the increasingly unfavourable economics of proposed schemes strengthened the hand of financial controllers who advocated caution over the planners and engineers involved in public works. The fragile economic margin produced fragile political support.

The DH schemes of the 60s and 70s, pushed by a coincidence of interests between local authorities and fuel industries, were accompanied by few actions through central government channels, except in changes in detailed conditions of finance and appraisal.

In the 70s and 80s, the changed pattern of general local government control had arguably put local authorities in a better position to initiate city-wide proposals and had in principle provided more room for manoeuvre. It was the severe financial constraints which were most important, however. These were clear from the outset and strongly conditioned authorities' predisposition and the approach of those which did pursue schemes. The larger urban authorities had the resources - as well as a strategic political orientation towards the social objectives of such a project - to pursue at least outline plans and the mobilisation of political support for them. Again the proposals have been worked out within the constraints confronted, though with some attempt at by-passing these, as in seeking funding elsewhere.

The main political actions - besides those over more general matters which impinged on CHP activity - have concerned the overall conduct of the programme. The changing conditions under which it, and hence individual projects, have progressed, have been the resultant of two forces: on the one hand attempts by the government to withdraw from involvement but impose its broader objectives for the sector on the activity; on the other hand the collective efforts of the local authorities to counteract tendencies towards fragmentation and competition, and further to increase the coherence, funding and commitment behind the programme. The continuation of a reasonable programme during the Conservative administration is itself significant; what may be more important is the visibility and broad support which has been fostered, with a view to obtaining greater commitment from a future government. Similarly a more strategic approach has been taken in trying to shift the general position of the ESI, since the interaction over specific projects has proved unsatisfactory.

Professional and Public Debate

Professional, academic and to a lesser extent wider public discussion formed a continuous backdrop to more specific negotiations, though its role in influencing their outcomes is nebulous. Certainly its volume was closely related to general concern over energy conservation and efficiency, reflecting cost increases or shortages. Its general level to some extent determined the attention given to the subject in government and the energy industries, and it was in part stimulated by their actions. That discussion could also be encouraged deliberately by government was demonstrated by the period of intense debate on energy matters in the mid-70s. In this sense wider debate was in part a contrary result of the closed corporatist mode of policy-making in the sector, and in conflict with it.

As a process in which deliberate interventions on CHP and DH were made, professional and public debate was in large part conducted by the same protagonists involved in negotiations within and between the major organisations. The prospects for CHP improved with broad participation, however, because it introduced viewpoints from outside a discourse otherwise constrained within the paradigm of producer organisations

committed to supply side strategies and particular technological systems. The impact of alternative views remained limited, despite gaining serious treatment and some support from advisory bodies, because their main route of influence was still via government policy and directives.

Expert Committees

Expert committees tended to form a microcosm of the wider debate. Both the DSIR/DHSC and the Marshall Group show clearly that representatives brought institutional affiliations and predispositions into the deliberations. That feature was important because of the distinct grouping noted in 4.2 of technical professionals around different interests - with electrical engineers almost exclusively incorporated in the ESI itself, and heating engineers remaining as independent consultants and siding with local authorities. Such committees were usually set up for a specific task, so that their terms of reference were given according to currently accepted views of a problem or the requirements of the government. In general the vesting of a general appraisal of the subject in such bodies tended to technicise the issues and divert attention from the social context. Additionally the terms were open to some manipulation, as shown by the diversion of both the ICDH/DHSC and the Joint Working Party of the early 50s away from policy formulation onto technical appraisal of individual cases. There were, however, several constraints in the operation of these arenas as sites of overt power struggle:

- representation tending to even out institutional influence and the presence of independent professionals with no institutional interest in the outcome;
- pressure to produce an output showing consensus rather than divergent views;
- a mandate to produce information or arguments addressing specified problems and with accepted criteria of validity or justification or presentation.

While most of the committees performed valuable collection and analysis of information, the significance of their outputs for policy varied. The

DSIR/DHSC report, ostensibly technical but long awaited as a determinant of policy or a substitute for it, had little impact, emerging after interest in DH had subsided. The Marshall Group's, by contrast, initiated government involvement in a lengthy if ultimately unsatisfactory programme.

