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

VOL II: Appendices and Notes

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APPENDICES

## APPENDIX 1: ABBREVIATIONS

AB - Area (Electricity) Board

ACEC - Advisory Council on Energy Conservation

ACORD - Advisory Board on Research and Development for Fuel and Power

AGR - Advanced Gas Reactor

AHS - Associated Heat Services

BEA - British Electricity Authority

BGC - British Gas Corporation

BGF - British Gas Federation

BP - back pressure

BRB - Building Research Board

BRE - Building Research Establishment

BRS - Building Research Station

BST - bulk supply tariff

CC - combined cycle

CEA - Central Electricity Authority

CEB - Central Electricity Board

CEGB - Central Electricity Generating Board

CGCC - coal gasification combined cycle

CH - central heating

CHP - combined heat and power

CHPA - Combined Heat and Power Association

CoL - City of London

CPRS - Central Policy Review Staff

CUC - Coal Utilisation Council

DC - Development Corporation

DCF - discounted cash flow

DEn - Department of Energy

DH - district heating

DHA - District Heating Association

DHSC - District Heating Sub-Committee

DoE - Department of Environment

DSIR - Department of Scientific and Industrial Research

DTI - Department of Trade and Industry

EC - Electricity Commission

EEB - Eastern Electricity Board

EEO - Energy Efficiency Office

EFL - external finance limit

EMEB - East Midlands Electricity Board

EP - Energy Paper (Department of Energy)

ESI - electricity supply industry

FBI - Federation of British Industry

FEBr - (Ministry of Fuel and Power) Fuel Efficiency Branch

FoE - Friends of the Earth

FRB - Fuel Research Board

GH - group heating

GL&CC - Gas Light and Coke Company

GLC - Greater London Council

GLO-RLC - Generation Station Operation - Research Liaison Committee

GT gas turbine

HDHL - high density heat load

HO - heat-only

HOB - heat-only boiler

HVRC - Heating and Ventilation (Reconstruction) Committee (DSIR)

ICDH - Interdepartmental Committee on Domestic Heating

ICivE - Institution of Civil Engineers

IDHC - International District Heating Conference

IEA - International Energy Agency

IEE - Institution of Electrical Engineers

IGE - Institution of Gas Engineers

IHVE - Institution of Heating and Ventilating Engineers

IIED - International Institute for Environment and Development

IMEA - Incorporated Municipal Electrical Association

IMechE - Institution of Mechanical Engineers

IoF - Institute of Fuel

ITOC - intermediate take-off condensing

JEA - Joint Electricity Authority

LB - London Borough

LBA - London Boroughs Association

LCC - London County Council

LEB - London Electricity Board

LPC - London Power Company

LPG - liquid petroleum gas

LRMC - long run marginal cost

MBC - Metropolitan Borough Council

MCC - Metropolitan County Council

MEB - Midlands Electricity Board

MFP - Ministry of Fuel and Power

MHLG - Ministry of Housing and Local Government

MinTech - Ministry of Technology

MLGP - Ministry of Local Government and Planning

MoH - Ministry of Health

MoP - Ministry of Power

MoW - Ministry of Works

MPBW - Ministry of Public Buildings and Works

MTCP - Ministry of Town and Country Planning

NCAT - National Centre for Alternative Technology

NCB - National Coal Board

NEC - net effective cost

NEDO - National Economic Development Office

NEI - Northern Engineering Industries

NIES - Northern Ireland Electricity Service

NIFES - National Industrial Fuel Efficiency Service

NIHE - Northern Ireland Housing Executive

NoSHEB - North of Scotland Hydro-Electric Board

NPV - net present value

NUM - National Union of Mineworkers

NWEB - North Western Electricity Board

OUERG - Open University Energy Research Group

PLA - Port of London Authority

PO - Parliamentary Order

PSBR - Public Sector Borrowing Requirement

PWR - Pressurised Water Reactor

QGA - quasi-governmental agency

RC - Regional Council

RCEP - Royal Commission of Environmental Pollution

RDF - refuse derived fuel

RFO - residual fuel oil

RIBA - Royal Institute of British Architects

SNG - substitute / synthetic natural gas

SSEB - South of Scotland Electricity Board

TDR - test discount rate

TE - total energy

TUC - Trades Union Congress

UDC - Urban District Council

UKAEA - United Kingdom Atomic Energy Authority

WCC - Westminster City Council

WMG - West Midlands Gas

## APPENDIX 2: UNITS AND CONVERSION FACTORS

SI or derived units are used throughout, except where the wording of original documents is quoted.

**Prefixes:**

| | | |
|---|---|---|
| E | (exa) | $10^{18}$ |
| P | (peta) | $10^{15}$ |
| T | (tera) | $10^{12}$ |
| G | (giga) | $10^{9}$ |
| M | (mega) | $10^{6}$ |
| k | (kilo) | $10^{3}$ |

**Suffixes:**

| | |
|---|---|
| e | denotes electrical energy/power |
| h | denotes heat energy/power |

**Conversion:**

| | |
|---|---|
| 1ha (hectare) | = 2.47 acres |
| 1km | = 0.62 miles |
| $1m^2$ | = 10.8 $ft^2$ |
| 1t (tonne) | = 2205lb or 1.02 tons |
| $1GJ_h$ (gigajoule (heat)) | = 9.5 therms |
| $1MW_h$ (megawatt (heat)) | = 34 therms/h or 3.4 MBTU/h |
| 1kWh | = 3.6MJ |
| 1tce (tonne coal equivalent) | = $35GJ_h$ (15000 BTU/lb) |
| 1toe (tonne oil equivalent) | = $43GJ_h$ (RFO, 18400 BTU/lb) |

## APPENDIX 3: FILES AND SOURCES

### Public Records Office, Kew

| | | |
|---|---|---|
| POWE 10/233 | Status of Electricity Commission Following Setting up of MFP | 1942 |
| POWE 11/ | Electricity Commission: Minutes | |
| POWE 12/308 | Refuse Destruction: Utilisation of Surplus Steam | 1931-2 |
| POWE 13/133 | Ministry of Transport: General Priority for Electrical Generating Plant | 1940-1 |
| POWE 14/23 | Relationship between MFP, EC, CEB | 1944-46 |
| 14/259 | Private Generating Plant: Parallel Operation with Grid | 1948-53 |
| 14/264 | District Heating: Policy and General | 1947-51 |
| 14/265 | Bankside District Heating | 1947-58 |
| 14/266 | Wythenshawe, Manchester | 1945-54 |
| 14/267 | LCC (General Powers) Act 1949: Bishop's Bridge Road | 1950-51 |
| 14/496 | Siting of Bankside Power Station | 1945-49 |
| 14/551 - 557 | Ridley Committee | 1951-52 |
| 14/679 | Working Party on Joint Generation of Power and Heat: Papers | 1953-55 |
| POWE 15/145 | Post-War Policy: Correspondence with Minister; Memoranda on National Fuel Problems, Policy Efficiency | 1944-46 |
| 15/150 | Ditto | 1947-48 |
| 15/164 | Fuel Efficiency Committee: Minutes | 1948-50 |
| POWE 25/209 | Ridley Report Recommendations: Policy | 1952-53 |
| 25/216 | Working Party on Joint Generation of Power and Heat: Policy | 1952-55 |
| 25/218 | Ridley: Implementation of Recommendations | 1952-53 |
| POWE 28/9 | Interdepartmental Responsibility for Domestic Fuel: Post-War Policy | 1943-44 |

| | | | |
|---|---|---|---|
| POWE | 28/188 - 193 | Ridley Committee: Papers: DCFP series | 1952 |
| | 28/194 | Ridley Committee: Minutes | |
| | 28/195 | Ridley Committee: Evidence | |
| | 28/196 | Ditto | |
| | 28/198 | Ridley Committee: Evidence: BEA | |
| | 28/200 | Ridley Committee: Evidence: FBI | |
| | 28/201 | Ridley Committee: Evidence: TUC | |
| | 28/203 | Ridley Committee: Draft Report | |
| | 28/205 - 208 | Ridley Committee: Action: Recommendations | 1952-55 |
| | 28/232 | Ditto | |
| POWE | 38/17 | Establishment and Constitution of BEA | |
| | 38/19 | Central Authority and Area Boards: Constitution | |
| | 38/22 - 23 | General Powers and Duties of BEA | |
| | 38/51 | Secretary's Working Party on Draft Electricity Bill | |
| | 38/68 | Points for Further Consideration | |
| | 38/74 | Memoranda for BEA on: Ministerial Statements; Government Discussions on Socialised Industries | |
| HLG | 49/284 | Blackley and Gorton Estates: Hot Water Supply | 1920-27 |
| | 49/285 | Ditto | 1931 |
| HLG | 101/185 | District Heating Supply: Powers of Local Authorities | 1946 |
| | 101/577 | District Heating: Report of DSIR, MoW, MFP | 1945-49 |
| | 101/578 | District Heating: Rate of Progress | 1949-58 |
| HLG | 91/317 | Aycliffe: District Heating Bill, 1950 | 1949-50 |
| | 91/326 | Ditto | 1949-50 |
| | 91/327 | Aycliffe: District Heating Scheme | 1950-51 |
| DSIR | 4/316 - 321 | H&V(R)C/DHSC: Minutes | 1942-46 |

| | | | |
|---|---|---|---|
| DSIR | 4/322 - 324 | H&V(R)C/DHSC: Technical Panel and Working Group | 1943-46 |
| | 4/325 | H&V(R)C/DHSC: Editorial Committee | 1944 |
| | 4/1910 - 1912 | H&V(R)C/DHSC: Collection of Information | 1942-45 |
| | 4/1913 | H&V(R)C/DHSC: American DH Plant | 1942-48 |
| | 4/1914 | H&V(R)C/DHSC: Study of USSR DH | 1943-44 |
| | 4/1915 | H&V(R)C/DHSC: 'Basic Scheme' | 1944-47 |
| | 4/1916 | H&V(R)C/DHSC: Final Report: Comparison of Countries | 1945-47 |
| | 4/1917 | Reports and Memoranda on Possible DH | |
| | 4/1919 | DH for New Towns: Information for Committee | 1946 |
| | 4/1920 | DH for Small Housing Estates | 1946 |
| | 4/1921 | Wythenshawe | 1946-47 |
| | 4/1922 | Correspondence on DH Development in UK | 1946-48 |

**Electricity Council Intelligence Section**

| | | |
|---|---|---|
| BEA/CEA A25876 | | 1948-57 |

**Central Electricity Generating Board**

| | | |
|---|---|---|
| CEGB 118.2 | Commercial: District Heating: Policy | 1975-78 |
| CEGB 118.2.1 | Finance: District Heating: General | 1967-76 |
| CEGB 118.3.1 | Commercial: Proposed District Heating Scheme: South Bank / Bankside | 1952-74 |
| CEGB 118.4.1 | Commercial: District Heating Schemes in Operation: Pimlico | 1947-83 |

**Bristol City Council Archives**

Council and Committee Minutes and other papers

**Coventry City Council Archives**

Council and Committee Minutes and other papers

**Birmingham Central Library: Local Studies**

Council and Committee Minutes and other papers

**Manchester Central Library: Local History**

Council and Committee Minutes and other papers

**Wolverhampton Library**

C/WCA 1950 Wolverhampton Corporation Act 1950

**Westminster City Library, Victoria**

Council Minutes

**Marylebone Library**

ES 650 St. Marylebone Electricity Committee

**City of London Records Office, Guildhall**

Council and Committee Minutes

604E Improvements and Town Planning Committee

**GLC Records Office, Clerkenwell**

Council and Committee Minutes

Engineer's Department: papers on South Bank scheme 1947-54

Legal and Parliamentary Department: papers on:

London County Council (General Powers) Act 1947

London County Council (General Powers) Act 1949

**LB Richmond upon Thames, Municipal Offices, Twickenham**

Papers on Twickenham Corporation Bill 1949

APPENDIX 4: AUTHORITIES KNOWN TO HAVE CONSIDERED SPECIFIC DH PROPOSALS OR TO HAVE OBTAINED DH POWERS, 1940-55

| Authority/Scheme | Date first mentioned | Source | Plans? | Outcome |
|---|---|---|---|---|
| Aberdeen | 7/51 | HLG 101/577 | | |
| Airdrie | 7/51 | HLG 101/577 | y | abandoned |
| Aycliffe | /49 | HLG 91/326 | y | MTCP rejected |
| Bacup | /48 | HLG 101/577 | y | |
| Barking | 11/47 | POWE 14/264 | | |
| Bedford | 11/47 | POWE 14/264 | | |
| Bilston/1 | 7/47 | POWE 25/216 | y | abandoned |
| /2 | 7/51 | HLG 101/577 | | |
| Birmingham/Shard End | | (1) | y | abandoned |
| /Duddeston & Nechells | | (1) | y | abandoned |
| Blaydon | 7/51 | HLG 101/577 | | |
| Bolton | 8/49 | (2) | | |
| Bonnyrigg and Lasswade/Bonnyrigg | 7/51 | HLG 101/577 | y | partial |
| Bournemouth | 11/47 | POWE 14/264 | | |
| Bradford | 8/49 | (2) | | |
| Bristol/centre | | (1) | y | |
| Brynmawr Housing Society (private) | 6/47 | POWE 25/216 | y | completed |
| Cardiff/Llanrhumney | 2/50 | POWE 25/216 | y | abandoned |
| Chelsea | | | | |
| Cheltenham | 11/47 | POWE 14/264 | | |
| City of London | | (1) | y | |
| Coventry/centre | | (1) | y | abandoned |
| Crawley | 7/51 | HLG 101/577 | | |
| Crewe | 11/47 | POWE 14/264 | y | abandoned |
| Dagenham/Heath Park | 10/47 | POWE 25/216 | y | partial |
| Dartford | 11/47 | POWE 14/264 | | |
| Darwen | 11/47 | (1) | y | abandoned |
| Doncaster | 1/50 | HLG 101/577 | | |
| Dover | 6/47 | Bristol recs. | | |
| Dumbarton | 7/51 | HLG 101/577 | | |
| Dudley | 8/49 | Local Bill | | |
| Durham | 7/51 | HLG 101/577 | | |
| East Kilbride/Whitemoss | 12/47 | POWE 25/216 | y | partial |
| Edinburgh | 8/49 | Bristol recs. | | |
| Elstree/Cowley Hill | /46 | | | |
| Farnworth | 7/51 | HLG 101/577 | | |
| Fife/Woodside | 7/48 | POWE 25/216 | y | completed |
| Glasgow/Priesthill | 10/46 | POWE 14/264 | y | completed |
| Glenrothes | 8/49 | POWE 14/264 | | |
| Harlow | 10/51 | POWE 14/264 | | |
| Harrow | 7/45 | POWE 14/266 | | |
| Hatfield | 7/51 | HLG 101/577 | | |
| Hemel Hempstead/Adeyfield | 6/49 | POWE 25/216 | y | |
| Heston & Isleworth/Hounslow West | 7/47 | POWE 25/216 | y | abandoned |
| Hillington | 7/51 | HLG 101/577 | | |

| | | | | |
|---|---|---|---|---|
| Huddersfield | 7/51 | HLG 101/577 | | |
| Huyton-with-Roby | 12/47 | HLG 101/577 | y | MoH rejected |
| ?/Hyde Back Bower | 7/51 | HLG 101/577 | | |
| Kettering | 7/51 | HLG 101/577 | | |
| Kidderminster | 7/51 | HLG 101/577 | | |
| Kingston upon Hull | 6/47 | Bristol recs. | | |
| LCC/Collingwood | 4/47 | HLG 101/577 | y | partial |
| LCC/Kingslake | /48 | (3) | y | completed? |
| LCC/Lancaster | /53 | (3) | y | completed? |
| LCC/South Bank | /47 | LCC records | | |
| LCC/Stepney & Poplar | 6/52 | BEA A25876 | | |
| Leyton | 1/50 | | | |
| Lincoln | 7/51 | HLG 101/577 | | |
| Liverpool | 6/47 | Bristol recs. | | |
| Luton/Farley | 6/47 | | | |
| Manchester/Wythenshawe | | (1) | y | abandoned |
| Newburn | /47 | HLG 101/577 | | |
| New Sarum/Bemerton Heath | | (1) | y | partial |
| Northampton | 7/51 | HLG 101/577 | | |
| Northwich | 7/51 | HLG 101/577 | | |
| Nottingham | 11/47 | POWE 14/264 | | |
| Oldbury | 9/49 | Local Bill | | |
| Ollerton | 7/51 | HLG 101/577 | | |
| Ongar/Shelley | 1/47 | POWE 25/216 | y | MoH rejected |
| Paddington/Bishops Bridge Road | 4/48 | POWE 25/216 | y | completed |
| Penge | 7/51 | HLG 101/577 | | |
| Plymouth/centre | 6/49 | POWE 14/264 | y | objections |
| Portsmouth | 6/47 | Bristol recs. | | |
| Rochdale | /47 | Local Bill | y | MoH rejected |
| Rugby | 7/51 | HLG 101/577 | | |
| Smethwick | 8/49 | Local Bill | | |
| Slough | 8/49 | (2) | | |
| Southampton | 6/47 | Bristol recs. | | |
| Southwark LB/Penrose | /52 | (3) | y | completed? |
| Spenborough/Windy Bank | 10/46 | (4) | | |
| Stafford | 11/47 | POWE 14/264 | y | abandoned |
| Stevenage | 11/47 | POWE 14/264 | | |
| Stourbridge | | HLG 101/578 | y | MoH rejected |
| Swansea | 6/47 | Bristol recs. | | |
| Swindon/Moredon | 12/47 | various | y | partial |
| Twickenham/Butts Farm | 5/47 | Bill+records | y | Bill rejected |
| Urmston/Flixton | 2/46 | various | y | partial |
| Wandsworth/Wendelsworth | 11/46 | (5) | | |
| /2 | 11/46 | POWE 14/264 | | |
| /3 | 11/46 | POWE 14/264 | | |
| Warrington | 5/54 | POWE 14/264 | | |
| Welwyn Garden City | 7/51 | HLG 101/577 | | |
| Wembley | 11/47 | POWE 14/264 | | |
| West Bromwich | 8/49 | Local Bill | | |
| Westminster/Pimlico | /46 | (1) | y | |
| Whiteley Homes Trust (private) | 7/51 | HLG 101/577 | y | abandoned? |
| Wolverhampton | 8/49 | records | | |
| Yarmouth | 11/47 | POWE 14/264 | | |

Sources:
1 See references in 6.4 and 6.7
2 EA Pearce, note 147, chapter 6.
3 Orchard Partners list, note 370, chapter 6.
4 Parl Deb Comm 427, 17 Oct 1946, c.232.
5 B Colquhoun, note 371, chapter 6.

## APPENDIX 5: LOCAL AUTHORITY DH POWERS IN LOCAL ACTS

| | | |
|---|---|---|
| Manchester | 1930 | 20&21 Geo 5 ch.78 s.15 |
| Manchester | 1946 | 9&10 Geo 6 ch.27 Pt.II |
| Dudley | 1947 | 10&11 Geo 6 ch.38 Pt.IV |
| LCC (Westminster) | 1947 | 10&11 Geo 6 ch.46 Pt.V |
| Coventry | 1948 | 11&12 Geo 6 ch.37 Pt.IV |
| Birmingham | 1948 | 11&12 Geo 6 ch.39 Pt.II |
| Darwen | 1948 | 11&12 Geo 6 ch.44 Pt.II |
| Rochdale | 1948 | 11&12 Geo 6 ch.47 Pt.IX |
| Smethwick | 1948 | 11&12 Geo 6 ch.49 Pt.IV |
| Slough | 1949 | 12&13 Geo 6 ch.33 Pt.III |
| Huddersfield | 1949 | 12&13 Geo 6 ch.37 Pt.II |
| Oldbury | 1949 | 12&13 Geo 6 ch.39 Pt.III |
| Crewe | 1949 | 12&13 Geo 6 ch.41 Pt.III |
| Bolton | 1949 | 12&13 Geo 6 ch.43 Pt.VIII |
| Bradford | 1949 | 12&13 Geo 6 ch.44 Pt.V |
| Swindon | 1949 | 12&13 Geo 6 ch.50 |
| West Bromwich | 1949 | 12&13 Geo 6 ch.52 Pt.II |
| LCC (LBs) | 1949 | 12&13 Geo 6 ch.55 Pt.II |
| Doncaster | 1950 | 14 Geo 6 ch.40 Pt.III |
| LCC (Westminster) | 1950 | 14 Geo 6 ch.42 Pt.VI |
| Wolverhampton | 1950 | 14 Geo 6 ch.58 Pt.II |
| Bristol | 1950 | 14 Geo 6 ch.60 Pt.II |
| Sunderland | 1951 | 14&15 Geo 6 ch.36 Pt.IX |
| Nottinghamshire (Newark, Mansfield, East Retford, Worksop) | 1951 | 14&15 Geo 6 ch.45 Pt.XII |
| Nottingham | 1952 | 15&16 Geo 6 & 1 Eliz 2 ch.33 Pt.V |
| Preston | 1952 | 15&16 Geo 6 & 1 Eliz 2 ch.47 Pt.IX |
| Essex (Dagenham) | 1952 | 15&16 Geo 6 & 1 Eliz 2 ch.50 Pt.XIV |
| Liverpool | 1956 | 4&5 Eliz 2 ch.40 |
| Leicester | 1956 | 4&5 Eliz 2 ch.49 Pt.XIV |
| Leeds | 1956 | 4&5 Eliz 2 ch.75 Pt.XII |
| Dundee | 1957 | 6&7 Eliz 2 ch.4 s.599. |
| Oldham | 1966 | ch.20 Pt.IV |
| Liverpool | 1966 | ch.40 Pt.VI |
| Hounslow | 1968 | ch.28 Pt.III |
| Newcastle upon Tyne | 1968 | ch.42 Pt.VI |
| Cardiff | 1969 | ch.47 Pt.IV |
| GLC (Outer LBs) | 1969 | ch.52 s.45 |
| Dudley | 1969 | ch.53 Pt.II |
| Warley | 1969 | ch.54 Pt.II |
| Walsall | 1969 | ch.58 Pt.II |
| West Bromwich | 1969 | ch.59 Pt.II |
| Wolverhampton | 1969 | ch.60 Pt.II |
| Norwich | 1970 | ch.27 Pt.II |
| Northampton | 1970 | ch.64 Pt.II |
| Bootle | 1970 | ch.80 Pt.III |
| Teesside | 1971 | ch.17 Pt.II |
| Torbay | 1971 | ch.60 Pt.III |
| Flintshire | 1971 | ch.66 Pt.VI |
| Scunthorpe | 1971 | ch.68 Pt.II |
| Glamorgan | 1973 | ch.1 Pt.IV |
| Salford | 1973 | ch.24 Pt.IV |

## APPENDIX 6: EXTRACTS FROM GENERAL LEGISLATION

### Electricity (Supply) Act 1919, 9&10 Geo 5 ch.100

16. (2) A joint electricity authority and any local authority, company or person may, with the consent of the Electricity Commissioners, enter into arrangements for the utilisation, for the purposes of the joint electricity authority, of water power, waste heat, or other form of energy which the local authority, company, or person may be able to dispose of, or for the supply by the joint electricity authority of any form of energy other than electricity, and, where such an arrangement has been made, the joint electricity authority may be authorised by order to exercise such powers (including the power to break up roads, railways and tramways) as may be necessary for the purpose of conveying such energy:

Provided always that such joint electricity authority, local authority, company, or person shall in no case have the power to enter into arrangements for the supply by the joint electricity authority of any form of energy, other than electricity, in any area or district within which any undertakers may be authorised by Parliament to supply such form of energy unless and until such undertakers consent thereto, and then only upon such terms and conditions as may be agreed upon with such undertakers.

### Housing (Scotland) Act 1925, 15&16 Geo 5 ch.15

43. (1) A local authority may provide housing accommodation for the working classes -

( .... )

(2) The local authority may alter, enlarge, repair or improve any house so erected, converted or acquired, and may fit out, furnish and supply any such house with all requisite furniture, fittings, and conveniences.

(....)