Inquiries and Hearings

Quasi-judicial arenas - the pre-legislative hearings over Local Bills for DH powers in the 40s and 50s, and the Sizewell Inquiry in the 80s - in part provided an extension of public and professional debate and again served to produce information and advance arguments about the option. Here actors were constrained by obligations to engage in argument with critics and to provide information. The adversarial nature of the arenas tended to overstress differences. In the battles over Local Bills, other parties wanting to protect their undertakings against disruption or competition would anticipate somewhat unlikely contingencies. The obligations and constraints imposed on local authority ventures - such as clauses on obligatory sale of electricity, notice of developments, and especially the proscription of subsidies from other sources - were undoubtedly more stringent than would be set for private ventures, precisely because they were in the public sector.

The strategies and tactics of groups opposing a development varied: attempts to go beyond and thereby undermine the terms of reference of the case for development; by contrast, the acceptance of these terms as a basis for an alternative appraisal so as to meet proponents on their own ground and avoid dismissal as unrealistic; and attempts to shift the ground of debate from, say, rights to enabling powers for an undertaking, to the technical feasibility of DH schemes in general.

10.4 ISSUES, EVALUATIONS AND ARGUMENTS

Introduction

In chapter 3 an argument was developed, derived in part from agenda-formation accounts and consistent with general notions of the social construction of knowledge, that the form and content of an issue is shaped by its context. Its initial manifestation as discontent with existing fulfilment of needs depends on prevalent ideology, suppressing or encouraging its articulation; the institutions through which an issue then passes provide procedures for evaluation and arenas for dispute. Conversely the output from each particular stage influences its subsequent route, the scope of debate and negotiation, the legitimate procedures and outputs, and so on. Its development results from groups engaging in both interactive and independent processes. It involves both discursive choice and dispute, and routine intellectual practices. The concepts of policy and technological paradigms, though not without problems of definition and interpretation, attempt to capture the importance and coherence of shared sets of such practices, and to relate them to organisational characteristics and broader rationalities and ideologies. The passage of an issue may involve fragmentation into sub-issues for separate treatment; conversely several issues may coalesce into demands for more fundamental change. It was argued in 1.3 that there is a strong tendency for issues to be projected at an early stage onto at least partly formed technological options which offer solutions. This alignment may shift, and in particular technicise, an issue.

The discussion of chapter 4 and 9.1 indicated the general substantive character of important knowledge forms in the energy sector: an ideological context of key concerns, policy commitments, technocratic approaches, and notions of possible or legitimate changes; and rationalities and techniques used in making or legitimating decisions. It suggested a number of concerns tending to promote discussion of CHP and DH, essentially criticisms of existing arrangements in the sector in terms other than the technical or narrow economic performance of producer organisations in their own framework. It indicated elements tending to suppress those concerns, largely by shifting the focus of discontent away

from methods and organisation of production. This inherent association of the options with a critical stance towards the sector suggests that demands for their introduction would inherently be disadvantaged in having to challenge established precepts. 10.3 then indicated constraints on treatment and output in each of several separate types of arena in which negotiation or debate was conducted.

Initial Formulation

The origins of the demands associated with DH and CHP in the partial or non-fulfilment of social objectives for energy provision, necessarily led to their expression largely in terms other than economic criteria from producers' point of view - variously

- as a way of improving heating and housing standards;
- for efficient use of primary energy;
- for its engineering appeal as an efficient system;
- and as a way of reducing air pollution.

The periods of revival of interest in the techniques have corresponded broadly to periods of increased concern over some or all of these issues, of general dissatisfaction with the operation of the sector, and of economic upheaval, all tending to lead to questioning of existing patterns of provision. That is not to say that conditions other than strong general interest and debate on existing provision were logically advantageous to introduction in those periods. As it transpired, the upheaval produced other priorities, and perversely the period of most rapid expansion of DH in Britain occurred when interest in conservation and efficiency was minimal but contingent conditions provided an incentive for the fuel industries to push the option.

The strongest political support has been mobilised when and where several of these objectives have been included in a coherent political programme. In the period of planning for postwar reconstruction and the establishment of the welfare state there was widespread acceptance of the

need to improve social conditions in cities. In the 1980s the base was narrower: among Labour controlled urban authorities, where the option was also identified with objectives of job creation and of regaining some local control over energy provision and strategic planning of the urban economy.

Evaluation Rationalities

As the question of introducing CHP/DH progressed in both periods II and IV, two shifts can be observed. First, the social objectives in its evaluation were replaced by economic criteria. The possibility of achieving these objectives thus became contingent on the proposals also satisfying increasingly narrow economic and specifically investment appraisals. The wider objectives continued to be aired in general public discussion but it became increasingly difficult to assert the need to incorporate them in formal evaluation. Second, the question of general introduction was avoided and the assessment of DH became fragmented. Both tendencies are related to an absence of an institutional base and a failure to establish such. The criteria which allowed or killed off individual schemes were limited not just by the inherent conservatism of the assumptions and methods of economic assessment, but further by the operating framework and practices of existing organisations. No strategic political choice was made to overrule specific criteria or change this framework to suit. The fragmented and difficult case-by-case approach to which DH was relegated hampered it in terms of political support and economic appraisal.

The issue of the national potential of CHP/DH thus tended to shift from whether the option was desirable and worthwhile in national terms to whether existing institutions would back specific schemes in terms of their particular market or other financial operating conditions. The process of narrowing down the terms of appraisal is clearest in the 70s and 80s. In this case it was not just brought down to criteria suiting the existing institutional structure but further to promote the reintroduction of private sector involvement in the energy sector. The primary motivation for investigation was in energy efficiency. The Marshall Group assessed costs and benefits to the nation. With reservations it accepted that scarce resources should be allocated by economics, and used DCF appraisal, though it did take opportunity costs in part. The site specific studies under the DEN programme considered returns to a developer, assuming

district heat to be sold at a substantial margin below the next competitor. The increasing involvement of the private sector in the proposals developed from that programme means that the introduction, form and extent of any scheme, will be dictated by the expectations and criteria of private investors. The broader social objectives motivating the political support and involvement of local authorities will at best be achieved incidentally, that is, insofar as financial criteria allow the scheme to develop and in particular to provide cheap heat. Where there is a conflict - for example, over extension of the network into less profitable areas - the former are likely to prevail. The political power of the local authorities without public funding is ultimately subject to the power of private interests to withdraw investment.

It has been indicated, too, that economic assessments further operated against CHP/DH for two reasons. First, the assessments were strict. This rigour was justified as rational, but its application to energy investment in the public sector was actually selective. Second, site specific CHP/DH assessments were made at the margin of existing energy systems, with several disadvantages. Electricity credits, on which the economics of CHP depended so heavily, were calculated in relation to a station as a peripheral addition or perturbation to the existing or projected generation system. As Lucas has demonstrated, this would produce a suboptimal mix of CHP and straight generation in terms of national resources.² Where an operating regime is devised to suit electricity requirements, according to an electricity-based merit order, rather than to suit heat load, the effective cost of heat may be further increased. The heat network must also be built alongside and in competition with an established production and distribution system for gas, for which comparable investment has been spread more widely or already amortised. The price structure of competing energy forms has by no means been rationally derived from appropriate costs or a perfect market. Further, in the 80s, with the stipulation of private sector investment, significantly higher rates of return are expected than for public sector investment.