### Housing Act 1936, 26 Geo 5 & 1 Edw 8 ch.51

s.72, subsections (1) and (2) identical to Housing (Scotland) Act 1925, s.43 (1) & (2)

New Towns Act 1946, 9&10 Geo 6 ch.68

2. (....)

(2) The objects of a development corporation established for the purposes of a new town shall be to secure the laying out and development of the new town in accordance with proposals approved in that behalf under the following provisions of this Act, and for that purpose every such corporation shall have power to acquire, hold, manage and dispose of land and other property, to carry out building and other operations, to provide water, electricity, gas, sewerage and other services, to carry on any business or undertaking in or for the purposes of the new town, and generally to do anything necessary or expedient for the purposes of the new town or for purposes incidental thereto:

Provided that, subject to the provisions of this Act with respect to the making of advances to development corporations, a development corporation shall not have power to borrow money.

(....)

## Electricity Act 1947, 10&11 Geo 6 ch.54

50. (1) It shall be the duty of the Central Authority to investigate methods by which heat obtained from or in connection 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.

(3) Any Electricity Board may, in accordance with a scheme submitted by them to the Minister and approved by order of the Minister, exercise for the purposes mentioned in the last foregoing subsection any powers of that Board under this Act (including any enactments incorporated therewith) or the Electricity (Supply) Acts, 1882 to 1936, or any local enactment, being powers relating to the breaking up of streets, railways and tramways, in like manner and subject to the like provisions and restrictions as they are exercisable for the purposes of the supply of electricity, subject to such adaptations as may be prescribed by the order:

Provided that, in the case of a scheme of the North of Scotland Board, the scheme shall be submitted to, and the order approved by, the Secretary of State.

(4) Any order made under this section shall be subject to special parliamentary procedure.

## Electricity Act 1957, 5&6 Eliz 2 ch.48

4th Schedule: Amendments of Electricity Act 1947

Section 50

In subsection (1) for the words "the Central Authority" and "the Authority" there shall be substituted the words "every Electricity Board".

Housing Act 1957, 5&6 Eliz 2 ch.56

92. (1) A local authority may provide housing accommodation -

(a) by the erection of houses on any land acquired or appropriated by them,

(b) by the conversion of any buildings into houses,

(c) by acquiring houses,

(d) by altering, enlarging, repairing or improving any houses or buildings which have, or an estate or interest in which has, been acquired by the local authority.

Any such powers as aforesaid may, for supplying the needs of the district, be exercised outside the district of the local authority.

(2) The local authority may alter, enlarge, repair or improve any house so erected, converted or acquired.

(....)

21. (1) A disposal authority may, subject to subsections (2) and (3) of this section, -

(a) use waste belonging to the authority for the purpose of producing from it heat or electricity or both;

(b) establish and operate, within or outside its area, such generating stations and other installations as the authority thinks fit for the purpose aforesaid; and

(c) where the authority operates an installation in which the waste is usually used as the main fuel for the purpose of producing heat or electricity, then -

(i) in the case of an installation for producing heat, use other fuel in addition to waste to produce the heat, and

(ii) in the case of an installation for producing electricity, use other fuel to assist in burning the waste to produce the electricity,

and, in an emergency, use other fuel instead of waste to produce the heat or electricity;

and a disposal authority may use, sell or otherwise dispose of any heat produced by the authority by virtue of this section.

(2) A disposal authority shall not be entitled to make any arrangements with a view to the production from waste of electricity for use other than by the authority unless -

(a) the authority has had consultations about the arrangements with the Central Electricity Generating Board and with any Electricity Board proposed to be specified in the arrangements in pursuance of paragraph (b) of the following subsection; and

(b) the arrangements are approved by the Secretary of State and are in accordance with any conditions which he attaches to his approval.

In the application of this subsection to Scotland the reference to the Central Electricity Generating Board shall be omitted.

(3) Where a disposal authority produces electricity by virtue of this section the authority -

(a) may use any of the electricity at the installation at which it was produced and on any premises occupied by the authority in connection with the installation, but it shall not use any of it elsewhere;

(b) may sell any of the electricity, on such terms as are specified in the relevant arrangements made in pursuance of the preceding subsection, to any Electricity Board (within the meaning of the Electricity Act 1947) which is so specified, but shall not sell or otherwise dispose of it to any other person;

and it shall be the duty of any Electricity Board so specified to buy electricity from the authority in accordance with the said arrangements.

(4) Subsection (6) of section 12 of this Act (except paragraph (b) of that subsection) and subsection (7) of that section (except so much of it as relates to the Pipe-lines Act 1962) shall have effect in relation to a disposal authority as if the reference in the said subsection (6) to the collection of waste in pursuance of that section included the conveying of heat produced by the authority by virtue of this section and of air, steam and water heated by such heat.

(5) It shall be the duty of a disposal authority by which an installation for producing heat is operated in pursuance of this section in any year to furnish to the Secretary of State, as soon as practicable after the end of that year, such particulars relating to the installation and heat produced at it as are prescribed.

(6) Nothing in this section (except the restrictions imposed by subsections (2) and (3)) shall be construed as prejudicing any power exercisable by a disposal authority apart from this section.

11.- (1) Subject to subsections (2) and (3) of this section, a local authority may -

(a) produce heat or electricity or both;

(b) establish and operate such generating stations and other installations as the authority thinks fit for the purpose of producing heat or electricity or both;

(c) buy or otherwise acquire heat;

(d) use, sell or otherwise dispose of heat produced or acquired by the authority by virtue of this section;

(e) without prejudice to the generality of the preceding paragraph, enter into and carry out agreements for the supply by the authority, to premises within or outside the authority's area, of such heat as is mentioned in the preceding paragraph and steam produced from and air and water heated by such heat.

(2) A local authority shall not be entitled to make any arrangements with a view to the production in pursuance of this section of electricity unless -

(a) the authority has had consultations about the arrangements with the Central Electricity Generating Board and with any Electricity Board proposed to be specified in the arrangements in pursuance of paragraph (b) of the following subsection; and

(b) the arrangements are approved by the Secretary of State and are in accordance with any conditions which he attaches to his approval.

(3) Where a local authority produces electricity by virtue of this section the authority -

(a) may use any of the electricity at the installation at which it was produced and on any premises occupied by the authority in connection with the installation, but shall not use any of it elsewhere;

(b) may sell any of the electricity, on such terms as are specified in the relevant arrangements made in pursuance of the preceding subsection, to any Electricity Board which is so specified, but shall not sell or otherwise dispose of it to any other person;

and it shall be the duty of any Electricity Board so specified to buy electricity from the authority in accordance with the said arrangements.

(4) A local authority may -

(a) construct, lay and maintain pipes and associated works for the purpose of conveying heat produced or acquired by the authority by virtue of this section and steam produced from and air and water heated by such heat;

(b) contribute towards the cost incurred by another person in providing or maintaining pipes or associated works which are connected with pipes provided by the authority in pursuance of the preceding paragraph.

(5) Parts V and VI of Schedule 3 to the Water Act 1945 (which relate to the laying of mains and the breaking open of streets) shall apply in relation to pipes and associated works provided or to be provided in pursuance of the preceding subsection as those Parts apply in relation to water mains and pipes but as if -

(a) sections 19(4) and 21 of that Schedule (which relate to the erection of street notices and the laying of service pipes) were omitted, and in section 22 of that Schedule the words "which they are authorised to lay" were omitted; and

(b) for any reference to undertakers or limits of supply there were substituted respectively a reference to the authority in question and the area of the authority; and

(c) for the reference to the special Act in section 25(4) of that Schedule there were substituted a reference to this subsection.

(6) It shall be the duty of a local authority by which an installation for producing heat is operated in pursuance of this section in any year to furnish the Secretary of State, as soon as practicable after the end of that year, such particulars relating to the installation and heat produced in it as are prescribed.

(7) In this section -

"associated works", in relation to pipes, means any of the following connected with the pipes, namely, any valve, filter, stopcock, pump, meter, inspection chamber and manhole and such other works as are prescribed;

"Electricity Board" has the same meaning as in the Electricity Act 1947; and

"prescribed" means prescribed by regulations made by statutory instrument by the Secretary of State;

and nothing in this section (except the restrictions imposed by subsection (3)) shall be construed as prejudicing any power exercisable by a local authority apart from this section.

12. (1) A local authority which supplies or proposes to supply heat, hot air, hot water or steam in pursuance of the preceding section may make byelaws -

(a) with respect to the works and apparatus to be provided or used by persons other than the authority in connection with the supply;

(b) for preventing waste and unauthorised use of the supply and unauthorised interference with works and apparatus used by the authority or any other person in connection with the supply;

(c) providing for any specified contravention of the byelaws to be an offence punishable on summary conviction with a fine of such an amount, not exceeding £100, as is specified in the byelaws.

(2) Subsections (1) to (5) of section 82 of Schedule 3 to the Water Act 1945 (which relates to the entry of premises by authorised officers of water undertakers) shall have effect for the purpose of authorising the entry of premises by authorised officers of an authority which provides or proposes to provide such a supply as is mentioned in the preceeding subsection as if for any reference to undertakers there were substituted a reference to the authority and as if in subsection (1) of that section -

(a) for paragraph (a) there were substituted the following paragraph -

(a) for the purpose of installing, examining, adjusting, removing or reading any meter used or to be used by the authority for measuring the heat, hot air, hot water or steam supplied or to be supplied by the authority;

(b) for the words from "the special Act" onwards in paragraph (b) there were substituted the words "byelaws in force by virtue of section 12 of the Local Government (Miscellaneous Provisions) Act 1976"; and

(c) for the words "the special Act" in paragraphs (c) and (d) there were substituted the words "section 11 of that Act".

(3) Building regulations may repeal or alter subsection (1) of this section or any provision of byelaws in force by virtue of that subsection and may make any modification of the preceding subsection which the Secretary of State considers is appropriate in consequence of the repeal or alteration; and section 80 of the Health and Safety at Work etc. Act 1974 (which among other things provides that regulations under subsection (1) of that section may repeal or modify any provision to which that subsection applies if it appears to the authority making the regulations that it is expedient to do so in consequence of any provision made by or under Part I of that Act) shall have effect as if the provisions to which subsection (1) of that section

applies included subsection (1) of this section and byelaws in force by virtue of subsection (1) of this section.

(4) The accounts of a local authority by which expenditure is incurred under any of the provisions of the preceding section and this section shall include a separate account of that expenditure and of any income connected with functions conferred on the authority by those provisions.

## Electricity (Scotland) Act 1979, ch.11

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

(2) Either of the Boards may provide or assist other persons to provide for the heating of buildings by any such metnods or otherwise for the use of heat so obtained, and may, in accordance with a scheme submitted by the Board concerned to the Secretary of State and approved by order made with or without modification by him, exercise for those purposes the powers conferred by subsection 13(8) for the purposes of that section, and section 13(9) shall apply in relation to the manner in which those powers are exercisable.

5. (1) In this section "private generator or supplier" means a person other than an Electricity Board or local authority who -

(a) generates electricity, or

(b) supplies electricity generated otherwise than by an Electricity Board or local authority.

(2) Where a private generator or supplier requests an Electricity Board -

(a) to give and continue to give a supply of electricity to premises where he generates electricity or from which he supplies electricity to others, or

(b) to purchase electricity generated by him, or

(c) to permit him to use the Board's transmission and distribution system for the purpose of giving a supply of electricity to any premises,

the Board shall comply with the request unless on technical grounds it would not be reasonably practicable to do so.

(3) Subject to sections 6 and 8 below, an offer under this section may include such reasonable terms and may be subject to such reasonable conditions as the Board may determine, including -

(a) terms requiring security to be given for the payment of any sums that may become payable to the Board, and

(b) the condition that any necessary planning or other consents are obtained (including, in the case of an offer by the Central Electricity Generating Board, the consent of the Secretary of State under section 2(6) of the Electricity Act 1957).

(4) Every offer under this section shall include such reasonable terms and conditions as the Board may consider necessary to secure that the control by Electricity Boards of the operation of the electricity supply system is not impaired.

(5) If, before a request under this section can be complied with, it is necessary for any electric lines or other electrical plant to be provided, or for any other works to be carried out, the terms of an offer under this section -

(a) shall include an undertaking by the Board to provide the lines or other plant or carry out the works, and

(b) may require the person making the request to make payments to the Board in respect of any expenditure incurred by the Board in carrying out the undertaking.

(6) A request under this section shall contain such particulars and shall be in such form, as may be prescribed by regulations made by the Secretary of State; and such regulations may make provision for the payment to the Board by the person making the request of fees to meet the Board's administrative expenses in dealing with the request.

19. (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".

(3) For section 15 of the Electricity (Scotland) Act 1979 (research into heating from electricity) there shall be substituted -

15. (1) It shall be the duty of each 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) For the purposes of a scheme under subsection (1), a Board may, in accordance with a scheme submitted by them to the Secretary of State and approved by order made with or without modification by him, exercise the powers conferred by section 13(8) for the purposes of that section, and section 13(9)

shall apply in relation to the manner in which the powers are exercisable.

(3) Nothing in subsection (1) shall require a 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.".

## APPENDIX 7: SURVEY OF LOCAL AUTHORITY INVOLVEMENT IN CHP/DH, 1980-83

Observations in chapter 8 on the responses of local authorities to the Department of Energy programme of investigation from 1980 are largely based on a postal survey conducted in August 1983.

### Categories of Authority

Questionnaires were sent to the Chief Executives of 97 local authorities, divided into groups according to their response to the DEn's invitation, subsequent selection, etc. (number of authorities in brackets):

A. Authorities which were contacted by the DEn or their association; responded favourably; and were subsequently shortlisted in WS Atkins' interim report. (7)

B. Authorities which were contacted; responded favourably initially but later withdrew. (2)

C. Authorities which were contacted; responded favourably; were not shortlisted in Atkins' interim report; but were added to the list later. (3)

D. Authorities which were contacted; did not initially respond favourably; but were added to the shortlist later. (2)

E. Authorities which became involved in discussions later about inclusion; but were not included in the investigations. (3)

F. Authorities which were contacted; responded favourably; but were not included. (5)

G. Authorities which were contacted and either did not respond or declined to participate. (56)

H. Authorities which were not contacted but whose areas had been listed in Energy Paper 34 as possible sites for CHP schemes on the basis of their estimated heat loads. (19)

Two residual groups of authorities were omitted and their involvement investigated by other means:

I. Those which did not initially respond favourably to the DEn invitiation but which became involved later as a result of the involvement of another authority in the area. (4)

J. Certain authorities from group A, because of their special circumstances and local authority structure. (3)

## Authorities

| | | | |
|---|---|---|---|
| A. | Strathclyde RC | Glasgow | Tyne and Wear CC |
| | Newcastle/Tyne | Southwark | Sheffield |
| | Liverpool | | |
| B. | Croydon | Westminster | |
| C. | Lothian RC | Manchester | Leicester |
| D. | Edinburgh | Tower Hamlets | |
| E. | Hampshire CC | Portsmouth | Camden |
| F. | Southampton | Barking | South Glamorgan CC |
| | Wakefield | Rochdale | |
| G. | Barnet | Bexley | Brent |
| | Bromley | Ealing | Enfield |
| | Greenwich | Hackney | Hammersmith & Fulham |
| | Haringey | Harrow | Havering |
| | Hillingdon | Hounslow | Islington |
| | Kensington & Chelsea | | Kingston/Thames |
| | Lambeth | Lewisham | Merton |
| | Newham | Redbridge | Richmond |
| | Sutton | Waltham Forest | Wandsworth |
| | City of London | Birmingham | Coventry |
| | Dudley | Sandwell | Solihull |
| | Walsall | Wolverhampton | Bolton |
| | Bury | Oldham | Salford |
| | Stockport | Tameside | Trafford |
| | Wigan | North Tyneside | South Tyneside |
| | Sunderland | Knowsley | St. Helen's |
| | Sefton | Wirral | Barnsley |
| | Doncaster | Rotherham | Bradford |
| | Calderdale | Kirklees | Leeds |
| | Bristol | | |
| H. | Nottingham | Stoke/Trent | Brighton |
| | Kingston/Hull | Stockton/Tees | Cleveland CC |
| | Middlesborough | Cardiff | Bournemouth |
| | Plymouth | Southend/Sea | Blackpool |
| | Derby | Aberdeen | Renfrew |
| | Gillingham | Swansea | Dundee |
| | Luton | | |
| I. | South Yorkshire | Gateshead | Merseyside |
| | Greater Manchester | | |
| J. | Belfast | Milton Keynes | Greater London Council |

## Objectives

The general objectives of the survey were:

- to discover how authorities reacted to the invitation and why they did or did not become involved, in terms of organisation, procedure, and other factors;

- to discover the pattern of subsequent treatment of the topic by both those shortlisted and those not, and differences between the groups.

Specific or additional objectives for each group included:

A. to indicate questions for further investigation and interviews

B. to indicate reasons for withdrawal after initial favourable response

C. to discover how authorities came to be added to the shortlist, and as for A

D. as for C

E. to discover how authorities came to be involved in the discussions and how they were later excluded from selection

F. whether interest was followed up or effectively ended by exclusion from the investigations

G. to indicate reasons for declining the invitation or not responding

H. to discover whether general discussion of CHP/DH or specifically the findings of EP34 had stimulated activity by other authorities

It was not intended that the information from the survey be analysed quantitatively.

## Questionnaire

As an example, the questions for group A were as follows:

1. How was the Authority originally notified about the Department of Energy's proposals (in April 1980) for investigating Combined Heat and Power/District Heating?

2. Which committee or department was responsible for responding to the communication? (If possible, could you indicate where and for roughly what date discussions on the matter would be minuted and whether these minutes are available for inspection?)

3. Within this group were there people with prior knowledge of district heating schemes? Did the topic seem readily suited to someone's existing responsibilities?

4. Was advice sought from outside the Authority? If so, from whom?

5. Which other committees or departments, if any, were notified, or took an interest, or considered they had responsibilities which impinged on the possibility of introducing CHP/DH?

6. Were there any notably enthusiastic advocates among councillors or officials? Or notable opponents?

7. What do you consider were the main factors which determined the Authority's positive response? (Specific characteristics of the area? Specific problems which CHP/DH might address? The enthusiasm of individuals?)

8. Who within the Authority now has responsibility for pursuing the matter? Has it entailed rearranging responsibilities (perhaps a specific new appointment or the formation of a working group or sub-committee)?

9. What documents or statements has the Authority published on the subject? In particular, has it yet responded to the detailed study contained in Atkins' report of Autumn 1982?

10. What other actions has the Authority taken on the matter besides its participation in negotiations with the Department of Energy and its consultants? (Has it sought to publicise or promote the possibility of a scheme? Has it participated in individual or collective lobbying for Government backing? Has it pursued independent appraisals or finance?)

11. Have other institutions or groups in the Authority's area shown interest in the scheme? If so, which?

12. Has the Authority encouraged such interest? (Has it sought their views on the matter? Has it set up a forum for discussion?) Have any of these groups continued to be involved in the Authority's work on the scheme?

13. Has the Authority made recommendations for an institutional structure for the introduction and administration of a scheme? (A local authority undertaking? A consortium of private and public bodies?)

14. What is the feeling among those responsible (or, if you are unable to gauge this, your own opinion) about the prospects for CHP/DH being introduced in your area? On what factors does it most depend?

15. Have any proposals or contingency plans been made for the event of Government support not being given to CHP/DH in your area?

16. Does the Authority administer any district heating schemes at present? Has it ever done so, as far as you are aware?

17. Any further comments?

## Response

The overall response was low. The response varied between groups, with, not surprisingly, those containing authorities which responded favourably to the DEn invitation, providing most and the fullest responses.

Response rates:

| | | |
|---|---|---|
| A. | 4/7 | 57% |
| B. | 2/2 | 100% |
| C. | 2/3 | 67% |
| D. | 1/2 | 50% |
| E. | 3/3 | 100% |
| F. | 2/5 | 40% |
| G. | 12/56 | 21% |
| H. | 9/19 | 47% |
| Overall | 35/97 | 36% |

## Observations

Of responding authorities which were contacted about the programme but did not respond favourably (G), most referred the invitation to technical officers for evaluation. It was regarded as politically neutral and a matter for technical opinion, and virtually all authorities claimed to have the necessary expertise to judge. Several did recognise a need to consult a number of departments which could be expected to have an interest, such as architecture, planning, engineering or housing. Only one responding authority sought outside advice. In some cases the enquiry was immediately related to specific perceived opportunities or a lack of them, based on officers' knowledge of existing power stations, heat plants, etc., and accordingly rejected. Thus officers concluded on technical grounds that investigation was not worthwhile rather than leaving that an open question, and to this extent could be considered to have misjudged the intention of the invitation. In several cases the treatment of the matter was strongly influenced by associations with unfavourable experience of HO/DH schemes. Preformed opposition to DH on technical or economic grounds or at least anticipated technical difficulties were behind several rejections. Some authorities did not see the enquiry as relevant because they did not operate DH schemes at the time. Problems with existing DH systems were also mentioned by authorities in other groups.

Thus very few of these authorities treated the issue as one of policy and it was not often raised at member level. One that did appreciate the significance of the programme had been reluctant to get involved with such an innovation and felt that a firmer lead from the DEn was needed. Anticipated high cost, unlikelihood of eventual Government finance, and lack of proven schemes, were also cited. Two authorities were persuaded to participate in discussions with an authority in an adjacent conurbation but were later excluded from the investigation anyway. Several authorities noted the criterion of 300 000 population which excluded them. A few metropolitan boroughs pursued a joint response with an adjacent borough to overcome this. One London borough initially accepted this exclusion but was later persuaded by officers and consultants to pursue a joint response, and was selected for investigation. The GLC encouraged LBs to respond.

Of responding authorities whose areas appeared in the lists in EP34 as possible sites on the basis of heat load estimates (H), most claimed to be aware from the technical press that the subject had been raised, but few had seen or considered the findings of EP34. Only one had discussions on the matter, but these were initiated before the DEn programme; a feasibility study for specific sites and sources was carried out in cooperation with the Area Electricity Board.

Of responding authorities which reacted favourably at some stage (A,B,C,E,F), over half dealt with the matter through a general policy committee, and the rest through technical departments; most consulted other technical departments seen as having an interest and a few sought outside advice. Most authorities reported little controversy about the issue, and officers' actions were duly endorsed by committees and council. There were, however, notably enthusiastic officers and councillors in some authorities. Of reasons for positive response, uppermost were heating problems and conditions in housing stock, the possibility of reduced fuel costs, the local employment potential of a major project in construction and manufacture, and keenness to pursue energy conservation. Some

authorities cited specific technical characteristics in their favour such as large numbers of group heating schemes suitable for incorporation. Several contacted adjacent or overlapping authorities to discuss participation.

Of responding authorities subsequently excluded from the investigations (B,E,F), only one London borough and one city council claimed to have registered and maintained a continuing interest in the subsequent development of the programme. (Several authorities are, however, known to have had the possibility of CHP/DH brought to their attention by outside groups.)

Three authorities which were included later (C), lobbied via various channels for inclusion. Two (D) were persuaded to be included later by other authorities.

Among the authorities subsequently involved in the first stage of the DEn investigations, the apparent enthusiasm, the resources committed and the organisational arrangements for pursuing the matter, varied widely. Some established special groups of officers from relevant departments and in some cases councillors, but without formal reorganisation or extra appointments. In others the responsibility was allocated to individuals. Most groups and individuals reported to a policy committee. Where adjacent or overlapping authorities were not already involved, authorities sought at least their nominal support and in some cases persuaded them to participate.

On future prospects (as at autumn 1983), most authorities stressed their commitment to the project but considered Government support in policy and financial terms crucial to its success.