Disputes

Besides the adoption of intellectual practices in evaluation whose rationalities may inherently disadvantage challenges to the existing order,

there has been dispute - that is, more discursive formation and deployment of arguments. First, much of the debate on courses of action was conducted in qualitative terms, asserting or appealing to broader notions about desired futures, raising awareness of current problems, or conversely justifying existing arrangements. To the extent that conservative arguments could deploy ideological elements accepted from constant usage and tallying with deeply embedded broader notions, challenges to them were disadvantaged. Moreover in early debates over national potential, network economics, CHP conversion, and several other topics, it can be seen that qualitative arguments were accepted and hence that an important part of advancing the options was to assert the need for more thorough and quantitative knowledge. Second, then, came debate over quantitative evaluations: contesting results within an accepted framework, as in most reactions to the early Marshall Group work, with the implicit assumption that the detail of calculations was mistaken or reflected institutional bias; disputing the framework of evaluation and attempting to broaden the questions addressed or the criteria used, as in critiques of published ESI studies of CHP/DH; or conversely justifying further narrowing the terms of study.

It was suggested in 1.3 that the limited political control over much technological development, in that the design and investment decisions were in private hands, was reflected in the narrow scope of public issues around it, often restricted to the distribution or mitigation of effects. In this case, much of the issue of development, from the starting point of the needs and objectives addressed, has been in the public sphere and seen as a matter for public policy. A particular pattern appears to result from this location. Though some economic criteria remain subtly incorporated into ostensibly technical procedures, to a large extent the evaluation methods have had to be justified explicitly. Even the acceptance of a framework of competition with other heat forms has been challenged by advocates of planned energy use, and has had to be supported with notions of 'freedom of choice' rather than left as an assumption. Rather, the political system has tended to narrow the issue by reasserting economic criteria as the rational or natural means of evaluation for public sector projects.

10.5 CONNECTING LEVELS OF ANALYSIS

Introduction

In 10.2 - 10.4 determinants of the course of events in the account were considered at three levels. The difficulty encountered in separating analytically the conceptual aspects from interorganisational processes, and both these from the effects of the broader context, indicates the importance of relations between these levels. Here those connections are considered further.

In chapter 3 a number of means were indicated from theoretical argument by which a structured and dynamic social context influenced specific actions, interactions and hence outcomes. They are reiterated here, from the broadest level of abstraction downwards.

- in that the broad systemic structures and processes produce routine outcomes, but also generate incentives for change because of inherent contradictions, and may create what can be treated as exogenous changes affecting action in the limited area under investigation;
- through the development of the institutions in a sector, and their general interrelations, according to the requirements the wider economy and society places on that sector and to rules of structure formation common to all sectors;
- in linking central actors in that sector to wider social groupings they represent, control or influence;
- in determining their interests in specific potential outcomes;
- in providing constraints and opportunities within which action takes place, and the resources which actors can mobilise;

- in suppressing, encouraging or shaping, issues, arguments and evaluations, through both accepted intellectual practices and debate.

Conversely it was indicated, first, that the institutional structure of systems itself consists of, and is reconstituted by, routine practices; second, that in addition the overt and deliberate exercise of power may be required to manage or contain contradictions; and third, that action resulting from these contradictions may be aimed at changing detailed or fundamental aspects of the systems.

As well as arguing for a certain approach, this thesis has relied on a particular substantive model of the more general levels of the social formation, which it was argued was consistent with the analytical principles and would allow a consistent explanation of more concrete levels. In chapter 4 the development of the energy sector and key organisations was described and interpreted along those lines.

Chains of Determination

Following Jessop's approach, chains of determination can be followed from the abstract levels of system features down through successively more concrete levels to detailed actions and outcomes. It is worth mapping out explicitly here the chains which are important in accounting for the action in chapters 5 to 8:

economic developments or crises -- state strategies for restructuring and hegemonic projects -- reorganisation of central government, state and private industries -- mandates, programmes, regulation, terms of operation, competition

general characteristics of social formations -- ideologies and rationalities -- suppression, selection, shaping and treatment of specific issues

development of state organisation -- representative, bureaucratic, judicial, etc. arenas and their responsibilities, articulation, accessibility, etc. -- filtration and treatment of issues

general policies, programmes, technological paradigms of energy industries -- physical systems -- economic and technical constraints -- forms and parameters of assessment

market and quasi-market conditions of production -- financial incentives and constraints -- modes of evaluation of projects and allocation of resources

development of urban consumption processes -- urban social movements and changes in local state -- local authority policies and political support

local state responsibilities and expenditure -- central control of local government -- detailed financial and legal constraints -- evaluation of projects

development and affiliation of professions -- institutional influence on knowledge and practices