## APPENDIX 8: CONSORTIA FOR DEPARTMENT OF ENERGY PROGRAMME BIDS, 1984

### London 1

Greater London Council
Balfour Beatty Ltd
London Borough of Southwark
London Borough of Tower Hamlets

### London 2

Professor James Thring
Wallis Smith Trust Co
Costain Group
GEC Engineering Research Centre
Utilicom
Battelle Institute (advisers)

### Belfast

Associated Heat Services PLC
Harland and Wolff Ltd
Fairclough Scotland Ltd
Mainmet Holdings PLC
Northern Engineering Industries PLC
Northern Ireland Electricity Service
Press Construction Ltd
Ulster Investment Bank Ltd

### Glasgow

Balfour Beatty Ltd
Taylor Woodrow PLC
Associated Heat Services PLC
Babcock Power Ltd
John Brown Engineering Ltd
Mainmet Holdings PLC
Motherwell Bridge Tacol Ltd
South of Scotland Electricity Board

### Liverpool

Associated Heat Services PLC
Babcock Power Ltd
GEC Ltd
Haden Young
Liverpool City Council
Norwest Holst
Tysons
WS Atkins and Partners (advisers)

## Newcastle

Associated Heat Services PLC
Mainmet Holdings PLC
Northern Engineering Industries PLC
Press Construction PLC
Sir Robert McAlpine and Sons Ltd
City of Newcastle upon Tyne
Gateshead MBC
Tyne and Wear County Council
Hill Samuel and Co Ltd (advisers)
Central Electricity Generating Board (advisers)

## Leicester

Hawker Siddeley Power Engineering Ltd
John Laing Construction Ltd
Foster Wheeler Power Products Ltd
GEC-Ruston Gas Turbines and GEC Engineering Research Centre
Associated Heat Services PLC
Mainmet Holdings PLC
Central Electricity Generating Board / Midland Region
East Midlands Electricity Board
National Coal Board
Leicestershire County Council
Leicester City Council
Morgan Grenfell and Co Ltd (advisers - others not specified)

## Manchester

No details known

## Sheffield

Lord Ezra
Associated Heat Services PLC
British Gas
Foster Wheeler Ltd
Mainmet Holdings PLC
Rolls Royce Ltd
Sheffield City Council
South Yorkshire County Council
WS Atkins and Partners Ltd (advisers)
Kleinwort Benson (advisers)
University of Sheffield, Department of Chemical Engineering and Fuel Technology (advisers)
Sheffield City Polytechnic, Energy Studies Group, Department of Mechanical Engineering (advisers)

Edinburgh

Associated Heat Services PLC
Mainmet Holdings PLC
Northern Engineering Industries PLC
Press Construction Ltd
Lothian Regional Council
Edinburgh District Council
South of Scotland Electricity Board
Scottish Development Agency
Fairclough Scotland Ltd

## APPENDIX 9: COAL CONSUMPTION

Total coal consumption 1923-1985, and domestic solid fuel consumption 1940-1985


Sources: MFP, Statistical Digest 1948/9 (London: HMSO, 1949); MoP, Digest of Energy Statistics (London: HMSO, various years); DEn, Digest of UK Energy Statistics (London: HMSO, various years).

## APPENDIX 10: GAS CONSUMPTION

Total gas sales 1945-1985, and domestic gas sales 1950-1985


Sources: MFP, Statistical Digest 1948/9 (London: HMSO, 1949); MoP, Digest of Energy Statistics (London: HMSO, various years); DEn, Digest of UK Energy Statistics (London: HMSO, various years); BR Mitchell and HG Jones, Second Abstract of British Historical Statistics (Cambridge: CUP, 1971).

## APPENDIX 11: GAS PRICES

Average selling price of gas 1948-1985, and relative to a general price index


Sources: MFP, Statistical Digest 1948/9 (London: HMSO, 1949); MoP, Digest of Energy Statistics (London: HMSO, various years); DEn, Digest of UK Energy Statistics (London: HMSO, various years). Real costs use price indeces derived from BR Mitchell and P Deane, Abstract of British Historical Statistics (Cambridge: CUP, 1962); BR Mitchell and HG Jones, Second Abstract of British Historical Statistics (Cambridge: CUP, 1971); DEn, Digest of UK Energy Statistics (London: HMSO, various years).

## APPENDIX 12: POWER STATION FUEL COSTS

Cost to ESI of coal 1914-85, and fuel oil, 1931-1985, and relative to a general price index


Sources: MFP, Statistical Digest 1948/9 (London: HMSO, 1949); MoP, Digest of Energy Statistics (London: HMSO, various years); DEn, Digest of UK Energy Statistics (London: HMSO, various years). For the derivation of real prices see Appendix 11. Coal prices before 1931 are notional only, and derived from London coal prices in BR Mitchell and P Deane, Abstract of British Historical Statistics (Cambridge: CUP, 1962).

APPENDIX 13: DOMESTIC ENERGY CONSUMPTION: PATTERN OF DELIVERED FORMS


Source: DEn, Digest of UK Energy Statistics (London: HMSO, various years).

## APPENDIX 14: PUBLIC SECTOR HOUSING CONSTRUCTION

Great Britain: dwellings completed by local authorities 1920-1939



Source: D Whitham, 'The First Sixty Years of Council Housing', in J English (ed.), The Future of Council Housing (London: Croom Helm, 1982); taken originally from M Bowley, Housing and the State (London: Allen and Unwin, 1945).

UK: public sector dwellings started 1951-1985


Source: DoE, Housing and Construction Statistics (London: HMSO, various years)

# NOTES AND REFERENCES

Chapter 1

1. On the technics of CHP, see e.g. RME Diamant and D Kut, District Heating and Cooling for Energy Conservation (London: Architectural Press, 1981), ch.5; C Mackenzie-Kennedy, District Heating: Thermal Generation and Distribution (Oxford: Pergamon, 1979); AF Postlethwaite, 'Combined Heat and Power', in D Merrick (ed.), Energy: Present and Future Options (London: Wiley, 1984), pp.265-370. For a convenient summary, see DEn, Combined Heat and Electrical Power Generation in the United Kingdom, Energy Paper 35 (London: HMSO, 1979), pp.3, 23-4. On the economics of CHP/DH see, for principles, EA French, 'The Principles of Appraising the Economics of District Heating', paper to 1st IDHC, London, Apr 1970; NJD Lucas, 'The Case for Combined Heat and Power in the UK', Energy Research 2, 1978, pp.29-42; and for application to schemes, e.g., DEn, EP35, op. cit.; District Heating Working Party of the Combined Heat and Power Group, District Heating Combined with Electricity Generation in the United Kingdom, Energy Paper 20 (London: HMSO, 1977); DEn/WS Atkins, Combined Heat and Power District Heating Feasibility Programme: Stage 1, Energy Paper 53 (London: HMSO, 1984); Orchard Partners, 'The Economics of Combined Heat and Power with District Heating in London', Report 268/1/R8 (Oct 1983).

2. On the technics of DH networks and HO sources, see e.g. Diamant and Kut, op. cit., esp. chs.8-12; Mackenzie-Kennedy, op. cit., chs.2,6 (note 1). Much activity and debate on CHP is also concerned with its application in industry for process heat. Though the two topics are strongly related technically, the institutional context is in many respects separate. This thesis does not deal with privately installed industrial CHP except where there are policies or actions affecting both or other forms of overlap, as in the involvement of the ESI in industrial schemes, and in the disputes over terms of interchange of electricity. On industrial CHP, see DEn, op. cit., pp.16-21 (note 1); Select Committee on Energy, Third Report 1982/3, Combined Heat and Power, HC 314-1 (London: HMSO, Apr 1983), pp.23-31; and section 4.5, esp. note 229.

3. For international reviews, see International Energy Agency, District Heating and Combined Heat and Power Systems: A Technology Review (Paris: IEA/OECD, 1983), ch.8 and apps.2-10; E Tremba, 'An International Survey of District Heating', paper to 1st IDHC, London, 1970; RME Diamant, 'District Heating with Combined Heat and Power Generation 13: Survey of Present Day Practice', H&ACJ 51, Jan 1978, pp.17-21; 'Situation and Development of District Heating in UNICHAL Member Countries', CE Translation 6668 from Fernwärme International 3 (1), 1974, pp.3-12 (London: CEGB, 1974). Material on historical and institutional aspects of the development of CHP and DH in specific countries still has to be gleaned from the many sketchy papers available, mostly in technical journals. See on Czechoslovakia: V Sládek, 'The Production and Supply of District Heating in Czechoslovakia', paper to 1st IDHC, London, 1970; J Vlach, 'Die Fernwärmeversorgung in der CSSR', Fernwärme International 6 (1), 1977, pp.5-7; Denmark: FE Olsen, 'District Heating in Denmark', paper to 1st IDHC, London, 1970; AE Haseler, 'District Heating in Denmark', JIHVE 36, Sep 1968, pp.186-97 and Oct 1968, pp.213-25; Germany: A Margolis, 'The Growth of District

Heating in Russia and Germany', Engineering 156, 8 Oct 1943, pp.283-4; W Rüdig, 'Energy Conservation and Electricity Utilities: A Comparative Analysis of Obstacles to CHP/DH', Energy Policy 14, Apr 1986, pp.104-16; Hungary: G Czipper and J Halzl, 'Die Rolle der Fernheizung und der Wärme-Kraft-Kupplung in der Energiewirtschaft Ungarns', paper I/2 to 3rd IDHC, Warsaw, Apr 1976; Poland: J Marecki and J Wójcicki, 'Technical and Economic Aspects of District Heating Development in Poland', paper to 1st IDHC, London, 1970; H Stepien, 'Entwicklung von Heizkraftwerken in Polen', paper III/17 to 3rd IDHC, Warsaw, Apr 1976; Romania: N Armenciou, 'Combined Heat and Power is Core of Romanian Policy', Energy International 15, Feb 1977, pp.23-6; Sweden: O Blomquist, 'Developments in District Heating in Sweden', paper to 1st IDHC, London, 1970; L Lindeberg, 'The Role of District Heating in the Energy Policy of a Modern Industrial Country', paper to DHA 3rd National Conference, A National Plan for Heat, Apr 1979; USA: MFP, District Heating in American Housing, (London: HMSO, 1947); BM Conaty, 'District Steam Heating', Steam Engineer 3, Jun 1934, pp.426-8, Jul 1934, pp.385-6 and 4, Oct 1934, pp.26-8; USSR: Margolis, op. cit.; EY Sokolov and S Belinski, 'Fifty Years of Soviet District Heating', Thermal Engineering 21, Nov 1974, pp.1-57. Reviews of the current status of district heating by country, and occasionally historical material, appear in Fernwärme International.

4. A brief account mentioning odd UK schemes is contained in Rudig, op. cit. (note 3).

5. Hannah's two-volume history of the British electricity supply industry has only the briefest of mentions of the option. (L Hannah, Electricity Before Nationalisation: A Study of the Development of the Electricity Supply Industry in Britain to 1948 (London: Macmillan, 1979); Hannah, Electricity Before Nationalisation: A Study of the Development of the Electricity Supply Industry in Britain to 1948 (London: Macmillan, 1979).)

6. Common explanations advanced at various times for the lack of development have included the notion that the climate is unsuitable; that other heating forms were cheaper; and that consumers preferred radiant heat sources. These may or may not be valid statements; the first, e.g., is generally accepted now as an invalid argument against DH, in that the British climate provides a long heating season and high load factor. But as explanations they are to varying extents inadequate and incomplete. To be acceptable as such, it would need to be demonstrated that these points were accepted as valid, and that in some way they actually influenced decisions not to introduce DH. The content of the knowledge itself cannot be held to have caused the outcome; rather some action based upon its acceptance may have done so. The truth or falsity of each is not irrelevant to the outcome, as some advocates of relativism would presumably contend; e.g. if a statement were subsequently demonstrated to be invalid and were accepted as such, it would be important to understand why it was not investigated and rejected earlier. See notes 18 and 19, and 3.5. The discussions in EP20 and EP35 are better in acknowledging, though leaving unexplored, the importance of institutional factors. (District Heating Working Party, op. cit., pp.19-20; DEn, op. cit., p.5 (note 1).)

7. See note 3. On Britain and West Germany, see Rüdig, op. cit. (note 3). See also the brief institutional comparison in NJD Lucas, 'Combined Heat and Power', in Royal Institute of Public Administration, Facing the Energy Future: Does Britain Need New Energy Institutions? (London: RIPA, 1981), pp.27-32.

8. The provision of statutory services - gas, water, electricity - is an issue rarely thought of and little discussed. Accepted but not sought after acquisitions on the Monopoly board, these services occupy a grey and undisturbed area in everyday conversation and academic literature.

(WI Jenkins, Policy Analysis: A Political and Organisational Perspective (London: Martin Robertson, 1978), p.87.)

9. cf. comments in KP Erickson, 'The Political Economy of Energy Consumption in Industrial Societies', in RM Lawrence and MO Heisler, International Energy Policy (Lexington: Heath, 1980), p.137.

10. Certain of the government files consulted for this research were still officially closed. The Department of Energy allowed access to POWE 14/264, 14/265 and 14/266, and the Department of Environment to HLG 101/578. See App.3. The Electricity Council and Central Electricity Generating Board allowed access to certain files with material extending into the period covered by chapter 7.

11. See 2.1 and 3.1.

12. S Russell, 'Denial of Choice: Technological Determinism and its Ideological Role', paper to joint STSA/EASST conference Choice in Science and Technology, London, 16-18 Sep 1983; Russell, Autonomy, Determinism, Imperatives: A Review of Thought on the Loss of Social Control of Technology (MSc dissertation, Technology Policy Unit, Univ of Aston, Sep 1980).

13. See e.g. C Offe, 'Structural Problems of the Capitalist State: Class Rule and the Political System: On the Selectiveness of Political Institutions', in K von Beyme (ed.), German Political Studies 1 (London: Sage, 1974), p.45; and chapter 4, note 84.

14. cf. discussions in P Saunders, Social Theory and the Urban Question (London: Hutchinson, 1981), pp.16-18; RA Alford, 'Paradigms of Relations between State and Society', in LN Lindberg et al. (eds.), Stress and Contradiction in Modern Capitalism (Lexington: Heath, 1975), pp.145-60.

15. M Reed, Redirections in Organizational Analysis (London: Tavistock, 1985), pp.74-5. See also Saunders, op. cit., p.16-18 (note 14); B Jessop, The Capitalist State: Marxist Theories and Methods (Oxford: Martin Robertson, 1982), pp.217-18; D Sayer, Marx's Method (Hassocks: Harvester, 1979), pp.105-41.

16. cf. Jessop, op. cit., pp.211-12 (note 15).

17. cf. P Dunleavy, Urban Political Analysis: The Politics of Collective Consumption (London: Macmillan, 1980), p.131.

18. S Russell, 'The Social Construction of Artefacts: A Response to Pinch and Bijker', Social Studies of Science 16, May 1986, pp.331-46. For arguments for relativism, see T Pinch and W Bijker, 'The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other', Social Studies of Science 14, Aug 1984, pp.399-441; Pinch and Bijker, 'Science, Relativism and the New Sociology of Technology', Social Studies of Science 16, May 1986, pp.355-6; D MacKenzie, 'Notes on the Science and Social Relations Debate', Capital and Class (14), Summer 1981, pp.49-50.

19. The critique of positivism is taken here as given: briefly, that it does not reflect the way knowledge is actually formed; that it is inadequate as a prescription for the development and use of knowledge; and that it is ideological in defending certain interests. See e.g. B Fay, Social Theory and Social Practice (London: Allen and Unwin, 1975), pp.49-66; B Hindess, Philosophy and Methodology in the Social Sciences (Hassocks: Harvester, 1977), pp.134-41.

20. Russell, 1980, op. cit. (note 12).

21. MacKenzie and Wacjman likewise allow diverse contributions and approaches in this general project. (D MacKenzie and J Wacjman (eds.), The Social Shaping of Technology: How the Refrigerator Got its Hum (Milton Keynes: Open University Press, 1985).)

22. Pinch and Bijker see diverse contributions encompassed by their 'new sociology of technology' but in effect attempt to assert a more narrowly defined action sociology approach as paradigmatic. (Pinch and Bijker, 1984, op. cit. (note 18).)

23. e.g. P Blackburn, R Coombs and K Green, Technology, Economic Growth and the Labour Process (London: Macmillan, 1985); D Wolfe, 'Socio-Political Contexts of Technological Change', paper to conference Technology and Social Change, Edinburgh University, 12-13 Jun 1986.

24. D Noble, America by Design: Science, Technology and the Rise of Corporate Capitalism (New York: Knopf, 1979); R Johnston, 'The Internal Structure of Technology', in P Halmos (ed.), The Sociology of Science, Sociological Review Monograph 7 (Keele: Univ of Keele, 1972), pp.117-30.

25. See the contributions in MacKenzie and Wacjman (eds.), op. cit., parts 3 and 4 (note 21).

26. Material useful to the general project can be found under diverse headings: history, sociology and philosophy of technology; economics of innovation or R&D; etc. There appears to be no really comprehensive single review attempting to categorise and relate the different fields and approaches. MacKenzie and Wajcman provide a useful bibliography and suggestions of areas yet to be tackled adequately: op. cit., pp.295-322 (note 21). See also CW Pursell, 'History of Technology', pp.70-120, J Gaston, 'Sociology of Science and Technology', pp.465-526, and C Mitcham, 'Philosophy of Technology', pp.282-363, in P Durbin (ed.), A Guide to The Culture of Science, Technology and Medicine (New York: Free Press, 1980).

27. See 9.1.

28. For a review of diffusion studies and their approaches, see K Warner, 'The Need for Some Innovative Concepts of Innovation: An Examination of Research on the Diffusion of Innovations', Policy Sciences 5, 1974, pp.433-51; LA Brown, Innovation Diffusion: A New Perspective (London: Methuen, 1981), chs.1, 2.

29. Similarly a focus on individual artefacts cannot deal with the properties of technological systems and the interdependence of their components.

30. For a general formulation of a Marxist model of a social formation and of capitalist social formations in particular, see e.g. M Campbell, Capitalism in the UK: A Perspective from Marxist Political Economy (London: Croom Helm, 1981), ch.2. A social formation in Marxist theory is based on a mode of production, with the economic sphere, of production and exchange, in some sense basic, shaping the character of a superstructure of political and conceptual activity. That is, the approach is essentially materialist, in depicting the production of material needs as in some sense fundamental; it is the inversion of idealist accounts. The dynamics of a society is essentially dialectical; the sources of change in its features are found in contradictions in underlying levels of its structure. The extent to which one level is autonomous from, or determined by, the underlying levels - above all, the extent of the primacy of the economic base versus the superstructure - has been a subject of continual reiteration, reinterpretation, misinterpretation and criticism. These debates are not dealt with here. The relationship of base and superstructure is accepted as one in which the former is central, dominant and constrains but by no means determines the latter in the sense of specifying it exhaustively; that the relation between levels is historically specific - that is, the degree of autonomy of, say, state actions from the economic sphere is itself dependent on the historical development of the latter; and above all, that the specific effectivity of different levels of the social formation is much in need of theoretical elaboration.

31. For a discussion of Marx's own treatment of technology, and the case for the continued relevance and power of his approach, see e.g. D MacKenzie, 'Marx and the Machine', Technology and Culture 25, 1984, pp.473-502. For a review of subsequent Marxists and their division into 'technicist' and 'critical' strands, see M Reinfelder, 'Introduction: Breaking the Spell of Technicism', in P Slater (ed.), Outlines of a Critique of Technology (London: Ink Links, 1980), pp.9-37.

32. For a good brief introduction to labour process theory, see J Gardiner, 'The Labour Process', in S Aaronovitch et al., The Political Economy of British Capitalism: A Marxist Analysis (Maidenhead: McGraw-Hill, 1981), pp.299-315. The major criticism of Braverman's work, and much which followed it, concerned a tendency to reduce capital's strategy to one of deskilling; but this is not a necessary consequence of the various ways in which capital can economise on labour power. Another controversy is over the economic changes themselves: between depictions of continuous responses to tendencies and of restructuring in periodic crises. See

H Braverman, Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century (London: Monthly Review Press, 1974); S Wood (ed.), The Degradation of Work? Skill, Deskilling and the Labour Process (London: Hutchinson, 1982); P Blackburn, K Green and S Liff, 'Science and Technology in Restructuring', Capital and Class (18), Winter 1982, pp.15-37.

33. See the argument in 3.3.

34. Russell, 1980, op. cit. (note 12). The dissertation contains a comprehensive list of references illustrating the themes in this section.

35. ibid., pp.6-7 and 35-7.

36. ibid., pp.38-9.

37. ibid., sections 2.3 and 2.4.

38. ibid., pp.14-17.

39. ibid., pp.30-4 and 48-50.

40. ibid., p.19.

41. ibid., pp.71-3. The classic statement is G Hardin, 'The Tragedy of the Commons', Science 162, 1968, pp.1243-48. Opposition to his argument for control over the process in some collective interest comes, of course, from advocates of free market conditions and of incrementalist strategies. They see overall control as impossible and unnecessary, arguing that individual decision-makers need only consider and act according to their immediate interests and context, and that the result will be self-regulating by virtue of the interactions between their decisions.

42. Russell, 1980, op. cit., pp.68-70 (note 12).

43. e.g. L Winner, Autonomous Technology: Technics Out-of-Control as a Theme in Political Thought (Cambridge, Mass.: MIT, 1977), pp.88-100.

44. Russell, 1980, op. cit., pp.19-20 (note 12). See the discussion on testing as a research site in T Pinch, 'Understanding Technology: Some Possible Implications of Work in the Sociology of Knowledge', paper to conference Technology and Social Change, Edinburgh University, 12-13 Jun 1986, pp.12-15.

45. J Ellul, The Technological Society (New York: Knopf, 1976); Russell, 1980, op. cit., pp.25-30 and references, p.111, note 78 (note 12).

46. ibid., pp.23-5.

47. ibid., pp.21-3.

48. ibid., pp.85-92.

49. ibid., pp.73-4.

50. Hence the futility of dismissals of technological determinism based on simple assertions of human 'free will'. (ibid., pp.30-1 and 71.)

51. See 3.5.

52. e.g. S Russell, 'Risk Assessment as a Political Activity: The Case of Comparative Studies of the Health Costs of Energy Systems', paper to 2nd Conference on Science, Society and Education, Risk and Participation, Leusden, Netherlands, Aug 1982.

53. ibid.

54. ibid.

55. Collingridge has categorised and discussed a number of forms of such constraint: D Collingridge, The Social Control of Technology (London: Frances Pinter, 1980). See also Russell, 1980, op. cit., pp.88-92 (note 12).

56. Collingridge, op. cit., ch.4 (note 55).

57. ibid., ch.3.

58. M Kaldor, paper to STSA/VWW conference Public Control of Technology, Univ of Sussex, Sep 1985.

59. B Wynne, Rationality and Ritual: The Windscale Inquiry and Nuclear Decisions in Britain (Chalfont St Giles: British Society for the History of Science, 1982), p.55. See also Wynne, 'Technology, Risk and Participation', in J Conrad (ed.), Society, Technology and Risk Assessment (London: Academic, 1980), pp.178-80.

60. Collingridge, op. cit., esp. ch.2 (note 55).

61. cf. Habermas's argument for the importance of negotiations between researcher and contractor as a research site: J Habermas, 'The Scientisation of Politics and Public Opinion', in Habermas (trans. J Shapiro), Toward a Rational Society (London: Heinemann, 1971), p.70. Such communities cannot be considered uniform entities and their internal structures are likely to have significant effects on their outputs. There may exist hierarchy, conflict, and significant divisions of labour. Contradictory rationalities may operate; in particular, objectives set by the incorporation of science and technology in capitalist enterprises may conflict with professional or other objectives.

62. G Dosi, 'Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change', Research Policy 11, 1982, pp.147-62. See also RR Nelson and SG Winter, 'In Search of a Useful Theory of Innovation', Research Policy 6, 1977, pp.56-60. The argument above about internal structures and conflicting rationalities in technical groups means that the consistency of a paradigm cannot be assumed. The term 'technological paradigm' has been given varying interpretations: see the broader conception in C Freeman, 'Prometheus Unbound', Futures 16, Oct 1984, pp.494-507; C Perez, 'Structural Change and the Assimilation of New Technologies in the

Economic and Social Systems', Futures 15, Oct 1983, pp.357-75. See also 3.5.

63. Johnston, op. cit. (note 24); W Bijker, 'Social Groups and their Technological Styles: Towards an Explanation of the Developmental Process of Bakelite', in C&C/EASST/4S, George Sarton Centennial (Ghent: Communication and Cognition, 1984), pp.329-32.

63. Noble, op. cit. (note 24).

Chapter 2

1. JK Benson, 'A Framework for Policy Analysis', in D Rogers and D Whetten (eds.), Interorganizational Coordination (Iowa State UP, 1983), pp.146-7.

2. JK Benson, 'Organizations: A Dialectical View', Admin Sci Qly 22, Mar 1977, p.10.

3. Benson, 1983, op. cit., p.146 (note 1).

4. e.g. TR Dye, 'Political Science and Public Policy: Challenge to a Discipline', in RN Spadaro et al., The Policy Vacuum (Lexington: Heath, 1975), pp.31-59. cf. Reed's comments on the 'Lego style' of conceptual development: M Reed, Redirections in Organizational Analysis (London: Tavistock, 1985), p.130.

5. Benson, 1977, op. cit., p.8 (note 2).

6. e.g. RH Hall and RE Quinn (eds.), Organizational Theory and Public Policy (London: Sage, 1983); WI Jenkins, Policy Analysis: A Political and Organisational Perspective (London: Martin Robertson, 1978). Allison's classic study, however, effectively crossed these disciplinary boundaries: G Allison, Essence of Decision: Explaining the Cuban Missile Crisis (Boston: Little Brown, 1971); Allison, 'Conceptual Models and the Cuban Missile Crisis', Amer Pol Sci Rev 63 (3), 1969, pp.689-718; G Allison and M Halperin, 'Bureaucratic Politics: A Paradigm and Some Policy Implications', in R Tranter and RH Ullman (eds.), Theory and Policy in International Relations (Princeton: Princeton UP, 1972). For a critique along the lines here, particularly of the 'bureaucratic politics' model, see L Freedman, 'Logic, Politics and Foreign Policy Processes', International Affairs 52, 1976, pp.434-49.

7. S Clegg and D Dunkerley, Organisation, Class and Control (London: RKP, 1980), esp. chs.3-7. For other reviews/critiques, see Benson, 1977, op. cit. (note 2); C Ham and M Hill, The Policy Process in the Modern Capitalist State (Brighton: Wheatsheaf, 1984), ch.7.

8. Clegg and Dunkerley, op. cit., p.213 (note 7).

9. JK Benson, 'Innovation and Crisis in Organizational Analysis', Sociological Quarterly 18, 1977, pp.3-16.

10. e.g. D Hickson et al., 'A Strategic Contingencies Theory of Intraorganisational Power', Admin Sci Qly 16 (2), 1971, pp.216-29.

11. Clegg and Dunkerley, op. cit., ch.7 (note 7).

12. Clegg and Dunkerley, op. cit., ch.8 (note 7). On negotiated order approaches, see e.g. R Day and JV Day, 'A Review of the Current State of Negotiated Order Theory: An Appreciation and a Critique', Sociological Quarterly, Winter 1977, pp.126-42.

13. Clegg and Dunkerley, op. cit., ch.13 (note 7).

14. See reviews in Benson, 1983, op. cit. (note 1); C Fudge and S Barrett, 'Reconstructing the Field of Analysis', in Barrett and Fudge (eds.), Policy and Action: Essays on the Implementation of Policy (London: Methuen, 1981), pp.249-78; D Dunkerley, T Spybey and M Thrasher, 'Interorganizational Networks: A Case Study of Industrial Location', Organization Studies 2 (3), 1981, pp.229-33.

15. e.g J Child, 'Organizational Structure, Environment and Performance: The Role of Strategic Choice', Sociology 6 (1), 1972, pp.1-21.

16. Benson, 1983, op. cit., p.141 (note 1).

17. e.g. FW Scharpf, 'Interorganizational Policy Studies: Issues, Concepts and Perspectives', in K Hanf and FW Scharpf (eds.), Inter-organizational Policy-Making: Limits to Coordination and Control (London: Sage, 1979), pp.345-70.

18. Benson, 1983, op. cit., p.146 (note 1).

19. ibid., p.142.

20. Fudge and Barrett point out the absence of clear dividing lines between exchange, dependence and negotiated order theories. (Fudge and Barrett, op. cit. (note 14).) See also Clegg and Dunkerley, op. cit., p.381-5, 450-1 (note 7).

21. Scharpf, op. cit. (note 17); KS Cook, 'Exchange and Power in Networks of Interorganizational Relations', Sociological Quarterly 18, Winter 1977, pp.62-82.

22. P DiMaggio, 'State Expansion and Organizational Fields', in Hall and Quinn (eds.), op. cit., pp.147-61 (note 6).

23. JK Benson, 'The Interorganizational Network as a Political Economy', Admin Sci Qly 20, 1975, pp.229-49.

24. Cook, op. cit. (note 21).

25. ibid., p.64.

26. ibid., p.78.

27. ibid., p.65.

28. ibid., p.74.

29. ibid., p.74.

30. Scharpf, op. cit., p.353 (note 17).

31. CB Marrett, 'On the Specification of Interorganizational Dimensions', Sociology and Social Research 56 (1), Oct 1971, pp.83-99.

32. On the use of the terms policy analysis, sciences, studies, see Ham and Hill, op. cit., pp.3-5 (note 7); BJ Hogwood and LA Gunn, Policy Analysis for the Real World (Oxford: OUP, 1984), pp.26-8.

33. On the origins and development of the 'policy orientation', see Hogwood and Gunn, op. cit., pp.32-6 (note 32); Ham and Hill, op. cit., pp.1-3 (note 7); HH Heclo, 'Policy Analysis', Brit J Pol Sci 2, Jan 1972, pp.83-108.

34. RT Golembiewski, 'Public Administration and Public Policy: An Analysis of Developmental Phases', in Spadaro et al., op. cit., pp.82-92 (note 4).

35. Y Dror, 'Prolegomena to the Policy Sciences', Policy Sciences 1 (1), 1970, pp.135-50; Dror, Design for Policy Sciences (New York: Elsevier, 1971).

36. H Lasswell, 'The Policy Orientation', in D Lerner and H Lasswell (eds.), The Policy Sciences (Stanford: Stanford UP, 1951), p.3. Ham and Hill side with Wildavsky's more modest view in wanting 'to draw on ideas from a range of disciplines' but fail to point out the inadequacy of unstructured eclecticism in method. (Ham and Hill, op. cit., p.11 (note 7); A Wildavsky, Speaking Truth to Power: The Art and Craft of Policy Analysis (Boston: Little Brown, 1979).)

37. Heclo, op. cit., pp.86-7 (note 31). Ukeles observes the unhealthy rapidity with which the field was accepted. (JB Ukeles, 'Policy Analysis: Myth or Reality?', Public Admin Review 37, 1977, pp.223-8.) Ham and Hill in contrast claim it was a slow process (op. cit., p.1 (note 7).) For an attempt to impose the rational-instrumental model as paradigmatic, see HD Lasswell, 'The Emerging Conception of the Policy Sciences', Policy Sciences 1 (1), 1970, pp.3-14.

38. Heclo, op. cit., p.88 (note 31)..

39. I Gordon, J Lewis and K Young, 'Perspectives on Policy Analysis', Public Admin Bulletin 25, Dec 1977, p.27.

40. For a review, see e.g. LA Gunn and BW Hogwood, Models of Policy-Making, PAT 2.0 (Glasgow: Univ of Strathclyde Centre for the Study of Public Policy, 1982), pp.16-26. See however, the view of the relation between prescription and description taken here, in 1.1: that explanations are inherently normative.

41. B Fay, Social Theory and Social Practice (London: Allen and Unwin, 1975), pp.49-66; L Tribe, 'Policy Science: Analysis or Ideology?', Philosophy and Public Affairs 1 (1), 1971, pp.66-110.

42. e.g. Dror's 'instrumental-normative' models 'do not state what the substantive values of the system should be, but instead show methods for increasing net output, whatever the values prescribing that output may be.' (Y Dror, Public Policy-Making Re-examined (Aylesbury: Leonard Hill, 1973), p.22.)

43. GM Dillon, 'Policy and Dramaturgy: A Critique of Current Conceptions of Policy-Making', Policy and Politics 5, 1976, p.49.

44. V Ronge, 'Theoretical Concepts of Political Decision-Making Processes', in J Conrad (ed.), Society, Technology and Risk Assessment (London: Academic Press, 1980), pp.209-38.

45. ibid., p.214. This allows the introduction of many arguably inappropriate ideas from individualistic decision theory.

46. ibid., p.218.

47. ibid., p.219.

48. Gordon et al., op. cit., p.29 (note 39).

49. Dillon, op. cit., p.48 (note 43).

50. Ronge, op. cit., p.219 (note 43). Dillon borrows the term 'dramaturgy' in the sense of a 'preoccupation with generating and employing symbolic and stylised presentations of form (or reality), so as to propagate and sustain an given intellectual, organisational or social order.' (Dillon, op. cit., p.55 (note 43).)

51. Gordon et al., op. cit., p.29 (note 39).

52. e.g. D Easton, A Systems Analysis of Political Life (London: Wiley, 1965).

53. Ronge, op. cit., p.222 (note 44). See also Ham and Hill, op. cit., pp.13-18 (note 7).

54. Many definitions reflect or indeed are intended to assert a particular conception of policy-making processes rather than to produce a category which can be widely accepted. Others are so broad as to be of little use analytically. See the discussions on definitions, and examples, in Hogwood and Gunn, op. cit., pp.13-24 (note 32); Heclo, op. cit., pp.84-5 (note 33); Ham and Hill, op. cit., pp.11-13 (note 7); BC Smith, Policy-Making in British Goverment: An Analysis of Power and Rationality (London: Martin Robertson, 1976), pp.12-15; SH Rakoff and GF Schaefer, 'Politics, Policy and Political Science: Theoretical Alternatives', Politics and Society 1, 1970, pp.68-70.

55. Ham and Hill, op. cit., p.12 (note 7).

56. The problems are similar to those raised in debates over other self- and other-ascribed versions of concepts such as interests. See 3.3. Ham and Hill seem to accept the broader definition in taking actions as well as decisions as 'the proper focus of policy analysis', but thereby rightly leave the category of policy as problematic. (Ham and Hill, op. cit., ch.1 (note 7).)

57. Gordon et al., op. cit., p.29 (note 39).

58. ibid.

59. For reviews, see e.g. Fudge and Barrett, op. cit., pp.249-78 (note 14); S Barrett and C Fudge, 'Examining the Policy-Action Relationship', in Barrett and Fudge (eds.), op. cit., pp.3-38 (note 14); M Hill, 'The Policy-Implementation Distinction: A Quest for Rational Control?', in ibid., pp.207-23; Ham and Hill, op. cit., ch.6 (note 7).

60. e.g. J Pressman and A Wildavsky, Implementation (Berkeley: Univ of California Press, 1973).

61. e.g. Barrett and Fudge, op. cit. (note 59); Fudge and Barrett, op. cit. (note 14); Gordon et al., op. cit. (note 39); G Majone and A Wildavsky, 'Implementation as Evolution', Policy Studies Review Annual 2, 1978, pp.103-16; Ham and Hill, op. cit., ch.6 (note 7).

62. TJ Lowi, 'Four Systems of Policy, Politics and Choice', Public Admin Review 32, 1972, pp.298-310.

63. RH Salisbury, 'The Analysis of Public Policy', in A Ranney (ed.), Political Science and Public Policy (Chicago: Markham, 1968), p.157.

64. T O'Riordan, 'Policy Making and Environmental Management: Some Thoughts on Processes and Research Issues', Natural Resources Journal 16 (1), Jan 1976, pp.55-72.

65. R de Man, 'Energy Policy in the Netherlands: Institutional Structure and the Policy Process', paper to conference Societal Problems of the Energy Transition, Dubrovnik, Sep 1982, pp.18-19.

66. PM Gregg, 'Towards Theoretical Premises for Policy Analysis', in Gregg (ed.), Problems of Theory in Policy Analysis (Lexington: Heath, 1976), pp.151-68.

67. Smith and Wood indicate the dangers of such typologies: they encourage misleading oversimplification; fetishise superficial categories and specific forms; and therefore obscure the possibility of different arrangements through changes in more fundamental relations. (B Smith and G Wood, 'State Intervention and Bureaucratic Reproduction: A Comparative Analysis', paper to Ann Conf Political Studies Association Public Administration and the State, Canterbury, Apr 1982, p.24.)

68. Barrett and Fudge, op. cit., pp.274-5 (note 59).

69. On discretion and its own literature, see Ham and Hill, op. cit., ch.9 (note 7); M Adler and S Asquith, 'Discretion and Power', in Adler and Asquith (eds.), Discretion and Welfare (London: Heinemann, 1981), pp.9-32; K Young, 'Discretion as an Implementation Problem', in ibid., pp.33-46. There remain a large number of insights into policy-making from decision theorists, including the large literature on incrementalist and synoptic modes, and notions like 'satisficing'. These may be valid descriptions; the extent of their occurence is to be examined empirically and their significance explained in terms of the specific context and actors. See also 3.6. For a review and critique, see e.g. J Gershuny, 'What Should Forecasters Do? A Pessimistic View', in PR Baehr and B Wittrock (eds.), Policy Analysis and Policy Innovation: Patterns, Problems and Potentials (London: Sage, 1981), pp.193-207; Ham and Hill, op. cit., ch.5 (note 7).

70. See the characterisations and critiques in e.g. WE Connolly, 'The Challenge to Pluralism', in Connolly (ed.), The Bias of Pluralism (New York: Atherton, 1969), pp.3-34; RA Alford, 'Paradigms of Relations between State and Society', in LN Lindberg et al. (eds.), Stress and Contradiction in Modern Capitalism (Lexington: Heath, 1975), pp.145-60.

71. S Lukes, Power: A Radical View (London: Macmillan, 1974), p.57.

72. ibid., p.57.

73. Alford, op. cit., p.151 (note 70).

74. Lukes, however, rejects the idea that the pluralist paradigm forms a closed confirmationist system; hence a wealth of empirical findings which contradict its own theoretical assertions. (Lukes, 1974, op. cit., pp.11-14 (note 71).) cf. the comments in D McEachern, A Class Against Itself: Power in the Nationalisation of the British Steel Industry (Cambridge: CUP, 1980), p.11; and FW Frey, 'Comment: On Issues and Non-Issues in the Study of Power', Amer Pol Sci Rev 65, 1971, p.1090. See e.g. RA Dahl, Who Governs? Democracy and Power in an American City (New Haven: Yale UP, 1961).

75. Alford, op. cit. (note 70). See e.g. EE Schattschneider, The Semi-Sovereign People: A Realist's View of Democracy in America (New York: Holt, Rinehart and Winston, 1960). The neo-elitist critique reflected a less sanguine view of American politics which emerged when neglected social problems erupted. Thus the central notion of non-decision-making was 'an intuitively plausible idea which fitted in with what seemed to be frightening empirical confirmations of the most pessimistic critical analysis of American society.' (G Parry and P Morriss, 'When is a Decision Not a Decision?', British Political Sociology Yearbook 1, 1974, p.318.)

76. P Saunders et al., 'Rural Community and Rural Community Power', in H Newby (ed.), International Perspectives in Rural Sociology (London: Wiley, 1978), pp.66-8.

77. P Bachrach and M Baratz, Power and Poverty: Theory and Practice (Oxford: OUP, 1970), p.7. The first part of the book is a revised version of the papers 'Two Faces of Power', Amer Pol Sci Rev 56, 1962, pp.947-52, and 'Decisions and Non-Decisions: An Analytical Framework', Amer Pol Sci Rev 57, 1963, pp.641-51.

78. Bachrach and Baratz, 1970, op. cit., pp.43-4 (note 77).

79. ibid., p.49.

80. Wolfinger claims it would be impossible to cover every potential issue; it would be difficult to distinguish non-decisions from, say, apathy or ignorance; it would be impossible to identify those responsible for particular values in the 'mobilisation of bias', to detect or measure indirect influence or anticipated responses, or to assess the impact of such values. (RE Wolfinger, 'Non-Decisions and the Study of Local Politics', Amer Pol Sci Rev 65, 1971, p.1077.) Newton demonstrates wittily the logical problem which arises if if an adequate research method is not found: '... it might be argued that the Flat Earth Society has failed to get a mass following only because it has to fight the false consciousness manipulated by a round-earther conspiracy.' Criteria of 'importance' are really only contingent solutions for specific cases. (K Newton, 'Democracy, Community Power and Decisionmaking', Political Studies 20, 1972, p.482.)

81. Wolfinger, op. cit., p.1079 (note 80).

82. According to Wolfinger, 'non-decisions are an unnecessary idea'. (Wolfinger, 'Rejoinder to Frey's Comment', Amer Pol Sci Rev 65, 1971, p.1104.) Similarly Debnam insists that the non-decision concept 'offers nothing which is not already available through decision-making analysis'. (G Debnam, 'Nondecisions and Power: the Two Faces of Bachrach and Baratz', Amer Pol Sci Rev 69, 1975, pp.889-99.) Other authors try to show the analytical category is redundant: Parry and Morriss, op. cit. (note 75), and from a different perspective, A Bradshaw, 'A Critique of Steven Lukes' Power: A Radical View', Sociology 10, 1976, pp.121-7. See also S Lukes, 'Reply to Bradshaw', Sociology 10, 1976, pp.129-32.

83. van der Eijk and Kok find three significantly different definitions in their work:

> the practice of limiting the scope of actual decision-making to "safe" issues by mainpulating the dominant community values, myths and political institutions and procedures
>
> a decision that results in suppression or thwarting of a latent or manifest challenge to the values or interests of the decision-maker
>
> an attempt to prevent an issue from reaching the decision-making stage

(C van der Eijk and WJP Kok, 'Non-Decisions Reconsidered', Acta Politica 10, 1975, pp.228-29.) Debnam also seizes on Bachrach and Baratz's inconsistent use of 'non-decision-making' and 'mobilisation of bias', highlighting some of the problems of action and inaction, and consciousness and unconsiousness, the resolution of which is explored in chapter 3. (Debnam, op. cit., (note 82).)

Offe finds yet another:

> a means by which demands for change in the existing allocation of benefits or privileges in the community can be suffocated before they are even voiced; or kept covert; or killed before they gain access to the relevant decision-making arena; or failing all these things, maimed or destroyed in the decision implementing stage of the policy process.

(Bachrach and Baratz, 1970, op. cit., p.44 (note 77), cited in C Offe, 'Structural Problems of the Capitalist State: Class Rule and the Political System: On the Selectiveness of Political Institutions', in K von Beyme (ed.), German Political Studies 1 (London: Sage, 1974), p.40.) Saunders et al. are probably too generous in what they attribute to Bachrach and Baratz. They see them as having identified three types of non-decision-making: powerful groups sidestepping conflict; subordinate groups withholding complaints because of anticipated negative reactions; and control over the political consciousness of a subordinate group. (Saunders et al., op. cit., p.67 (note 76).)

84. Frey, op. cit. (note 74). Bachrach and Baratz point out that while their critics all proclaim the difficulty of researching non-decisions, they grudgingly acknowledge that 'this second face of power is

actually exercised in the real world; witness Debnam's concession that it "is descriptively suggestive of certain possible areas of neglect ...".' (P Bachrach and M Baratz, 'Power and its Two Faces Revisited', Amer Pol Sci Rev 69, 1975, p.901.)

85. van der Eijk and Kok, op. cit., p.230 (note 83).

86. M Crenson, The Unpolitics of Air Pollution: A Study of Non-Decision Making in the Cities (Baltimore: John Hopkins UP, 1971). Newton saw Crenson's work as a major advance in a debate which

> seemed to have reached a dead end. It had raged for over fifteen years, involving literally hundreds of people including some of the best brains in the profession, and had passed through many passionate, bitter and rancorous phases until through sheer exhaustion and old age, it seemed at the point of collapse.

(Newton, op. cit. (note 80).) For a much less satisfactory attempt to operationalise and test the concepts, see C Hewitt, 'Policy-Making in Postwar Britain: A Nation-Level Test of Elitist and Pluralist Hypotheses', Brit J Pol Sci 4 (2), 1974, pp.18-216.

87. van der Eijk and Kok, op. cit. (note 83). See also Frey's defence of the concept of non-decision and his attempt to improve on Bachrach and Baratz's formulation. (Frey, op. cit. (note 74).) Frey arrives at six categories of non-decision, but does not achieve the clarity of van der Eijk and Kok. He does introduce what can be recognised as Lukes's 'third dimension' of power, discussed shortly, but fails to grasp its significance. He identifies the two essential components of an explanation of a non-decision: justifying expectation of influence; and identifying a mechanism whereby influence operates. His methods for both are useful despite the limitations of his approach; the former are considered in 3.3. See also W Solesbury, 'The Environmental Agenda: An Illustration of How Situations May Become Political Issues and Issues May Demand Responses from Government: Or How They May Not', Public Admin 54, 1976, pp.379-97; P Dunleavy, 'An Issue Centred Approach to the Study of Power', Political Studies 24 (4), 1976, pp.423-44.

88. See also Dunleavy's notion of 'gate-keepers'. (ibid., pp.429-31.)

89. Bachrach and Baratz already identified this as 'modification' and Frey talks of a 'shifted issue' as well as a 'suppressed issue'. (Bachrach and Baratz, 1970, op. cit., p.54 (note 77); Frey, op. cit., p.1099 (note 74).) See also JK Stringer and JJ Richardson, 'Managing the Political Agenda: Problem Definition and Policy Making in Britain', Parliamentary Affairs 33 (1), 1980, pp.23-9.

90. van der Eijk and Kok, op. cit., p.235 (note 83).

91. Lukes, 1974, op. cit. (note 71). See also Lukes, 'Power and Structure', in Essays in Social Theory (London: Macmillan, 1977), pp.3-29.

92. Lukes, 1974, op. cit., p.21 (note 71).

93. ibid., p.22. Bachrach and Baratz themselves point out that the

domination of certain groups may be such that they remain unaware of challenges to that position, and indeed of alternatives to the existing order.

94. Newton, op. cit., p.487 (note 80).

95. Lukes, 1974, op. cit., p.23 (note 71).

96. Thereby, as Newton observes, the two-dimensional framework produces a class bias:

> The control of air pollution represents the triumph of a particular type of middle class politics. If Crenson is right and some political systems are relatively inaccessible and unresponsive to even middle class pressures, then, one wonders, how much more inaccessible they are likely to be to the sorts of people whose lives are polluted by rats, damp, and a decaying inner city environment.

(Newton, op. cit., p.487 (note 80).)

97. Hindess takes issue with the self-proclaimed 'radical' nature of Lukes's analysis. Adding the aspect of unrecognised occurrences does not necessarily produce a radical approach to a political phenomenon:

> ... one could construct a concept of, say, 'boredom' and identify several views of it, views ranging from the one-dimensional view which requires explicit assertions of boredom to the 3-D view which maintains that while boredom frequently goes unrecognised it would be recognised under different conditions. In this example the dimensional views may be identified without any reference to values: there is nothing 'radical' about the 3-D view and nothing 'liberal' about the 1-D view.

Nor argues Hindess, does the identification of unrecognised interests make Lukes's view radical. (B Hindess, 'On Three-Dimensional Power', Political Studies 24 (3), 1976, pp.329-33.) Giddens likewise finds the notion of dimensions inappropriate. (A Giddens, Central Problems in Social Theory: Action, Structure and Contradiction in Social Analysis (London: Macmillan, 1979), pp.89-91.)

98. J Gaventa, Power and Powerlessness: Quiescence and Rebellion in an Appalachian Valley (Oxford: Clarendon, 1980).

99. Gaventa recognises that acknowledgement of a third dimension opens up a more radical analysis, and 'allows consideration of the social forces and historical patterns involved in Gramsci's concept of hegemony ...' It does not mean, of course, that either Lukes himself or others accepting the need to extend the conception of power actually produce a radical account, let alone one based on Gramsci's theory. (ibid., p.13.)

100. ibid., p.43.

101. For other reviews of some of the material covered in this section, with varying depths of critical insight, see: Jenkins, op. cit., pp.105-20 (note 6); Gaventa, op. cit., pp.5-20; McEachern, op. cit., pp.10-18 (note 74); Ham and Hill, op. cit., ch.4 (note 7); Dunleavy, op. cit. (note 87); S Clegg, The Theory of Power and Organisation (London: RKP, 1979), ch.4.

102. Clegg, op. cit., p.63 (note 101).

103. Bradshaw, op. cit., p.123 (note 82).

104. McEachern, op. cit., p.15 (note 74).

105. ibid., p.16.