Challenges to existing structures and procedures observed in the account - to restructure existing industries and create new organisations; to change mandates and terms of operation; to challenge forms and criteria of appraisal; to change detailed financial and legal conditions; and so on - can be interpreted as attempts to intervene at different points along these chains. Identifying the precise points of contact of the issue with its context - particularly its marginality or centrality to other processes - has been seen throughout to be essential to understanding its treatment.

Acontextual Accounts

The effect in analysis of severing these chains at some point and ignoring underlying levels of context, it was argued, is to leave general system characteristics and preconditions fixed and unexplained, and hence to generalise historically specific outcomes. Politically it is to deny the possibility of different outcomes through change to these unquestioned levels. This point was argued in chapter 4 in relation to the character of some of the major actors. If actions of government are not referred to its location and role in a particular society, their explanation is likely to rely on an ideological self-image rather than objective results. Similarly it was argued that the nationalised industries had to be seen as an integral part of a 'mixed' but essentially capitalist economy; otherwise their actions were typically attributed to some uniform 'public interest'. It can be illustrated further with more specific features of the account which acontextual approaches would be unable to explain, especially those which changed between the periods studied because of wider developments:

- why interest in CHP and DH, and their political significance, fluctuated;
- why the attitude of certain actors towards the option could change fundamentally;
- why different criteria and procedures for appraisal could be accepted at different times;
- and why there were changes in the nature of conflict between central and local government directly over DH, and conversely in the role and centrality of DH as an issue in more general disputes between them.

Conclusion

In conclusion it can be asked in what sense it can be said that the course of development of CHP and DH in this country, and in particular the absence of large scale schemes, is characteristic of the social context.

At least within the analytical framework adopted here, the first sense is almost a truism: that the actions which excluded it took place in that context, and were ultimately shaped through various mediations by it. But in Offe's terms, it can be asked whether this exclusion was accidental, that is, a different outcome could have been realised without affecting the institutional structure and procedural rules of the society; or systematic, and explicable only by reference to those features.³ The question effectively addresses the conditions which would need to have been different to allow development.

It is clear that relatively minor changes, in, for example, rules or parameters for evaluations, or organisational mandates or attitudes, could have permitted substantially more schemes to proceed within essentially the existing institutional framework. The systematic character, then, was first in the structuring of the balance of power of the actors such that these minor changes were never made, and second and more fundamentally in the setting of constraints such that so few schemes did make progress and that introduction of these became so dependent on detailed circumstances. The options were systematically excluded in part through the normal operation of institutions and to that extent unintentionally, and in part through active resistance, because of the challenges which their introduction would represent to established interests in the sector and more widely, the political demands with which they were associated, and because of the economic and organisational conditions which their adoption would require. The structuring of the energy sector in vertically integrated chains, with competition, commercial operation and commodity allocation; the maintenance of these arrangements by producer organisations and the failure of government coordination; supply-side policies and the political weakness of most user interests; and the mediation of social evaluation by economic assessment; have been identified as important features of energy provision in Britain which militate against options put forward as solutions to the continuing inadequacies of that pattern.

The techniques have, of course, been introduced more extensively in other countries with similar economies and polities, and they cannot be exclusively identified with any one broad category of social formation. In each, the structure of the energy sector and the balance of social forces within it, would need to be analysed on similar lines. The question of the

minimum institutional changes needed here to allow substantial introduction would best be answered by systematic comparative study, and indeed proposals for organisational reform in the British energy sector to accommodate CHP/DH have in large part been based on such comparison.⁴ Adding a comparative dimension to the historical one chosen as the basis of this study, would not only further the understanding of these specific options and energy provision in general, but would also help consolidate the analytical framework for understanding technology which this thesis has attempted to develop.