106. ibid., pp.16-17.

## Chapter 3

1. Benson characterises the approach as dialectical. (JK Benson, 'Organizations: A Dialectical View', Admin Sci Qly 22, Mar 1977, pp.1-21.) The approach here, with Benson and Mills, rejects the notion of 'laws' of dialectics as proposed by Engels, as objective principles governing both social and natural processes, or as a rigorous methodology for the discovery of such. But it also opposes Mills's contention that

> As a guide to thinking, 'dialectics' can be more burdensome than helpful, for if everything is connected, dialectically, with everything else, then you must know 'everything' in order to know anything, and causal sequences become difficult to trace.

(CW Mills, The Marxists (Harmondsworth: Penguin, 1962), pp.128-9.) The concepts of dialectics may usefully be treated as organising principles for dealing with the complexity of social life. Thus as Benson observes,

> Efforts to identify contradictions and crises present difficult methodological problems. It should be recognised, however, that these concepts are not redeemed through operational definitions. Rather, these ideas are invoked as interpretations or analyses of events. Contradictions and crises are synthesising ideas which help us to make sense of complex events.

(JK Benson, 'A Framework for Policy Analysis', in D Rogers and D Whetten, Interorganizational Coordination (Iowa State UP, 1983), p.165.) The term dialectic will continue to be used here for an interactive relation between elements of a social system, stressing that social categories and units of analysis are not distinct but are separated analytically, and that their relation is seldom mechanistically causal. The principles for examining social processes listed here thus remain essential to counteract ahistoricism, abstraction from context, and deterministic or mechanistic causation, and to deal with the dual nature of, for example, structure or power. cf. EP Thompson, 'The Poverty of Theory: or an Orrery of Errors', in The Poverty of Theory and Other Essays (London: Merlin, 1978), pp.303-6.

2. For a critique, see e.g. I Gough, 'Theories of the Welfare State', Int J Health Services 8 (1), 1976, pp.27-40.

3. See e.g. L Althusser, For Marx, trans. B Brewster (Harmondsworth: Penguin, 1969); A Callinicos, Althusser's Marxism (London: Pluto, 1976); Thompson, op. cit. (note 1).

4. See Alford's discussion of a synthesis of pluralist, elitist and class paradigms. From a standpoint of probably artificial neutrality between them, he considers that each can accommodate explanations of the findings of the others. (RA Alford, 'Paradigms of Relations between State and Society', in LN Lindberg et al (eds.), Stress and Contradiction in Modern Capitalism (Lexington: Heath, 1975), pp.145-60.) The view here maintains that while each so far has

developed different strengths in terms of the level of analysis tackled, there is not symmetry in adequacy of explanation. For a pessimistic view of the possibilities of synthesis, see FG Castles, 'How Does Politics Matter? Structure or Agency in the Determination of Public Policy Outcomes', European Journal of Political Research 9, 1981, pp.119-32. There are useful discussions of the problem of structure and agency outside the sociology and political science literature: see esp. EH Carr, What is History? (Harmondsworth: Penguin, 1964), esp. 'Society and the Individual', pp.31-55; and Thompson, op. cit. (note 1).

5. S Lukes, Power: A Radical View (London: Macmillan, 1974), p.54.

6. A Giddens, Central Problems in Social Theory: Action, Structure and Contradiction in Social Analysis (London: Macmillan, 1979), p.91. For a more clearly dualistic treatment, see J Steiner, 'Decision Process and Policy Outcome: An Attempt to Conceptualise the Problem at Cross-National Level', European Journal of Political Research 11, 1983, pp.309-18.

7. Lest the brief mention of Althusser's work here be taken as a complete dismissal, see Callinicos's positive evaluation of his work: op. cit., esp. p.102 (note 3).

8. Lukes, 1974, op. cit., p.55 (note 5).

9. B Hindess, 'Power, Interests and the Outcome of Struggles', Sociology 16 (4), Nov 1982, pp.498-511.

10. B Jessop, 'Power and Contingency', paper to EGOS Symposium on Power, Bradford, May 1976.

11. Hindess, 1982, op. cit., p.499 (note 9). Hindess's target is oversimplification of causality:

> ... social phenomena are always dependent on definite and specifiable conditions which are themselves not reducible to any single general principle of explanation.

See also B Hindess, 'On Three-Dimensional Power', Political Studies 24 (3), 1976, pp.329-33.

12. T Benton, 'Objective Interests and the Sociology of Power', Sociology 15 (2), 1981, pp.161-84.

13. ibid., p.179. Knights and Willmott, also pointing out Lukes's view of the mutual exclusivity of action and structure, claim that Benton does not overcome this dualism. While he advocates a dialectical explanation - by looking for countertendencies generated by the contradictory strategies of dominant actors - his examples locate sources of countertendency solely outside the specific power relation in question, that is, in attachment to alternative oppositional identities. (D Knights and H Willmott, 'Power, Values and Relations: A Comment on Benton', Sociology 16 (4), 1982, pp.578-85.)

14. Jessop, 1976, op. cit., p.20 (note 10).

15. ibid., p.23.

16. S Clegg, The Theory of Power and Organisation (London: RKP, 1979), p.75.

17. ibid., p.79.

18. ibid., p.95.

19. Karpik offers a similar concept of a 'logic of action'. (L Karpik, 'Organizations, Institutions and History', in Karpik (ed.), Organization and Environment: Theory, Issues and Reality (London: Sage, 1980), pp.15-68.) Clegg and Dunkerley justify the term 'mode of rationality' thus:

> What one is doing is to construct a possible abstract model (a mode, not a determinant logic) not of action but of the rationality which can be demonstrated through deconstructing that action.

(S Clegg and D Dunkerley, Organisation, Class and Control (London: RKP, 1980), p.502.)

20. Giddens, op. cit. (note 6). See also Giddens, 'Action, Structure, Power', in Profiles and Critiques in Social Theory (London: Macmillan, 1982); Giddens, The Constitution of Society: Outline of the Theory of Structuration (Cambridge: Polity, 1984). Indeed Clegg unfairly attacks an earlier Giddens formulation as remaining in an individualist framework. (Clegg, op. cit., pp.68-75 (note 16).)

21. B Jessop, The Capitalist State: Marxist Theories and Methods (Oxford: Martin Robertson, 1982), ch.5.

22. ibid., p.213.

23. ibid., p.215.

24. ibid., pp.214-15, 218-19.

25. ibid., pp.218-20.

26. Jessop also refuses 'to privilege the reproduction of the dominant mode of production as the point of reference' or 'to privilege economic determination in the first, intermediate or last instance.' (ibid., p.228.)

27. Thompson, op. cit., p.295 (note 1).

28. Jessop, 1982, op. cit., p.254 (note 21).

29. Giddens, 1979, op. cit., p.69 (note 6).

30. ibid., p.66.

31. ibid., p.69.

32. ibid., pp.76-80. Giddens distinguishes three mechanisms whereby actions become interdependent in such a system: homeostatic control loops; self-regulation through feedback; and reflexive self-regulation.

33. ibid., pp.81-5.

34. ibid., pp.106-7.

35. ibid., pp.93-4, 100-1.

36. ibid., pp.106-11. Economic and political power are related in a close but complex way. The importance of the distinction here is that the forms are not to be conflated, nor one reduced to the other, as in some cruder Marxist theory, in some notions of 'industrial society', and in arguments for a 'managerial revolution'.

37. ibid., pp.55-9.

38. See e.g. the involved discussions which Frey and Lukes get into over whether an exercise of power can be held to have taken place. At root is an individualistic concept of power linked to an attribution of responsibility. (Lukes, op. cit., pp.50-6 (note 5); F W Frey, 'Comment: On Issues and Non-Issues in the Study of Power', Amer Pol Sci Rev 65, 1971, p.1098.) Another recurrent theme necessarily treated inadequately is the wielding of power through established routines: see e.g. G Parry and P Morriss, 'When is a Decision Not a Decision?', British Political Sociology Yearbook 1, 1974, pp.317-36.

39. Jessop, 1982, op. cit., p.227 (note 21).

40. ibid., p.258.

41. Attempts to reduce other forms of social relation to class relations, by however convoluted a chain of causation, are rejected here. Thus capital accumulation cannot be the sole reference point or principle of explanation in analysing capitalist social formations. Other axes cut across class relations: thus a particular arena can be a site of, say, officialdom-people relations, as Jessop terms them, or gender relations. (Jessop, 1982, op. cit., pp.247-52 (note 21).)

42. Benson, 1983, op. cit., p.148 (note 1).

43. ibid., p.148. See also the less satisfactory discussion of sectors in M Painter, 'Whitehall and Roads: A Case Study of Sectoral Politics', Policy and Politics 8 (2), 1980, pp.163-86.

44. Giddens, 1979, op. cit., p.80 (note 6).

45. Jessop, 1982, op. cit., pp.252-3 (note 21).

46. Lukes, 1974, op. cit., p.55 (note 5).

47. See reviews in Clegg, op. cit., p.101-9 (note 16); Clegg and Dunkerley, op. cit., pp.443-50 (note 19). Clegg shows the connection of this conception of power with the ontological assumptions of market theory, or 'vulgar political economy' as Marx termed it. Later work in organisation theory started to see power as operating through the structure of organisations. It was inherent in a developing conception of organisations as composed of differentiated groups with conflicting interests that outcomes depended on the operation of power, if not its conscious and visible exercise. Walsh

et al., however, dispute this characterisation of the treament of power in organisation studies. (K Walsh, B Hinings, R Greenwood and S Ranson, 'Power and Advantage in Organisations', Organisation Studies 2 (2), 1981, pp.131-52.)

48. Giddens, 1979, op. cit., p.89 (note 6).

49. D McEachern, A Class Against Itself: Power in the Nationalisation of the British Steel Industry (Cambridge: CUP, 1980), p.193. See also ibid., p.100.

50. Giddens, 1979, op. cit., p.91 (note 6).

51. ibid., p.93.

52. ibid., p.93. cf. M Reed, Redirections in Organizational Analysis (London: Tavistock, 1985), p.131.

53. Giddens, 1982, op. cit., pp.39, 198-9 (note 20); Giddens, 1979, op. cit., pp.145-50 (note 6).

54. esp. his use of 'hegemonic domination'. (Clegg, op. cit., pp.97-100 (note 16).)

55. Clegg, op. cit., p.147 (note 16). See also Clegg and Dunkerley, op. cit., pp.495-501 (note 19). Walsh et al. distinguish power from domination, but tend thereby to lapse back into dualism, with the former processual and the latter structural. However, they make a useful attempt to define conditions, relating to conflict or coincidence of values and interests among sub-groups in organisations, in which power is exercised. (Walsh et al., op. cit. (note 47).)

56. Jessop, 1982, op. cit., p.253 (note 21).

57. ibid., pp.255-6.

58. Hindess, 1982, op. cit., p.506 (note 9).

59. For reviews, see e.g. M Hill, The Sociology of Public Administration (London: Weidenfeld and Nicholson, 1972), ch.5; Clegg and Dunkerley, op. cit., ch.8 (note 19).

60. Benton finds that Lukes gives three ways of distinguishing 'real' from subjective interests, none of which, claims Benton, is sound: by postulating conditions of relative autonomy; by counterfactual conditional arguments; and by observing the expression of alternative views during abnormal relaxed conditions. (Benton, op. cit. (note 12).) For other useful discussions of the concept of interests and problems with it, see ID Balbus, 'The Concept of Interests in Pluralist and Marxist Analysis', Politics and Society 1, 1971, pp.151-77; WE Connolly, 'On Interests in Politics', Politics and Society 2, 1972, pp.459-77.

61. McEachern, op. cit., pp.20-2 (note 49).

62. ibid., p.17.

63. ibid.

64. J Westergaard and H Resler, Class in a Capitalist Society: A Study of Contemporary Britain (London: Heinemann, 1975), p.248.

65. RA Alford, 'Paradigms of Relations between State and Society', in LN Lindberg et al. (eds.), Stress and Contradiction in Modern Capitalism (Lexington: Heath, 1975), pp.145-60.

66. Benson, 1983, op. cit., p.154 (note 1).

67. ibid., p.159.

68. Benton, op. cit., pp.164-73 (note 12).

69. Giddens, 1979, op. cit., pp.188-90 (note 6).

70. Jessop, 1982, op. cit., p.256 (note 21).

71. ibid., pp.257-8.

72. Benton, op. cit., pp.180-2 (note 12).

73. Hindess, 1982, op. cit., p.501 (note 9).

74. Benton, op. cit., pp.162, 182 (note 12); Jessop, 1982, op. cit., p.258 (note 21).

75. Offe warns against the 'objectivistic' extreme: a completely 'deductively obtained concept of the revolutionary class and its "objective" interests', in an approach which

> runs the risk of raising the still-to-be-proved class character of the state to a theoretical premise and at the same time degrading to trivialities the historical peculiarities of a concrete system of institutions - whether it can be brought into line with the dogmatically preconceived class concept or not. There is a danger of playing down selection rules which do not fit easily into an objectivistic class theory.

(C Offe, 'Structural Problems of the Capitalist State: Class Rule and the Political System: On the Selectiveness of Political Institutions', in K von Beyme (ed.), German Political Studies 1 (London: Sage, 1974), p.43.)

76. e.g. Saunders et al.:

> It may reasonably be argued, for example, that in a capitalist economy, it is in people's interests to maximise their economic benefits and minimise their costs. This is not to deny the existence (or indeed the substantive rationality) of altruistic behaviour within a market system, but it is to recognise that the function of a market lies in allocating values, and that the functionally rational goal of actors in that market thus necessarily relates to profit maximisation and the minimisation of costs.

(P Saunders et al., 'Rural Community and Rural Community Power',

in H Newby (ed.), International Perspectives on Rural Sociology (London: Wiley, 1978), p.68.) Not surprisingly, pluralist critics declare such negative concepts methodologically illegitimate, insist on observability and claim that an infinite universe of non-issues would have to be explored. The need to justify expectation and the act of doing so disposes of this objection in specific cases. Identifying selectivity in a way which allows general or specific predictions, however, remains problematic. See note 84.

77. This list draws on the suggestions of Frey and on Offe's list and criticisms of each, with reference to his notions of selection mechanisms discussed in 3.6. (FW Frey, op. cit., pp.1095-7 (note 38); Offe, op. cit., pp.42-5 (note 75).) Note that Offe does not entirely separate the investigation of expectations and mechanisms; the selectivity of the system can only be explained with reference to the substantive issues encountering it.

78. The definition of needs of course raises problems; they are always bound to a specific perceived context of opportunities and aspirations. While the approach is useful as a general indictment of a social system, it remains controversial and inconclusive for analysis of specific limits and selectiveness, and critical effort 'is used up ineffectively in utopian thinking ...' (Offe, op. cit., p.43 (note 75).)

79. Either units of analysis with comparable social characteristics and conditions can be used, or variables may be held constant to provide ceteris paribus conditions. Crenson takes this approach further than just qualitative expectations because of the absence or presence of an issue, to degrees of 'issue-ness' related quantitatively to political influence. (M Crenson, The Unpolitics of Air Pollution: A Study of Non-Decision Making in the Cities (Baltimore: John Hopkins UP, 1971).) The limitations of the method are that selectivity common to the systems is not revealed; and the required conditions of comparability are seldom rigorously met.

80. Here there are, first, a danger of self-justification if the method is used for anything more than tentative suggestions; second, no criterion for distinguishing systematic from accidental exclusion; and third, no means of discovering potential conflicts not articulated in any of the regions or periods explored.

81. cf. Benton's discussion of Gramsci's treatment of 'effective action'. (op. cit., (note 12).)

82. It is, however, hardly to be expected that all relevant selection rules will be laid down, or that those which are will be adhered to strictly. Indeed, fundamental ones will not explicitly be acknowledged because of a need to maintain legitimacy.

83. As Lukes observes, justification of the counterfactual is relatively easy for Crenson. For ideological limitations on perceived possibilities and the legitimacy of demands, it is much more difficult. (Lukes, 1974, op. cit., p.46 (note 5).)

84. From this inadequacy Offe concludes that the actual limits of a specific system of government will only be perceived in the process of conflict with it, when 'collective normative options turn into

empirical force', and further that such praxis cannot be based entirely on analytical insight. This is consistent with his analysis of capitalist states necessarily operating so as not to disclose their real role. (Offe, op. cit., p.45 (note 75).)

85. LA Gunn and BW Hogwood, Models of Policy-Making, PAT 2.0 (Glasgow: Univ of Strathclyde Centre for the Study of Public Policy, 1982), p.8.

86. P Dunleavy, 'Is There a Radical Approach to Public Administration?', Public Admin 60, 1982, pp.215-33; Dunleavy, Urban Political Analysis: the Politics of Collective Consumption (London: Macmillan, 1980).

87. Reed, op. cit., esp. pp.116-36 (note 52); CC Harris, Fundamental Concepts and the Sociological Enterprise (London: Croom Helm, 1980), esp. chs.3, 4.

88. C Offe, Disorganised Capitalism: Contemporary Transformations of Work and Politics (Cambridge: Polity, 1985), pp.300-16; JK Benson, 'The Analysis of Bureaucratic-Professional Conflict: Functional versus Dialectical Approaches', Sociological Quarterly 14, Summer 1973, pp.376-94.

89. Benson, 1977, op. cit. (note 1). See also Benson's earlier outline in 1973, op. cit. (note 88), and Clegg and Dunkerley's formulation: op. cit., ch.13 (note 19). For a similar but more abstract statement of principles, see W Heydebrand, 'Organizational Contradictions in Public Bureaucracies: Toward a Marxist Theory of Organizations', Sociological Quarterly 18, Winter 1977, pp.83-107. For an attempt to develop a framework based more on 'Frankfurt-inspired' critical theory and stressing the role of technological rationality, see M Alvesson, 'A Critical Framework for Organizational Analysis', Organisation Studies 6 (2), 1985, pp.117-38. For a response to Benson and Clegg and Dunkerley, and an attack on radical organisation theory in general, see DA Bradley and R Wilkie, 'Radical Organisation Theory: A Critique' British J Sociology 31 (4), 1980, pp.574-9.

90. Benson, 1977, op. cit., p.17 (note 1).

91. Benson, 1983, op. cit., p.147 (note 1).

92. ibid., p.147.

93. Thus Benson's model is broadly consistent with, and can be related to, Marxist conceptions of the developmental logic of the state. See 4.3.

94. ibid., pp.155-8.

95. ibid., pp.159-60.

96. Some theorists of corporatism would, however, see it extending across many sectors and therefore characterise it as the predominant political form or even economic system: e.g. J Winkler, 'Corporatism', Europ J Sociology 17 (1), 1976, pp.100-36; Winkler, 'The Corporatist Economy: Theory and Administration', in

R Scase (ed.), Industrial Society: Class, Cleavage and Control (London: Allen and Unwin, 1977), pp.43-58. See reviews in C Ham and M Hill, The Policy Process in the Modern Capitalist State (Brighton: Wheatsheaf, 1984), pp.36-42; L Panitch, 'Recent Theorisations of Corporatism: Reflections on a Growth Industry', British J Sociology 31 (2), 1980, pp.159-87.

97. Benson, 1983, op. cit., pp.164-8 (note 1).

98. Here Benson, in putting 'rules of structure formation' alongside power-interest structures as an element of the deeper level - rather than as a mediating element between levels - does not achieve the conceptual clarity of Giddens or indeed Clegg. (ibid., pp.160-4.)

99. J Urry, 'Duality of Structure: Some Critical Issues', Theory, Culture and Society 1 (2), 1982, pp.100-5.

100. P Dunleavy, 'Professions and Policy Change: Notes Towards a Model of Ideological Corporatism', Public Admin Bulletin 36, 1981, p.3.

101. For a review, see P Berger and J Luckmann, The Social Construction of Reality: A Treatise on the Sociology of Knowledge (Harmondsworth: Penguin, 1966), pp.13-30.

102. The discussion of ideology here draws in particular on Giddens, 1979, op. cit., ch.5 (note 6); J Larrain, The Concept of Ideology (London: Hutchinson, 1979), chs.2, 6.

103. For a more individualistic but nonetheless useful discussion on the constitution of subjectivities, see K Young, 'Values in the Policy Process', Policy and Politics 5, 1977, pp.1-22.

104. Benson, 1983, op. cit., p.150 (note 1).

105. P Dunleavy, Urban Political Analysis: The Politics of Collective Consumption (London: Macmillan, 1980), pp.144-50.

106. Jessop, 1982, op. cit., pp.243-4 (note 21); Jessop, 'Accumulation Strategies, State Forms and Hegemonic Projects', Kapitalistate (10/11), 1983, pp.89-111.

107. Giddens, 1979, op. cit., pp.193-6 (note 6).

108. A Cawson and P Saunders, 'Corporatism, Competitive Politics and Class Struggle', in R King (ed.), Capital and Politics (London: RKP, 1983), p.12.

109. S Russell, 'The Social Construction of Artefacts: A Response to Pinch and Bijker', Social Studies of Science 16 (2), May 1986, pp.331-46.

110. cf. Larrain, op. cit., ch.6 (note 102). The phrase 'ideological function' is useful, stressing that knowledge has potential for use as ideology, but neither conflating an item of knowledge with ideology, nor separating them entirely.

111. IR Sanderson, On Social Knowledge, Ideology and the Nuclear Debate (PhD thesis, Open Univ, Apr 1984), ch.5.

112. e.g. J Habermas, 'The Scientisation of Politics and Public Opinion', in Habermas (trans. J Shapiro) Toward a Rational Society (London: Heinemann, 1971), pp.62-80.

113. cf. ibid., p.70.

114. G Dosi, 'Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change', Research Policy 11, 1982, pp.147-62. See chapter 1, note 61 on reservations about the notion of paradigms.

115. S Russell, 'Risk Assessment as a Political Activity: The Case of Comparative Studies of the Health Costs of Energy Systems', paper to 2nd Conference on Science, Society and Education, Risk and Participation, Leusden, Netherlands, Aug 1982.

116. ibid.

117. cf. J Rosenhead and C Thunhurst, 'Operational Research and Cost Benefit Analysis: Whose Science?', in J Irvine, I Miles and J Evans, Demystifying Social Statistics (London: Pluto, 1979), pp.289-304; L Tribe, 'Policy Science: Analysis or Ideology?', Philosophy and Public Affairs 1 (1), 1971, pp.66-110.

118. For a review, see S Russell, Autonomy, Determinism, Imperatives: A Review of Thought on the Loss of Social Control of Technology (MSc dissertation, Technology Policy Unit, Aston Univ, Sep 1980), pp.21-30.

119. Sanderson, op. cit. (note 111).

120. Dunleavy, op. cit., p.14 (note 100).

121. Russell, op. cit. (note 115). See 1.3.

122. cf. Offe, op. cit., p.45 (note 75).

123. ibid., pp.31-57.

124. Offe distinguishes social-structurally excluded events, for which the preconditions are absent in a particular society; accidentally excluded events, which could have been realised in their contingent circumstances without affecting the institutional structures and procedural rules of the society; and systematically excluded events, whose non-realisation cannot be ascribed to historical or social premises nor to accidental contingent factors, and cannot be explained without reference to political structures and processes. (Offe, op. cit., pp.36-7 (note 75).

125. ibid., p.37.

126. ibid., p.40.

127. cf. Giddens, 1979, op. cit., pp.85-8 (note 6).

128. See 2.4.

129. See 2.4.

130. e.g. Levin, in an attempt to explain decision-makers' behaviour in largely psychological terms, sees a decision as 'a deliberate act that generates commitment on the part of the decision-maker to a course of some specificity.' The decision-maker envisages actions, scope for these actions, desirable outcomes and relationships between these elements; they form a mental picture or 'schema'. Levin sees schemas developing because of new information or interactions with other parties. Both specificity and commitment increase as the process advances. As an explanation of decision processes, Levin's model has obvious inadequacies, but if his categories of this subjective policy development process are situated in a wider context they may provide useful insights at a detailed level. (PH Levin, 'On Decisions and Decision-Making', Public Admin 50, 1972, pp.19-44.) Law uses a similar notion of system-builders' 'scenarios' (J Law, 'The Anatomy of a Socio-Technical Struggle: the Design of the TSR2', paper to conference Technology and Social Change, Centre of Canadian Studies, Edinburgh Univ, June 1986.) See also chapter 2, note 69.

131. This oversimplified view of terrain and process appears to come from a rationalisation backwards from specific outcomes. It must then be acknowledged as a danger faced by the retroductive method accepted here. It is arguably avoided only by evaluations which challenge the sufficiency of the analyst's determinations as explanation. See 1.1.

132. C van der Eijk and WJP Kok, 'Non-Decisions Reconsidered', Acta Politica 10, 1975, p.244-5, citing RC Macridis, 'Comparative Politics and the Study of Government: the Search for Focus', Comparative Politics 1 (1), 1968, p.5.

133. A systems or engineering conception of feedback, as direct alteration of inputs by outputs, is inadequate (e.g. SH Rakoff and GF Schaefer, 'Politics, Policy and Political Science: Theoretical Alternatives', Politics and Society 1 (1), 1970, pp.51-77); the effects of output are mediated by a structured context, and may thereby affect any of the elements at any stage. Thus it may be possible to identify, say, the exacerbation of contradictions by an output with unforeseen consequences; ideological influence on the subsequent perception of unresolved problems; and reorganisation of arenas as an output. See the discussion on Giddens (3.2) and Urry (3.4) earlier. Gregg notes that policy-makers are not just 'reactive'; they may create or modify the 'decision environment' to structure the agenda. (PM Gregg, 'Towards a Resolution of Some Problems of Policy Theory', in Gregg (ed.), Problems of Theory in Policy Analysis (Lexington: Heath, 1976), pp.151-68.)

134. McEachern, op. cit. (note 49).

135. See Hindess's discussion of the constitution and articulation of arenas. (Hindess, 1982, op. cit. (note 9).)

136. See also Crenson's suggestion of an 'ecology of issues', in terms of relations between responses of political systems to each. (Crenson, op. cit., p.128 (note 79).)

137. B Wynne, Rationality and Ritual: the Windscale Inquiry and Nuclear Decisions in Britain (Chalfont St Giles: British Society for the History of Science, 1982).

138. B Smith and G Wood, 'State Intervention and Bureaucratic Reproduction: A Comparative Analysis', paper to Ann Conf Political Studies Association, Public Administration and the State, Canterbury Apr 1982. See also V Ronge, 'The Politicization of Administration in Advanced Capitalist Societies', Political Studies 22 (1), 1974, pp.86-93.

## Chapter 4

1. See 3.2 and 3.4, esp. on problems of definition and boundaries.

2. On the international politics of oil, see e.g. A Porter, M Spence and R Thompson, The Energy Fix (London: Pluto, 1986), pp.19-25; M Tanzer, The Energy Crisis: World Struggle for Power and Wealth (New York: Monthly Review Press, 1974).

3. cf. comments in CO Jones, 'American Politics and the Organization of Energy Decision Making', Annual Review of Energy 4, 1979, pp.99-121.

4. The exception is nuclear power: see e.g. H Kitschelt, 'Structures and Sequences of Nuclear Energy Policy Making', Political Power and Social Theory 3, 1982, pp.271-308; D Elliott et al., The Politics of Nuclear Power (London: Pluto, 1978); J Camilleri, The State and Nuclear Power: Conflict and Control in the Western World (Brighton: Wheatsheaf, 1984); W Walker and M Lonnroth, Nuclear Power Struggles: Industrial Competition and Proliferation Control (London: Allen and Unwin, 1983). There are also useful reviews or comparative analyses of national policies: e.g. NJD Lucas, Western European Energy Policies: A Comparative Study (Oxford: OUP, 1985); D Evans, Western Energy Policy: The Case for Competition (London: Macmillan, 1978); International Energy Agency, Energy Policies and Programmes of IEA Countries (Paris: IEA, annually); GF Ray, Energy Management: Can We Learn from Others? (Aldershot: Gower/ PSI/RIPA, 1985).

5. e.g. R Williams, 'Britain's Energy Institutions', in Royal Institute of Public Administration, Facing the Energy Future: Does Britain Need New Energy Institutions? (London: RIPA, 1981), pp.13-26; more prescriptive papers in KM Gentemann (ed.), Social and Political Perspectives on Energy Policy (New York: Praeger, 1981); and works reviewed in Jones, op. cit. (note 3).

6. Lucas's analysis of sectoral organisation and its implications for policy is good but he stops short of connecting its structure and dynamics to an explicit broader social model and falls back on notions of political 'tradition'. His structure of explanatory factors is unclear. His normative orientation, in an adherence to markets and a depiction of other factors as 'distortions', is very different to that taken here. (NJD Lucas, 'The Influence of Existing Institutions on the European Transition from Oil', in GT Goodman et al, The European Transition from Oil (London: Academic, 1981), pp.173-189.) Besides this exposition of a general framework, Lucas has also produced some rich and detailed studies of the energy institutions of individual countries: Lucas, Energy in France (London: Europa, 1979); Lucas, 'The Role of Institutional Relations in Danish Energy Policy', International Relations 6, Nov 1977, pp.347-73. Pearson gives a detailed description of British energy institutions in the late 70s, but fails to impose any structure or criterion of significance on the mass of material. Much is of transient interest and had changed by the time the book appeared. Her reviews, evaluation and application of models of policy-making is unsatisfactory. (LF Pearson, The Organization of the Energy Industry (London: Macmillan, 1981).) See also Kitschelt, op. cit., esp. pp.297-303 (note 4); O Keck, 'Industrial

Policy for Nuclear Power: A Comparison of West German and British Experience', paper to conference Issues in the Sizewell B Inquiry, Polytechnic of the South Bank, London, Oct 1982; papers in LN Lindberg (ed.), The Energy Syndrome: Comparing National Responses to the Energy Crisis (Lexington: Heath, 1977), esp. JH Chesshire et al., 'Energy Policy in Britain: A Case Study of Adaptation and Change in a Policy System', pp.33-38, 51-61; R de Man, 'Energy Policy in the Netherlands: Institutional Structure and the Policy Process', paper to conference Societal Problems of the Energy Transition, Dubrovnik, Sep 1982, pp.18-19; R Williams, 'The Structure of the UK Nuclear Industry and its Influence on Policy', Nuclear Energy 19, Dec 1980, pp.417-22. Other useful general discussions of energy issues from a similar viewpoint to that taken here include: MB Caldwell and JT Woolley, 'Energy Policy and the Capitalist State', in JR Hammarlund and LN Lindberg (eds.), The Political Economy of Energy Policy: A Projection for Capitalist Society (Wisconsin: Univ of Wisconsin Institute for Environmental Studies, Dec 1976), pp.110-53; MJ Prior, 'British Energy Policy in the 80s', in D Currie and R Smith (eds.), Socialist Economic Review (London: Merlin, 1981), pp.254-64; Prior, 'Energy Policy, the Environment and Democratic Control', in Prior (ed.), The Popular and the Political: Essays on Socialism in the 1980s (London: RKP, 1981), pp.137-60; Lindberg, 'Energy Policy and the Politics of Economic Development', Comparative Political Studies 10, Oct 1977, pp.355-82; and Porter et al., op. cit. (note 2).

7. Again, there are few attempts to examine the sector in these terms. See B Fine and L Harris, The Peculiarities of the British Economy (London: Lawrence and Wishart, 1985), and the analyses of the nationalised industries in 4.4, note 116.

8. Ray explores the important association - though its nature is contentious - of energy with economic long waves: GF Ray, 'Energy and the Long Cycles', Energy Economics 5, Jan 1983, pp.3-8. See also W Walker, 'Technical Change', in R Belgrave and M Cornell (eds.), Energy Self-Sufficiency for the UK? (Aldershot: Gower/NIESR/PSI/RIIA, 1985), pp.164-84.

9. See Sheldrick's discussion based on Downs's model of an 'issue-attention cycle': B Sheldrick, 'Energy Conservation as a UK Government Policy (up to mid-1982)', Univ of Leeds School of Geography Working Paper 354 (Mar 1983), pp.27-35; A Downs, 'Up and Down with Ecology: The Issue-Attention Cycle', Public Interest 28, 1972, pp.38-50.

10. See 8.1, esp. notes 43, 44.

11. See 7.1 and 8.7.

12. This analysis draws in particular on Lucas, 1981, op. cit. (note 6).

13. See the flow diagram in DEn/Government Statistical Service, Energy Flow Chart 1983: United Kingdom (London: HMSO, Jun 1984).

14. Because of the focus of the thesis, the discussion here is not concerned with labour processes themselves or capital-labour relations in the energy industries.

15. G Ray, 'Energy', in J Clark (ed.), Technological Trends and Employment: 2: Basic Process Industries (Aldershot: Gower/SPRU, 1985), pp.1-69. See also notes 39, 40.

16. cf. lists in R Bending and R Eden, UK Energy: Structure, Prospects and Policies (Cambridge: CUP, 1984), pp.278-80; R Eden et al., Energy Economics: Growth, Resources and Policies (Cambridge: CUP, 1981), pp.389-93.

17. cf. discussion in DEn, Energy Policy: A Consultative Document, Cmnd. 7107 (London: HMSO, Feb 1978), pp.67-8.

18. The contribution of coal to TPE dropped steadily to 37% by 1972 and then levelled out. (GF Ray, 'Energy and Primary Materials', Long Range Planning 15 (5), 1982, p.111.)

19. PEP, The British Fuel and Power Industries (London: PEP, 1947).

20. MW Kirby, The British Coal-Mining Industry 1870-1946: A Political and Economic History (London: Macmillan, 1977), ch.2.

21. Board of Trade, Report of the National Fuel and Power Committee, Cmd.3201 (London: HMSO, 1928).

22. ibid.

23. L Hannah, Electricity Before Nationalisation: A Study of the Development of the Electricity Supply Industry in Britain to 1948 (London: Macmillan, 1979), ch.3.

24. See chapter 5, note 22.

25. See 8.7. Report of the Committee on National Policy for the Use of Fuel and Power Resources, Cmnd.8647 (London: HMSO, Sep 1952).

26. National Coal Board, Plan for Coal (London: NCB, 1950). See also the revision, Investing in Coal (London: NCB, 1956).

27. See note 215.

28. MoP, Fuel Policy, Cmnd.2798 (London: HMSO, Oct 1965); MoP, Fuel Policy, Cmnd.3438 (London: HMSO, Nov 1967); PL Cook and AJ Surrey, Energy Policy: Strategies for Uncertainty (London: Martin Robertson, 1977), chs.2, 3; Chesshire et al., op. cit., pp.42-7 (note 6).

29. I Berkovitch, Coal on the Switchback: The Coal Industry Since Nationalisation (London: Allen and Unwin, 1977), chs.8,9.

30. MoP, 1965 and 1967, op. cit. (note 28).

31. Cook and Surrey, op. cit., ch.2 (note 28). See 8.1. On the oil economy in the 70s and its effects, see e.g. Bending and Eden, op. cit., pp.13-16 (note 16); Porter et al., op. cit., pp.21-5 (note 2). On the influence of European supranational institutions on British energy policy, see Pearson, op. cit., pp.144-9 (note 6); NJD Lucas, Energy and the European Communities (London: Europa, 1977).

32. National Coal Board, Plan for Coal (London: NCB, 1974).

33. Chesshire et al., op. cit., pp.47-51 (note 6).

34. DEn, Digest of UK Energy Statistics (London: HMSO, 1984); H Motamen, 'Structural Changes in the UK Energy Market', Energy Policy 13, Dec 1985, pp.559-63.

35. cf. Lucas, 1981, op. cit., pp.175-6 (note 6).

36. On UK primary fuel mix, see e.g. Bending and Eden, op. cit., ch.5; S Littlechild and K Vaidya, Energy Strategies for the UK (London: Allen and Unwin, 1982), ch.1.

37. MoP, 1967, op. cit.; Cook and Surrey, op. cit., ch.2 (note 28).

38. See 1.3.

39. GF Ray and L Uhlmann, The Innovation Process in the Energy Industries (London: NIESR, 1979). See also IEA, Energy Technology Policy (Paris: OECD/IEA, 1985), esp. pp.44-7.

40. Central Policy Review Staff, The Future of the UK Power Plant Manufacturing Industry (London: HMSO, 1976).

41. See 4.5, esp. note 235.

42. On the AEA, see R Williams, The Nuclear Power Decisions: British Policies 1953-78 (London: Croom Helm, 1980), esp. ch.1.

43. See e.g. comments on the structure of the DEn in 8.1.

44. cf. Caldwell and Wooley, op. cit. (note 6).

45. See 8.1, esp. note 8.

46. See Williams's argument for a conservation agency: op. cit. (note 5).

47. Lindberg finds this was the predominant response in Western nations: LN Lindberg, 'Comparing Energy Policies: Political Constraints and the Energy Syndrome', in Lindberg (ed.), op. cit., pp.325-56 (note 6); Lindberg, 1977, op. cit. (note 6).

48. cf. discussion in IR Sanderson, On Social Knowledge, Ideology and the Nuclear Debate (PhD thesis, Open Univ, Apr 1984).

49. DEn, Energy Policy: A Consultative Document, Cmnd.7107 (London: HMSO, 1978), pp.3-5. See also e.g. Report ..., op. cit., p.1 (note 25), and 4.5, note 235.

50. For discussions on the different dimensions of energy policy, see Deciding about Energy Policy: Principles and Procedures for Making Energy Policy in the UK (London: Council for Science and Society, 1979); LN Lindberg, 'The Energy Crisis: A Political Economy Perspective', in Lindberg (ed.), op. cit., pp.8-11 (note 6).

51. M Hillman, Conservation's Contribution to UK Self-Sufficiency (London: Heinemann/PSI/RIPA, 1984), pp.6-11; NEDO, Energy Conservation in the United Kingdom (London: HMSO, 1974).

52. 25% of electricity is now used to produce low grade heat (below 100°C). (RP Bush and BJ Matthews, The Pattern of Energy Use in the UK: 1976 (Energy Technology Support Unit), cited in R Armson and D Crabbe, 'CHP Stations Produce More Useful Electricity', Elec Rev 210, 26 Feb 1982, pp.16-17.)

53. G Leach et al., A Low Energy Strategy for the United Kingdom (London: International Institute for Environment and Development / Science Reviews, 1979); D Olivier et al., Energy Efficient Futures: Opening the Solar Option (London: Earth Resources Research, 1983).

54. e.g. total energy supplied to consumers / total inland primary energy consumption: 1960: 0.73; 1985: 0.68. (NEDO, op. cit., ch.4 (note 51); DEn, Digest of UK Energy Statistics 1986 (London: HMSO, 1986).) The figure and the implication should be treated cautiously, however. The question remains to what extent higher grade delivered forms allow greater efficiency of end use and the amount by which this compensates. (ibid., chs.4,10.) The 'energy ratio' TPE/GDP is often used as a measure of efficiency; this has been steadily falling. (Bending and Eden, op. cit., pp.246-8 (note 16).)

55. On off-peak heating see Open University Energy Research Group, A Critique of the Electricity Industry, ERG-013 (Mar 1976), pp.110-21.

56. See discussion in M Shanks, 'Energy and the Consumer', in D Ezra (ed.), The Energy Debate (Croydon: Benn, 1983), pp.180-95.

57. see 4.4.

58. cf. Prior, 1981, op. cit., p.256 (note 6).

59. For a technical history, see NS Billington and BM Roberts, Building Services Engineering: A Review of its Development (Oxford: Pergamon, 1982), ch.3. On current use patterns, see Olivier et al., op. cit., esp. ch.6 on the domestic sector (note 53).

60. Olivier et al., op. cit., p.14 (note 53). Some 42% of delivered energy in the UK in 1976 was for end uses below 100°C.

61. J Bradshaw and T Harris (eds.), Energy and Social Policy (London: RKP, 1983).

62. cf. J Goode et al., Energy Policy: A Reappraisal, Fabian Research 243 (London: Fabian Society, 1980).

63. B Sheldrick, 'Local Authorities and Energy Conservation: The Institutional Environment', Univ of Leeds School of Geography Working Paper 374 (Dec 1983). See 4.6.

64. Bradshaw and Harris (eds.), op. cit. (note 61); D Green, 'The Unacceptable Face of Fuel Poverty', Fuel Poverty Paper 2 (London: National Fuel Poverty Forum, 1979).

65. MFP, Domestic Fuel Policy: Report of the Fuel and Power Advisory Council, Cmd. 6762 (London: HMSO, Mar 1946); MoW, Heating and Ventilating of Dwellings, Post-War Building Studies 19 (London: HMSO, 1945), esp. App.1, Wartime Social Survey, 'Heating of Dwellings Inquiry', pp.107-91. See 6.2, esp. note 46.

66. MFP, District Heating in American Housing, National Building Studies Special Report 7 (London: HMSO, 1947), p.1.

67. JP Macey, 'The Economics of District Heating', paper to District Heating for the New Britain conference, Univ of Nottingham Dept of Architecture and Civic Planning, Apr 1969, p.23.

68. MFP, 1946, op. cit., p.32 (note 65).

69. AE Haseler, 'District Heating Facts and Figures', Mun J 75, 1 Sep 1967, pp.2291-3; Olivier et al., op. cit., p.310 (note 53).

70. MFP, 1946, op. cit., p.13.

71. Hannah, 1979, op. cit., pp.30-1 (note 23).

72. Clean Air Act 1956, 4&5 Eliz 2, ch.52; HA Scarrow, 'The Impact of British Domestic Air Pollution Legislation', Brit J Pol Sci 2 (3), 1972, pp.261-82.

73. 'Heating and Heating Systems for Council Houses and Flats', Housing Monthly 12, Jul 1976, pp.21-3.

74. See 7.1.

75. On current patterns of domestic energy use, see Bending and Eden, op. cit., ch.6 (note 16); Olivier et al., op. cit., ch.6 (note 53).

76. Sanderson, op. cit. (note 48); Sanderson, 'The Nuclear Debate: Ideology and Science' (Open Univ Technology Policy Group Occasional Paper, Jan 1981); Prior, 'Energy Policy ...', loc. cit., pp.146-7 (note 6).

77. cf. Jones, op. cit. (note 3); F Tugwell, 'Energy and Political Economy', Comparative Politics 13, Oct 1980, pp.103-18; Prior, 'British Energy Policy ...', loc. cit., p.245 (note 6).

78. IR Sanderson, 'Policy Making and the Public Interest', paper to seminar The CEGB and the Public Interest, Polytechnic of the South Bank, London, Jun 1981; E Davies, 'Who Decides the Public Interest?', in M Shanks (ed.), Lessons of Public Enterprise (London: Cape, 1963), pp.227-47.

79. See 4.4 and 8.7.

80. Sanderson, 1981, op. cit. (note 78). On the concept of use-values, see K Marx (trans. B Fowkes), Capital, vol.1 (Harmondsworth:

Penguin, 1976), pp.125-8.

81. e.g. CH Green, 'Revealed Preference Theory: Assumptions and Presumptions', in J Conrad (ed.), Society, Technology and Risk Assessment (London: Academic Press, 1980), pp.49-56.

82. See e.g. the controversy over public information in the Ridley Committee material: chapter 6, note 414. For a critique of the dominant individualist ideology of conservation issues, see I Cooper, 'Occupant Control over Energy Consumption in Non-Domestic Premises', and G Gaskell and R Pike, 'Conceptual and Methodological Issues in Social Research on Residential Energy Use', papers to conference Social Research on the Use of Energy in Buildings, CURS, Univ of Birmingham, Jan 1982.

83. cf. Tanzer, op. cit., ch.9.

84. For reviews, see B Jessop, The Capitalist State: Marxist Theories and Methods (London: Martin Robertson, 1982), chs.1-4; Jessop, 'Recent Theories of the Capitalist State', Cambridge J Economics 1, 1977, pp.353-73; D McEachern, A Class Against Itself: Power in the Nationalisation of the British Steel Industry (Cambridge: CUP, 1980), ch.2; B Frankel, 'On the State of the State: Marxist Theories of the State after Leninism', Theory and Society 7, 1979, pp.199-242; D Gold, CYH Lo and EO Wright, 'Recent Developments in Marxist Theories of the Capitalist State', Monthly Review, 27 Oct 1975, pp.29-43 and Nov 1975, pp.36-51. This section also draws on C Offe, 'The Theory of the Capitalist State and the Problem of Policy Formation', in LN Lindberg et al., Stress and Contradiction in Modern Capitalism (Lexington: Heath, 1975), pp.125-44.

85. Jessop, 1982, op. cit., ch.5 (note 84).

86. This theme is developed particularly by state derivation theorists. For reviews, see J Holloway and S Picciotto, 'Introduction: Towards a Materialist Theory of the State', in Holloway and Picciotto (eds.), State and Capital: A Marxist Debate (London: Arnold, 1978), pp.1-31; Jessop, 1982, op. cit., ch.3 (note 84); McEachern, op. cit., pp.33-8 (note 84). The emphasis here is less on deriving necessary forms, functions and dynamics as in much abstract state theory and more on finding ways of analysing specific political outcomes and becoming aware of contributory factors.

87. Jessop, 1982, op. cit., pp.243-4 (note 84); Jessop, 'Accumulation Strategies, State Forms and Hegemonic Projects', Kapitalistate (10/11), 1983, pp.89-111.

88. The issue of the 'relative autonomy' of the state has been much discussed. It is useful as a description, but should be avoided as an explanation of state action: it is either tautologous, or infinitely flexible - combining quantities of instrumental or pluralist character as required - and as such is immune to empirical evaluation. cf. Jessop, 1982, op. cit., pp.226-7 (note 84).

89. Offe, 1975, op. cit., (note 84). Many contributions stress the fundamental contradiction between the state's accumulation and legitimation functions, particularly to explain the distribution of functions between different sorts of state institution: e.g.

J O'Connor, The Fiscal Crisis of the State (New York: St Martin's, 1973), esp. pp.5-10; I Gough, 'State Expenditure in Advanced Capitalism', New Left Review 92, Jul/Aug 1975, pp.53-92; P Dunleavy, 'Topics in British Politics', in H Drucker et al., Developments in British Politics 2 (London: Macmillan, 1986), pp.366-8. See also note 291.

90. C Offe, 'Structural Problems of the Capitalist State: Class Rule and the Political System: On the Selectiveness of Political Institutions', in K von Beyme (ed.), German Political Studies 1 (London: Sage, 1974), pp.31-57. See 3.6.

91. Jessop, 1982, op. cit., esp. p.228 (note 84). See 3.3.

92. D Coates, The Context of British Politics (London: Hutchinson, 1984), pp.233-5; I Gough, 'Theories of the Welfare State: A Critique', Int J Health Services 8 (1), 1978, pp.27-40; Gough, The Political Economy of the Welfare State (London: Macmillan, 1979), ch.3.

93. cf. P Dunleavy, Urban Political Analysis: The Politics of Collective Consumption (London: Macmillan, 1980), p.101.

94. A Cawson and P Saunders, 'Corporatism, Competitive Politics and Class Struggle', in R King (ed.), Capital and Politics (London: RKP, 1983), pp.8-27. See also 4.6.

95. There are dangers, however, in judging practices as irrational, incompetent or anachronistic: an outcome may be functional to other interests or reflect objectives other than those assumed. cf. 2.3 on the 'rational' model in policy studies.

96. P Blackburn, K Green and S Liff, 'Science and Technology in Restructuring', Capital and Class (18), Winter 1982, pp.15-37.

97. O'Connor, op. cit.; Gough, 1975, op. cit. (note 89).

98. Jessop argues that the declining significance of parliament and the problems of establishing corporatist structures - so that neither is adequate for securing support for state policies - have accelerated the strengthening of the administrative and repressive state apparatuses. (B Jessop, 'The Transformation of the State in Post-War Britain', in R Scase (ed.), The State in Western Europe (London: Croom Helm, 1980), pp.54-65.)

99. V Ronge, 'The Politicization of Administration in Advanced Capitalist Societies', Political Studies 22 (1), 1974, pp.86-93.

100. P Dunleavy and RAW Rhodes, 'Government Beyond Whitehall', in Drucker et al., op. cit., pp.107-17 (note 89); Jessop, 1982, op. cit., pp.60-2 (note 84); A Barker (ed.), Quangos in Britain: Government and the Networks of Public Policy-Making (London: Macmillan, 1982).

101. Dunleavy, 1980, op. cit., pp.110-9; Dunleavy, 'Professions and Policy Change: Notes Towards a Theory of Ideological Corporatism', Public Admin Bulletin 36, 1981, pp.3-16; Dunleavy, 'Quasi-Governmental Professionalism: Some Implications for Policy-Making in Britain', in Barker (ed.), op. cit., pp.181-205 (note 100).

102. DN Chester, 'Public Corporations and the Classification of Administrative Bodies', Political Studies 1, 1953, pp.34-52.

103. McEachern, 1980, op. cit., pp.178-80 (note 84); Jessop, 1980, op. cit., pp.74-8 (note 98). See discussions on alternative explanations of the significance of political parties in Dunleavy, op. cit., pp.341-3 (note 89); J Dearlove and P Saunders, Introduction to British Politics: Analysing a Capitalist Democracy (Cambridge: Polity, 1984), ch.2.

104. For a characterisation of British political parties, see e.g. C Leys, Politics in Britain: An Introduction (London: Heinemann, 1983), chs.9-11; M Beloff and G Peele, The Government of the UK: Political Authority in a Changing Society (London: Weidenfeld and Nicholson, 1985), ch.7.

105. McEachern, 1980, op. cit., p.179 (note 84).

106. RGS Brown and DR Steel, The Administrative Process in Britain (London: Methuen, 1979), ch.11; A Gray and WI Jenkins, Administrative Politics in British Government (Brighton: Wheatsheaf, 1985), esp. ch.4. For an attempt to apply some concepts of conventional organisation theory to British government, see DC Pitt and BC Smith, Government Departments: An Organizational Perspective (London: RKP, 1981).

107. On the Cabinet, see M Rush, The Cabinet and Policy Formation (London: Longman, 1984).

108. See esp. Jessop, 1980, op. cit., pp.23-93 (note 98); R Smith, 'The Historical Decline of the UK', in S Aaronovitch et al., The Political Economy of British Capitalism: A Marxist Analysis (Maidenhead: McGraw-Hill, 1981), pp.126-9, pp.76-87.

109. Jessop, 1982, op. cit., pp.23-37 (note 84).

110. Smith, op. cit., p.77 (note 108).

111. Smith, op. cit., pp.81-2 (note 108); Jessop, 1980, op. cit., pp.39-43 (note 98).

112. The National Plan, Cmnd.2764 (London: HMSO, Sep 1965).

113. Jessop, 1980, op. cit., pp.47-54 (note 98); Smith, op. cit., pp.83-7 (note 108).

114. For summaries, see e.g. A Glyn and J Harrison, The British Economic Disaster (London: Pluto, 1980); papers in S Hall and M Jacques (eds.), The Politics of Thatcherism (London: Lawrence and Wishart, 1983).

115. D Heald and D Steel, 'The Privatisation of UK Public Enterprises', Annals of Public and Cooperative Economy 52, 1981, pp.351-67; M Webb, 'Energy Policy and the Privatisation of the UK Energy Industries', Energy Policy 13, Feb 1985, pp.27-35. See 8.1.

116. This section relies heavily on the few radical analyses available: B Fine and K O'Donnell, 'The Nationalised Industries', in Currie and

Smith (eds.), op. cit., pp.265-85 (note 6); J Hughes, 'Nationalisation and the Private Sector', in J Urry and J Wakeford (eds.), Power in Britain: Sociological Readings (London: Heinemann, 1973), pp.146-53; McEachern, 1980, op. cit., esp. pp.64-7, 185-90 (note 84); S Aaronovitch, 'The State and Production', in Aaronovitch et al., op. cit., pp.126-9 (note 108); J Westergaard and H Resler, Class in a Capitalist Society: A Study of Contemporary Britain (London: Heinemann, 1975), pp.203-16. See also contributions to Shanks (ed.), op. cit. (note 78). For information, see esp. DN Chester, The Nationalisation of British Industry 1945-51 (London: HMSO, 1975); R Rees, The Control of Nationalised Industries, D323 Unit 4/5 (Milton Keynes: Open Univ, 1979); L Tivey, Nationalization in British Industry (London: Cape, 1973); D Steel, 'Nationalisation and Public Ownership', in C Cook and J Ramsden (eds.), Trends in British Politics Since 1945 (London: Macmillan, 1978), pp.109-31.

117. For a review, see D Steel, 'Government and Industry in Britain', Brit J Pol Sci 12 (4), Oct 1982, pp.478-86.

118. e.g. R Murray, 'Public Sector Possibilities', Marxism Today 31, Jul 1986, pp.28-32.

119. cf. Fine and O'Donnell, op. cit., p.269 (note 116).

120. On later nationalisations, see Steel, 1978, op. cit., pp.114-5 (note 116). On earlier forms of public utility and regulation of private utilities, see papers in Public Admin 4, 1926, pp.287-430; ME Dimock, British Public Utilities and National Development (London: Allen and Unwin, 1933); WA Robson (ed.), Public Enterprise: Developments in Social Ownership and Control in Great Britain (London: Allen and Unwin, 1937); Robson, 'The Public Utility Services', in HJ Laski et al. (eds.), A Century of Municipal Progress 1835-1935 (London: Allen and Unwin/NALGO, 1935), pp.299-331.

121. See note 78.

122. See refs. in Tivey, 1973, op. cit., ch.2 (note 116) and Chester, op. cit., ch.1 (note 116).

123. Chester, op. cit., ch.1 (note 116).

124. Fine and O'Donnell, op. cit., p.270 (note 116).

125. McEachern, op. cit., pp.96-7 (note 84).

126. Jessop, 1982, op. cit., p.29 (note 84); Tivey, 1973, op. cit., pp.215-19 (note 116); Steel, 1978, op. cit., pp.111-13 (note 116).

127. McEachern, 1980, op. cit. (note 84). cf. T Williams, A History of the British Gas Industry (Oxford: OUP, 1981), p.103.

128. Chester, op. cit., ch.5 (note 116); AH Hanson, 'Labour and the Public Corporation', Public Admin 32, Summer 1954, pp.203-9.

129. Fine and O'Donnell, op. cit., pp.271-2 (note 116); Hughes, 1973, op. cit. (note 116).

130. GDH Cole, The Postwar Condition of Britain (London: RKP, 1956),

p.120; Tivey, 1973, op. cit., pp.99-109 (note 116); POWE 38/17 and 38/19.

131. Westergaard and Resler, op. cit., pp.210-11 (note 116). See 8.7.

132. M Burrage, 'Nationalisation and the Professional Ideal', Sociology 7, 1973, pp.253-72.

133. Westergaard and Resler, op. cit., pp.210-14 (note 116).

134. Hughes, 1973, op. cit. (note 116); Davies, op. cit. (note 78). Resistance to more radical models also came from within the civil service; see POWE 28/232, and papers, Mar 1949, in POWE 14/264.

135. cf. the contemporary view of JH Smith and TE Chester, 'The Distribution of Power in the Nationalized Industries', pp.275-93, esp. p.293. See also the anticipation of many of the issues prior to nationalisation in Dimock, op. cit., ch.9 (note 120).

136. J Hughes, 'Relations with Private Industry', in Shanks (ed.), op. cit., pp.126-48 (note 78); DL Munby, 'The Nationalised Industries', in GDN Worswick and PH Ady, The British Economy in the 1950s (Oxford: Clarendon, 1962), pp.420-23; D Heald, 'Economic and Financial Control of the UK Energy Industries', Energy Policy 9, Jun 1981, pp.99-111.

137. L Hannah, Engineers, Managers and Politicians: The First Fifteen Years of Nationalised Electricity Supply in Britain (London: Macmillan, 1982), pp.73-5; Select Committee on Nationalised Industries, The Electricity Supply Industry, HC 236-I-III (London: HMSO, May 1963), pp.143-9; Report of the Committee of Inquiry into the Electricity Supply Industry, Cmnd.9672 (London: HMSO, Jan 1956), pp.95-7.

138. Munby, op. cit., pp.415-19 (note 136). See also the recommendations of the Herbert Committee on the ESI specifically. (Report ..., op. cit. (note 137).)

139. Nationalised Industries: A Review of Economic and Financial Objectives, Cmnd. 3437 (London: HMSO, 1967).

140. Fine and O'Donnell, op. cit., esp. pp.270-1 (note 116).

141. cf. McEachern, 1980, op. cit., p.189 (note 84).

142. e.g. Conservative Political Centre, Denationalisation: Failure of the Nationalised Industries (London: CPC, 1984); T Eggar, Reversing Clause IV: A Policy for Denationalisation (London: CPC, 198-.; J Redwood, Public Enterprise in Crisis: The Future of the Nationalised Industries (Oxford: Blackwell, 1980).

143. e.g. Munby, op. cit., pp.415-28 (note 136); Rees, op. cit., pp.29-52 (note 116); Tivey, 1973, op. cit., ch.6 (note 116). The Financial and Economic Obligations of the Nationalised Industries, Cmnd.1337 (London: HMSO, Apr 1961); Nationalised Industries ..., op. cit. (note 139); The Nationalised Industries, Cmnd.7131 (London: HMSO, Mar 1978).

144. Rees, op. cit., pp.23-4 (note 116).

145. Fine and O'Donnell, op. cit. (note 116); Heald, 1981, op. cit. (note 136); D Heald, 'The Economic and Financial Control of the Nationalised Industries', Economic Journal 90, Jun 1980, pp.243-65.

146. See also comments on the rise of economists in the nationalised energy industries: TW Berrie, 'The Effects of Energy Policy and Economics on Energy Options', IEE Conference Energy Options, 1984, pp.363-7; E Price, 'Energy Economics 1940-60', in P Tempest (ed.), Energy Economics in Britain (London: Graham and Trotman, 1983), pp.337-52; Price, 'Energy Economics After 1960', in ibid., pp.353-68; Hannah, 1982, op. cit., ch.7 (note 137).

147. Heald, 1980, op. cit. (note 145); Heald, 1981, op. cit. (note 136).

148. Fine and O'Donnell, op. cit., pp.272, 276 (note 116). See also Select Committee on Nationalised Industries, 1963, op. cit., pp.58-62 (note 137).

149. Rees, op. cit., ch.4 (note 116); Heald, 1980, op. cit., pp.259-62 (note 145). See Fine and O'Donnell, op. cit., pp.266-7 (note 116) on the inherent conflict between economic and financial objectives.

150. Select Committee on Nationalised Industries, First Report 1967/8, Ministerial Control of the Nationalised Industries, HC 371-I-III (London: HMSO, Jul 1968); Report ..., op. cit., p.136-7 (note 137); A Albu, 'Ministerial and Parliamentary Control', in Shanks (ed.), op. cit., pp.90-112 (note 78). While orthodox analyses stress the problem of conflict between Minister and management, Fine and O'Donnell argue the system is functional and has an effective unity of objectives. (Fine and O'Donnell, op. cit., p.273 (note 116).)

151. Munby, op. cit., pp.415-16 (note 136); Rees, op. cit., pp.29-32 (note 116).

152. Munby, op. cit., p.415 (note 136); Steel, op. cit., pp.483-4 (note 117), citing CD Foster, Politics, Finance and the Role of Economics: An Essay on the Control of Public Enterprise (London: Allen and Unwin, 1971). See 6.1 and 8.1, and British Imperial Calendar and Civil Service List and Civil Service Yearbook for specific years.

153. See 8.1, esp. note 27.

154. Competition Act 1980, ch.21.

155. Select Committee on Nationalised Industries, 1968, op. cit. (note 150); NEDO, A Study of the UK Nationalized Industries: Their Role in the Economy and Control in the Future (London: HMSO, 1976); The Nationalised Industries, op. cit. (note 143). On these and other developments in the 70s, see L Tivey, 'Structure and Politics in the Nationalised Industries', Parliamentary Affairs 32 (2), 1979, pp.159-75; Rees, op. cit., ch.5 (note 116).

156. L Tivey, 'Nationalized Industries as Organized Interests', Public Admin 60, Spring 1982, pp.42-55; Steel, 1982, op. cit., pp.451-2 (note 117).

157. cf. Lucas, 'The Influence ...', loc. cit., p.174 (note 6).

158. The history of the ESI to 1964 (and briefly in an epilogue to 1979) is tackled in Hannah, 1979, op. cit. (note 23), and Hannan, 1982, op. cit. (note 137).

159. This account of prenationalisation history draws on Hannah, 1979, op. cit. (note 23); Electricity Council, Electricity Supply in the United Kingdom: A Chronology (London: Electricity Council, 1982); Political and Economic Planning, Report on the Supply of Electricity in Great Britain (London: PEP, Dec 1936); Dimock, op. cit., chs.6,7 (note 120); Electricity Commissioners, Reports, esp. (23), 1947/8, pp.6-15; H Self and E Watson, Electricity Supply in Great Britain (London: Allen and Unwin, 1952); ICR Byatt, The British Electrical Industry 1875-1914: The Economic Returns of a New Technology (Oxford: Clarendon, 1979), chs.6, 12; HH Ballin, The Organisation of Electricity Supply in Great Britain (London: Electrical Press, 1946).

160. Electric Lighting Act 1882, 45&46 V, ch.56; Electric Lighting Act 1888, 51&52 V, ch.12; Electric Lighting (Clauses) Act 1899, 62&63 V, ch.19; Electric Lighting Act 1909, 9 Edw 7, ch.34; Electricity (Supply) Act 1919, 9&10 Geo 5, ch.100; Electricity (Supply) Act 1926, 16&17 Geo 5, ch.51.

161. It was accepted that competition in gas and water supply in the 1840s and 50s had led to inefficiency and high prices. (Byatt, op. cit., p.197 (note 159).)

162. B Bowers, 'More Heat than Light in First Electricity Act', Elec Rev 211, 20/27 Aug 1982, pp.16-17; Self and Watson, op. cit., pp.10-12 (note 159); Hannah, 1979, op. cit., ch.1 (note 23); RAS Hennessey, The Electric Revolution (Newcastle upon Tyne: Oriel, 1972), pp.29-35; A Page, presidential address, JIEE 66, Dec 1927, pp.1-11.

163. PEP, 1936, op. cit., ch.2 (note 159).

164. Byatt, op. cit., p.105 (note 159).

165. OC Hormell, 'Electricity in Great Britain: A Study in Administration', National Municipal Review 17, 1928, pp.371-3; Hannah, 1979, op. cit., pp.25-35 (note 23); Byatt, op. cit., pp.111-12 (note 159).

166. Ministry of Reconstruction Coal Conservation (Haldane) Committee Final Report incl. Power Generation and Transmission Sub-Committee, 'Interim Report', Cmd.8880, 1918; Ministry of Reconstruction Advisory Council, Report of the Committee of Chairmen on Electric Power Supply, Cmd.93, 1919; Report of the Committee Appointed by the Board of Trade to Consider the Question of Electric Power Supply, Cmd.9062, 1918; Report of the Departmental Committee of the Board of Trade to Consider the Position of the Electrical Trades After the War, Cmd.9072, 1918. See also Hannah, 1979, op. cit., ch.2 (note 23). The Haldane

Committee considered the generating plant in most towns was 10-20% of the size needed.

167. Electricity Commissioners, Report (23), 1947/8, p.7; Hormell, op. cit., pp.373-4 (note 165); Hannah, 1979, op. cit., ch.3 (note 23).

168. Electricity (Supply) Act 1919, s.1(1).

169. Hormell, op. cit., pp.372-3 (note 165). See the map of British Electric Traction Company holdings, Mun J, 20 Jun 1902, p.505.

170. Electricity Commissioners, op. cit., p.7 (note 167).

171. Hennessey, op. cit., pp.56-7 (note 162).

172. See also H Quigley, Electrical Power and National Progress (London: Allen and Unwin, 1925).

173. Report of the Committee Appointed to Review the National Problem of the Supply of Electrical Energy (London: HMSO, 1926); Hormell, op. cit. (note 165); Hannah, 1979, op. cit., ch.3 (note 23).

174. ibid., ch.3.

175. Hannah, 1979, op. cit., p.101 (note 23); Hormell, op. cit., pp.375-6 (note 165); PEP, 1936, op. cit. (note 159).

176. Hannah, 1979, op. cit., ch.4, esp. p.194 (note 23); PEP, 1947, op. cit. (note 19). See also the influential suggestion of a national grid: GV Twiss, 'National Electricity Supply' Electrician 94, 23 Jan 1925, pp.88-90 and 30 Jan 1925, pp.111-18.

177. ibid., ch.4; Electricity Commissioners, op. cit., p.8 (note 167).

178. Hannah, 1979, op. cit., p.8 (note 23); PEP, 1947, op. cit. (note 19).

179. See also V Ramanadham, The Structure of the British Electricity Supply Industry (PhD thesis, LSE, 1951).

180. Hannah, 1979, op. cit., p.333 (note 23).

181. MoT, Report of the Committee on Electricity Distribution, (London: HMSO, Jun 1936); Hannah, 1979, op. cit., ch.7 (note 23).

182. MoT, Electricity Distribution: Outline of Proposals, (London: HMSO, 1937).

183. Listed in 2nd Schedule, Electricity Act 1947. On the general position of the industry after WW2, see PEP, 1947, op. cit. (note 19); Electricity Commissioners, op. cit., pp.15-17 (note 167).

184. CH Sharp, The Public and Private Ownership of Industrial Enterprise: A Study of Municipal and Company Enterprises in Gas and Electricity Supply (PhD thesis, Univ of Birmingham, 1954); Ramanadham, op. cit. (note 179).

185. Electricity Act 1947, 10&11 Geo 6, ch.54. The IMEA, however, was opposed to over-centralisation: e.g. Editorial, 'Local Government

Reorganisation', IMEAJ 26, Jun 1945. See also 8.1, esp. note 22.

186. Hannah, 1982, op. cit., p.11 (note 137).

187. ibid., pp.10-11, 43.

188. ibid., ch.5. See also 6.8.

189. See also Report ..., op. cit., chs.3-6 (note 137).

190. Hannah, 1982, op. cit., pp.14-16 (note 137); Self and Watson, op. cit., App.1 (note 159).

191. Hannah, 1982, op. cit., chs.2, 6 (note 137).

192. ibid., ch.2. See also 4.4.

193. ibid., pp.4, 7 (note 137).

194. See 6.8.

195. DCFP 122 in POWE 14/554 and POWE 28/194; BEA, 'General Views on National Fuel and Power Policy', in POWE 14/551; Minutes, 3 Mar 1952, in POWE 14/555; BEA, Memorandum, in Report ..., op. cit., App.XI (iii) (note 25).

196. DCFP 122 in POWE 14/554.

197. ibid.

198. ibid.

199. Hannah, 1979, op. cit., pp.315-19 (note 23).

200. The CEB suggested 1.2GW$_e$ of new plant would be needed 1947-50. (POWE 14/496; C Hinton, Heavy Current Electricity in the United Kingdom: History and Development (Oxford: Pergamon, 1979), ch.6.)

201. Hannah, 1979, op. cit., p.311 (note 23).

202. SR&O 2386, 1947; Report ..., op. cit., pp.28-9 (note 137); Hannah, 1982, op. cit., pp.24-5 (note 137); Hinton, op. cit., ch.6 (note 200).

203. Hannah, 1979, op. cit., ch.8 (note 23).

204. ibid., ch.9.

205. Hannah, 1982, op. cit., chs.4, 7, 11, 17 (note 137); Select Committee, 1963, op. cit., pp.78-87 (note 137). See also NCB, Memorandum, App.XI (ii) in Report ..., op. cit. (note 25).

206. Report ..., op. cit. (note 137). See also Hannah, 1982, op. cit., ch.13 (note 137).

207. Report ..., op. cit., p.136 (note 137).

208. ibid., pp.136-9.

209. ibid., p.138.

210. Electricity Act 1957, 5&6 Eliz 2, ch.48. In Northern Ireland, the NI Joint Electricity Committee was formed in 1948 to coordinate the three existing Ulster undertakings. (Electricity Council, op. cit., p.43 (note 159).) In 1967 the NI Joint Electricity Authority was formed with wider supervisory powers. (ibid., pp.72-3.) This was superseded by the NIES in 1973. (ibid., p.85.) In Scotland, NoSHEB was formed in 1943 to develop hydro resources, and became responsible in 1948 for all generation and distribution in the north. (ibid., p.42.) The SSEB was formed in 1955 to take over generation and the distribution responsibilities of the two Area Boards in the south. (ibid., pp.49, 51.)

211. Select Committee, 1963, op. cit., pp.8-16, esp. 10 (note 137); M Ince, Energy Policy: Britain's Electricity Industry (London: Junction, 1982), pp.26-7.

212. Report ..., op. cit., p.62 (note 137).

213. The SWEB installed 3 x 3$MW_e$ GTs for peak load. (Select Committee, 1963, op. cit., p.153 (note 137).)

214. Ince, op. cit., p.27 (note 211).

215. On the origins and early years of the nuclear programme, see Select Committee, 1963, op. cit., pp.114-6; Hannah, 1982, op. cit., chs.14, 19 (note 137).

216. ibid., ch.19; M Prior, 'Myths and Mysteries of Electricity from Coal and Nuclear Power', Coal and Energy Quarterly (22), Jan 1979, p.24.

217. In the mid-60s the CEGB also ordered a total of 720MWe of GTs for peak supply. (Hannah, 1982, op. cit., p.251 (note 137).)

218. Hannah, 1982, op. cit., p.186 (note 137).

219. ibid., ch.16.

220. The rate was set at 8%, though not published. (Hannah, 1982, op. cit., p.205 (note 137).)

221. Nationalised Industries ..., op. cit. (note 139).

222. Hannah, 1982, op. cit., p.207 (note 137). On the problem of assessing actual rates of return, see Select Committee, 1963, op. cit., pp.47-9 (note 137). The CEGB considered it impossible to give an actual rate for an individual station.

223. Select Committee, 1963, op. cit., pp.47-8 (note 137).

224. See 4.4, note 137.

225. Select Committee, 1963, op. cit., pp.156-62.

226. Hannah, 1982, op. cit., chs.9, 20 (note 137); Hinton, op. cit., ch.6 (note 200). For indications of ESI thinking on future generation practice and arguments for economies of scale, see: E Forth, 'The

Trend in Power Station Design', JIoF 22, Aug 1949, pp.290-8, 305; B Donkin and PH Margren, 'Economic Plant Sizes and Boiler Set Groupings on the British Grid', Proc IEE II 99, Aug 1952, pp.384-407; VA Pask, 'Power Stations and their Equipment', Proc IEE A 103, Apr 1956, pp.169-88; F Dronsfield, 'Progress Review 52: Electrical Power Generation from Fossil Fuels', JIoF 35, Mar 1962, pp.132-42; F Tombs, 'Economies of Scale in Electricity Generation since 1945', Proc Inst Mech Eng 192, 1978, pp.387-95; and refs. in AJ Abdulkarim and NJD Lucas, 'Economies of Scale in Electricity Generation in the United Kingdom', Energy Research 1, 1977, pp.223-31.

227. Ince, op. cit., ch.6 (note 211); Abdulkarim and Lucas, op. cit. (note 226).

228. Hannah, 1982, op. cit., pp.251-3 (note 137).

229. See GS West, 'The Economic Viability of Private Generation or Total Energy Schemes', IEE Conference Publication 73, 1970, pp.325-37; Hannah, 1982, op. cit., ch.5 (note 137); Report ..., op. cit., ch.17 (note 137); J Burchnall, The Supply Industry and Private Generation (London: Electricity Council, 1976). On private generation and industrial CHP immediately after nationalisation, see also POWE 14/259, 14/551 and other material in the Ridley Committee files (App.3). There was clearly a tension between the wish of the newly nationalised ESI to control as much supply as possible, and the possibility that increased private supplies could relieve the grave capacity shortage.

230. Hannah, 1979, op. cit., ch.5 (note 137).

231. See 8.6.

232. An important exception is Slough Estates. See 8.6 esp. note 306. See also chapter 5, note 55.

233. See 7.2 and 8.6.

234. Williams, op. cit. (note 42).

235. ibid.; M Spence, 'Nuclear Capital', Capital and Class (16), Spring 1982, pp.7-12; Porter et al., op. cit., pp.26-33 (note 2); W Cannell and R Chudleigh, The PWR Decision: How Not to Buy a Nuclear Reactor (London: FoE, 1984).

236. Transcripts and proofs of evidence are available. The inspector's report is expected in autumn 1986.

237. Prior, 1979, op. cit. (note 216); JW Jeffrey, 'The Real Cost of Nuclear Electricity in the UK', Energy Policy 10, Jun 1982, pp.76-100; Coal and Nuclear Power Costs, Energy Commission Paper 6, 1978; C Sweet, The Price of Nuclear Power (London: Heinemann, 1983), ch.6.

238. Electricity Council, op. cit., p.97 (note 159).

239. OU-ERG, op. cit., pp.37-45 (note 55); N Evans, 'Electricity Investment Planning in the UK', in Aspects of UK Energy Supply,

pp.79-89.

240. M Prior, 'The Cost of Electricity Under Uncertainty', Futures 12, Aug 1980, pp.275-88.

241. Editorial, 'What Price Reliability of Supply?', Elec Rev 204, 2 Feb 1979, p.15; C Sweet, 'Has the Time Come for CEGB to Reassess its Strategy?', Elec Rev 207, 28 Nov 1980, pp.16-17.

242. Central Policy Review Staff, The Future of the United Kingdom Power Plant Manufacturing Industry (London: HMSO, 1976).

243. e.g. Select Committee, 1963, op. cit., pp.193-6 (note 137). On construction, see Hannah, 1982, op. cit., ch.20 (note 137); Report of the Committee of Inquiry into Delays in the Commissioning of CEGB Power Stations, Cmnd.3960 (London: HMSO, 1969).

244. Monopolies and Mergers Commission, Central Electricity Generating Board: A Report on the Operation by the Board of its System for the Generation and Supply of Electricity in Bulk, HC 315 (London: HMSO, May 1981); OU ERG, op. cit. (note 239); papers at Future of the Electricity Supply Industry conference, Polytechnic of the South Bank, London, Jun 1985; R Papadopoulos, 'Growth and Overcapacity in the UK Electricity Industry', Energy Policy 9, Jun 1981, pp.153-5.

245. e.g. Electricity Council, 'Flexibility in Long-Term Energy Policy', in DEn, National Energy Conference, Energy Paper 13 (London: HMSO, 1976); S Steward, 'Can the Supply Industry Learn from its History?', Elec Rev 211, 12 Nov 1982, pp.30-1.

246. Electricity Bill 1970; Commons 2nd Reading, Parl Deb Comm 799, 6 Apr 1970, c.34-160; Standing Committee E, 30 Apr - 14 May 1970.

247. DEn, The Structure of the Electricity Supply Industry in England and Wales: Report of the Committee of Inquiry, Cmnd.6388 (London: HMSO, Jan 1976). See 8.6.

248. DEn, Reorganisation of the Electricity Supply Industry in England and Wales, Cmnd.7134 (London: HMSO, Apr 1978).

249. Draft Electricity Bill, Ann.B in ibid.; Electricity Council, letter Jun 1978, App. to Select Committee on Nationalised Industries, Sixth Special Report 1977-78, Comments by the Nationalised Industries and Others on the Government White Paper on the Nationalised Industries, HC-638 (London: HMSO, Jul 1978), pp.30-2.

250. Parl Deb Comm 988, 14 Jul 1980, c.455 (w); 'Howell Gives Kiss of Life to Boneless Wonder', Elec Rev 207, 18 Jul 1980, p.5; 'Why Howell Let Sleeping Plowdens Lie', Elec Rev 207, 1 Aug 1980, p.11.

251. Energy Act 1983, ch.25. See 8.6.

252. See 8.1.

253. P Millbank, 'Top Heavy Regions to Go in CEGB Shake-Up', Elec Rev 215, 5 Oct 1984, p.5.

254. On Sizewell, see e.g. Editorial, 'Price and ESI Strategy', Elec

Rev 219, 15/29 Aug 1986, p.11. See 7.2 and 8.6 on disputes over prices for standby and buy-back.

255. See the discussion of the MFP and DEn in 6.7 and 8.1.

256. On the Electricity Consumers' Council, see comments in Ince, op. cit., pp.20, 50 (note 211). On the earlier Consultative Councils, see Hannah, 1982, op. cit., pp.65-7 (note 137); Report ..., op. cit., pp.119-24 (note 137).

257. See e.g. J Lyons, 'A Response to the Attacks on the Industry from the Right and the Left', paper to Future of the Electricity Supply Industry conference, Polytechnic of the South Bank, London, Jun 1985. See 8.7 esp. note 382.

258. e.g. C Sweet, 'A Return to Energy Policy', paper to Future of the Electricity Supply Industry conference, Polytechnic of the South Bank, London, Jun 1985.

259. Dunleavy, 1980, op. cit., chs.1, 2 (note 93).

260. See 2.4.

261. The general discussion here of the character of the local state draws on Dunleavy, 1980, op. cit. (note 93); C Cockburn, The Local State: Management of Cities and People (London: Pluto, 1977).

262. Cockburn, op. cit., pp.158-9 (note 261).

263. Cawson and Saunders, op. cit. (note 94).

264. On the concept of collective consumption, see Dunleavy, 1980, op. cit., pp.46-8, 50-3 (note 93); M Castells (trans. E Lebas), City, Class and Power (London: Macmillan, 1978), ch.2; J Lojkine, 'Contribution to a Marxist Theory of Capitalist Urbanization', in CG Pickvance (ed.), Urban Sociology: Critical Essays (London: Tavistock, 1976), pp.121-3.

265. Dunleavy, 1980, op. cit., pp.70-86 (note 93); Dunleavy, 'The Urban Basis of Political Alignment: Social Class, Domestic Property Ownership and State Intervention in Consumption Processes', Brit J Pol Sci 9, Oct 1979, pp.409-43.

266. ibid., pp.135-44.

267. ibid., pp.144-50.

268. ibid., pp.150-6.

269. RAW Rhodes, Control and Power in Central-Local Government Relations (London: Gower/SSRC, 1981); Dunleavy, 1980, op. cit., ch.5 (note 93); P Dunleavy and RAW Rhodes, 'Beyond Whitehall', in H Drucker et al., Developments in British Politics (London: Macmillan, 1983), pp.113-22 (note 100).

270. HA Scarrow, 'Policy Pressures by British Local Government: the Case of Regulation in the "Public Interest"', Comparative Politics 4. 1971, pp.1-28.

271. Dunleavy, 1980, op. cit., ch.5 (note 93).

272. Lojkine, op. cit., pp.119-46 (note 264).

273. e.g. local authority expenditure increased from £1.5b in 1954 to £12.8b in 1974, a doubling as a percentage of GDP. (Cockburn, op. cit., p.62 (note 261). See also Dunleavy, 1980, op. cit., pp.57-64 (note 93).

274. S Merrett, State Housing in Britain (London: RKP, 1979), ch.1; Housing of Working Classes Acts 1890, 53&54 V ch.70, and 1903, 3 Edw 7 ch.39; Housing, Town Planning, etc. Act 1909, 9 Edw 7 ch.44.

275. D Whitham, 'The First Sixty Years of Council Housing', in J English (ed.), The Future of Council Housing (London: Croom Helm, 1982) pp.9-33; H Pelling, The Labour Governments 1945-51 (London: Macmillan, 1984), pp.108-10.

276. M Boddy, 'Local Economic and Employment Strategies', in M Boddy and C Fudge (eds.), Local Socialism: Labour Councils and New Left Alternatives (London: Macmillan, 1984), pp.160-91.

277. D Heap, An Outline of Planning Law (London: Sweet and Maxwell, 1973), pp.1-24.

278. Housing, Town Planning, etc. Act 1909, 9 Edw 7 ch.44.

279. Town and Country Planning Act 1932, 22&23 Geo 5 ch.48.

280. Town and Country Planning Act 1944, 7&8 Geo 6 ch.47. The Town and Country Planning (Interim Development) Act 1943, 6&7 Geo 6 ch.29, had given authorities limited control over war-damaged areas.

281. New Towns Act 1946, 9&10 Geo 6 ch.68.

282. Town and Country Planning Act 1947, 10&11 Geo 6 ch.51. See also GDH Cole, The Post-War Condition of Britain (London: RKP, 1956), ch.26.

283. Heap, op. cit., pp.13-24 (note 277).

284. PG Richards, The Local Government System (London: Allen and Unwin, 1983), ch.7.

285. London Government Act 1963, ch.33; Local Government Act 1972, ch.70. On the earlier structure of local government, see Cole, op. cit., ch.28 (note 282).

286. Cockburn, op. cit., pp.6-24 (note 261); RJ Haynes, Organisation Theory and Local Government (London: Allen and Unwin, 1980), ch.3.

287. Management of Local Government (London: HMSO, 1967); Royal Commission on Local Government in England 1966-69, Cmnd.4040 (London: HMSO, 1969); The New Local Authorities: Management and Structure (London: HMSO, 1972).

288. A Alexander, Local Government in Britain Since Reorganisation (London: Allen and Unwin, 1982), chs.4,5.

289. Cockburn, op. cit., p.100 (note 261).

290. Even 'community planning' initiatives, argues Cockburn, were essentially concerned with management rather than democratic participation; interaction between authorities and local groups was carefully structured. (Cockburn, op. cit., ch.4 (note 261).)

291. B Keith-Lucas and PG Richards, A History of Local Government in the Twentieth Century (London: Allen and Unwin, 1978), ch.3; Richards, op. cit., ch.3 (note 284); RAW Rhodes, 'Intergovernmental Relations in the Postwar Period', Local Government Studies 11, Nov/Dec 1985, pp.35-57. A major current in radical analyses of the state sees the allocation of functions between levels of government as a key mechanism for managing contradictory pressures. See Dunleavy's discussion of the dual state thesis: P Dunleavy, 'The Limits to Local Government', in Boddy and Fudge (eds.), op. cit., pp.66-78 (note 276).

292. Water and sewerage responsibilities were removed in 1974. Local authority representatives were removed from the public boards in 1983.

293. K Ascher, The Politics of Privatisation: Contracting Out in the NHS and Local Government (London: Macmillan, 1986).

294. On the exclusion of local authorities from the NI boards, see Cole, op. cit., ch.9 (note 282).

295. Sheldrick, 1983, op. cit. (note 63). See the programme in R Davies, 'Neighbourhood Energy Projects: Opportunity and Context' (London: National Council for Voluntary Organisations / Neighbourhood Energy Action, Dec 1981).

296. P Saunders, 'What is Happening to Local Government?', Local Government Studies 11, Nov/Dec 1985, pp.1-4; RAW Rhodes, 'Continuity and Change in British Central-Local Government Relations: "The Conservative Threat" 1979-83', Brit J Pol Sci 14, Jul 1984, pp.261-83; Dunleavy and Rhodes, 1983, op. cit., pp.122-32 (note 269).

297. Rhodes, 1985, op. cit. (note 291).

298. ibid.

299. S Duncan and M Goodwin, 'Local Economic Policies: Local Regeneration or Political Mobilisation?', Local Government Studies 11, Nov/Dec 1985, pp.75-96.

300. ibid. Duncan and Goodwin also discuss the problem of distinguishing between restructuring in the interests of labour, and 'servicing capital', and the varying extents to which local authorities acknowledge this.

301. D Massey, 'Enterprise Zones: A Political Issue', Int J Urban and Regional Research 6 (4), 1982, pp.229-34; J Shutt, 'Tory Enterprise

Zones and the Labour Movement', Capital and Class (23), Summer 1984, pp.19-44.

302. Richards, op. cit., pp.59-61 (note 284); M Loughlin, 'The Restructuring of Central-Local Government Legal Relations', Local Government Studies 11, Nov/Dec 1985, pp.59-74.

303. ibid.

304. ibid.

305. Before 1919, the Local Government Board; then the MoH, the MLGP and MHLG, and from 1971 the DoE. Local Government Act 1933, 23&24 Geo 5 ch.51; Local Government Act 1972, ch.70.

306. CA Cross, Principles of Local Government Law (London: Sweet and Maxwell, 1981), pp.21-2.

307. The restrictions on local government activities were also relaxed. Local Government Act 1972, ch.70; Local Government (Miscellaneous Provisions) Act 1976, ch.57. See also 7.1, note 91 on general powers for DH in the 1976 Act.

308. Local Government Finance: Report of the Committee of Inquiry, Cmnd.6453 (London: HMSO, 1976); NP Hepworth, The Finance of Local Government (London: Allen and Unwin, 1970), ch.7.

309. The sources of capital have varied. The Public Works Loans Board has had a major role since 1945 - though the extent of its intended and actual use has been subject to several changes by government - loaning on terms fixed by the Treasury to some extent independent of the market. Small private sources have declined in significance, and increasing amounts have come from major financial institutions.

310. See 6.6 and 6.8.

311. Richards, op. cit. (note 284); Hepworth, 1970, op. cit., ch.6 (note 308).

312. NP Hepworth, The Finance of Local Government (London: Allen and Unwin, 4th edition, 1978), p.137. From the mid-70s the various funds and institutions of the European Communities, and the European Investment Bank, were added to the sources from which authorities could seek loans and grants, including for infrastructure projects. (ibid.)

313. PA Watt, 'The Control of Local Authority Capital Expenditure', Local Government Studies 8, May/Jun 1982, pp.91-5; Richards, op. cit., pp.106-7 (note 284); M Boddy, 'Local Councils and the Financial Squeeze', in Boddy and Fudge (eds.), op. cit., pp.215-41 (note 276).

314. Dunleavy and Rhodes, op. cit., p.115 (note 100).

## Chapter 5

1. See JF Collins, 'The History of District Heating', DHA Journal (18), Aug 1977, pp.18-21; NS Billington and BM Roberts, Building Services Engineering: A Review of Its Development (Oxford: Pergamon, 1982), pp.122-4; JR Kell, 'District Heating', RIBA Journal 54, Aug 1947, p.513; TH Parker, Suggestions for Warming and Ventilating the Houses of Parliament with Hot-Water in Cast-Iron Pipes: also a Variety of Facts and Experiments and Descriptions concerning the Hot-Water System ... (London: Beddowes, 1836). Parker claimed: 'Steam and hot water were employed at the Soho Manufactory, Birmingham, as far back as about the year 1777; which is a contradiction of all claims of a recent date to the invention of heating rooms and buildings by hot water within metal pipes.'

2. Brunel suggested to the architect Sidney Smirke that heat could be piped to working class homes in London. In interesting contrast to early experiments in hotels, public buildings and the homes of wealthy inventors, the idea was connected with 'a plan for substituting healthy cheap and cheerful lodgings in lieu of the dismal abodes of the labouring poor of the Metropolis.' It would be 'of inestimable importance in London where the high price of fuel is a burthen to the poor.' (Cited in Kell, op. cit., p.513 (note 1).) Willhelm Siemens advocated DH for Birmingham in 1863. (Billington and Roberts, op. cit., p.122 (note 1).) Collins ascribes the lack of attempts and of success to the lack or inadequacy of equipment. (Collins, op. cit., p.19 (note 1).)

3. Kell, op. cit. (note 1); Collins, op. cit. (note 1); AE Margolis, 'Experiences with District Heating in Europe and the USA and its Future Development', HVE 9, Oct 1935, pp.142-6.

4. GL Thayer, 'Utilisation of Exhaust Steam', Electrician 39, 3 Sep 1897, p.617; FH Prentiss, 'The Distribution of Steam from the Central Station', Electrician 27, 4 Sep 1891, pp.508-9.

5. Prentiss, op. cit. (note 4).

6. Thayer, op. cit., (note 4).

7. 'Utilisation of Heat Rejected by Gas Engines', Elec Rev 41, 27 Aug 1897, p.270; 'Use for Gas Engine Waste Heat', Elec Rev 45, 20 Oct 1899, p.648; 'Utilising the Waste Heat of Gas Engines', Elec Rev 47, 24 Aug 1900, pp.296-7.

8. 'The Utilisation of Central Station Exhaust Steam', Electrician 29, 15 Jul 1892, p.272. See also 'Steam Heating from Central Stations', Elec Rev 62, 12 Jun 1908, p.974; 'American Views on Heating in Connection with Electricity Supply', Elec Rev 57, 1 Sep 1905, pp.337-8. For a sceptical view, see 'Steam Heating in Connection with Electricity Supply', Elec Rev 57, 29 Sep 1905, p.486.

9. See e.g. ER Dolby, 'Exhaust Steam: Its Employment for Power, Heating, etc.', Proc Inst Civ Eng III, 1921, p.3; Dolby, 'Methods of Heating Adopted in Hospitals and Asylums Recently Built', Proc Inst Civ Eng 174, 1907, pp.91-151. The first industrial CHP plant in Britain is reputed to be that installed at the Singer factory,

Clydebank, in 1898. (RJR Budden and DL Tolley, 'The Role of the Electricity Supply Industry in CHP', in Electricity Council, CHP Bureau brochure.)

10. OF Allan, Gas Engine, cited in 'Use for Gas Engine Waste Heat', loc. cit. (note 7).

11. St. Marylebone Electricity Committee, Minutes, 1 Aug 1917, file ES650.

12. 'Discussion' on SB Donkin, 'Industrial, Agricultural, and Domestic Heating, with Electricity as a By-Product', J Inst Civ Eng I, 1935-6, p.404.

13. WN Haden, 'Evidence on Economies in Consumption of Fuel for the Heating of Buildings by the Introduction of Central Heating Appliances', 6 Aug 1903, in Second Report of the Royal Commission on Coal Supplies vol. II, (London: HMSO, 1904), pp.343-51.

14. CI Haden, 'Utilisation of Exhaust Steam from Electric Generating Stations, and Coal Economy', paper to IEE/IHVE Joint Discussion, London, 19 Jan 1922; abstract in Elec Rev 90, 27 Jan 1922, pp.139-40 and JIEE 60, Mar 1922, pp.265-71; papers on Bloom Street scheme, 1953, in BEA/CEA A25876; DVH Smith, 'District Heating and its Relation to Housing and Town Planning', HVE 14, Jun 1941, pp.461-71; 'The Bloom Street District Heating Scheme', Ind Htg Eng 17, Jan 1955, pp.3-5. West suggests that heat supply started from Bloom Street as early as 1903. (GS West, 'The Electricity Supply Industry's Role in District Heating', paper to DHA, 4 Feb 1975 (London: Electricity Council, 1975).)

15. CI Haden, op. cit. (note 14).

16. See 6.8.

17. Manchester Corporation Electricity Committee, Minutes, 5 Jan 1921, p.87; 'Electricity in England and America: Manchester Corporation Deputation's Conclusions', Mun J 30, 7 Jan 1921. p.9.

18. 'Discussion', Manchester 21 Feb 1921, on Haden, op. cit., p.552 (note 14).

19. 20 & 21 Geo 5, ch.78, part III, s.15; Manchester Corporation General Purposes Committee, Parliamentary Sub-Committee, Minutes, various 1928-30.

20. See 4.6.

21. HLG 94/284 and 94/285; GN Haden, letter to DSIR, 15 Feb 1914, in Manchester Corporation Electricity Committee files.

22. Local Government Board and Scottish Office, Report of Committee on Building Construction in Connection with the Provision of Dwellings for the Working Classes, Cd.9191 (London: HMSO, 1918); Ministry of Reconstruction, Final Report of Women's Housing Sub-Committee, Cd.9232 (London: HMSO, 1918). Christopher Addison was Minister of Health in the Coalition Government.

23. HLG 94/284; 'The Gorton Tenants and the "Hot Water Rent"', Manchester Guardian, 5 Feb 1923.

24. HLG 94/285.

25. DSIR 4/316; DSIR 4/1910.

26. JH Cheetham, 'Future for District Heating', Mun J 60, 29 Feb 1952, p.438; MFP, District Heating in American Housing, National Building Studies Special Report 7 (London: HMSO, 1947).

27. DVH Smith, 'District Heating', HVE 1 (10), Apr 1928, pp.284-7 and 1 (11), May 1928, pp.320-1; Smith, op. cit. (note 14); 'District Heating: Comparison of Costs', Elec Rev 137, 9 Nov 1945, pp.669-70; Smith, 'Individual and District Heating Schemes', IoF Bulletin, 19 Aug 1946, pp. 254-64; 'District Heating Costs', HVE 17, 8 Dec 1934, p.243; Smith, letter, HVE 21, Feb 1948, pp.354-5; AII, DCFP 58 in POWE 14/554; Kell, op. cit., p.514 (note 1).

28. Smith, HVE 1 (11), p.321 (note 28); papers, May 1950, in HLG 91/326.

29. e.g. 'District Heating Too Expensive, Say Delegates', Mun J 56, 3 Dec 1948, p.2470. At least two London estates had DH schemes in the 30s: Oliver Goldsmith Estate, Southwark, installed in 1930 and currently serving 354 dwellings plus shops, and Meakin, Southwark, now serving 140 dwellings. (Annex 3.1 in Orchard Partners, Present State and Future Evolution of the Heat Market in the Member States: District Heating in the UK, 266/1/R1 (London: Orchard Partners, Mar 1983).)

30. Smith, HVE 1 (11), p.320 (note 27).

31. Smith, HVE 1 (10), p.286 (note 27).

32. 'District Heating Too Expensive ...', loc. cit. (note 29); papers, May - Jun 1950, in HLG 91/327. Losses were put at £10 000 in 1945-6 ('District Heating in London', HVE 21, Dec 1947, p.223) and in 1947 the economic charges were considered double the actual charges of 5s6d - 6s6d/week (IGE, 2nd Report of the District Heating Committee', Trans Inst Gas Eng 97, (1947-8), p.144.). See also Women's Advisory Committee on Solid Fuel, survey 1944, cited by N Smith, discussion on IGE, '1st Report of the District Heating Committee', Trans Inst Gas Eng 95 (1945-6), p.129; and Dundee Corporation (Consolidated Powers) Order Confirmation Act 1957, 6 Eliz 2, ch.4. The schemes were finally dismantled in the 70s and in most cases gas CH was installed. (BGC, 'Communal Heating Schemes Changing to Individual Heating', App.10 in Select Committee on Energy, Third Report 1982/3, Combined Heat and Power vol.II, HC 314-2 (London: HMSO, 1983).)

33. Ministry of Reconstruction, Coal Conservation Committee: Final Report (London: HMSO, 1918). See also 'Utilising Waste Heat and the Fuel Shortage', Elec Rev 83, 11 Oct 1918, p.357.

34. Board of Trade, Report of the National Fuel and Power Committee, Cmd. 3201 (London: HMSO, 1928).

35. IEE/IHVE Joint Discussion, London 19 Jan 1922, IHVE Report 20, 1920-21, pp.176-232; CI Haden, op. cit. (note 14); FH Whysall, 'Utilisation of Waste Heat from Electrical Generating Stations', abstracts in Elec Rev 90, 27 Jan 1922, pp.139-41 and JIEE 60, Mar 1922, pp.271-2; 'The Utilisation of Waste Heat from Power Stations', Manchester discussion 21 Feb 1922, Elec Rev 90, 31 Mar 1922, p.464.

36. L Hannah, Electricity Before Nationalisation: A Study of the Development of the Electricity Supply Industry in Britain to 1948 (London: Macmillan, 1979), pp.54-62. See 4.5.

37. D Brownlie, Manchester discussion 21 Feb 1922, JIEE 60, Mar 1922, p.555. There is indeed no evidence from general papers on power station development that CHP was considered seriously. See e.g. the 'Progress Reviews' series, IEE Journal, and other papers noted in Select List of References on Historical Development of Electric Power Generation and Supply in Great Britain, Electricity Council Bibliography B25 (London: Electricity Council, Aug 1969).

38. HM Sayers, 'The Utilisation of Waste Heat', Elec Rev 90, 27 Jan 1922, p.115.

39. REB Crompton, London discussion, Elec Rev 90, 27 Jan 1922, p.140.

40. SL Pearce, Manchester discussion, JIEE 60, Mar 1922, p.552. Pearce served as an Electricity Commissioner in 1925-6 and 1940-5.

41. WH Allen, JIEE 60, pp.279-80.

42. op. cit. (note 33).

43. CI Haden, op. cit. (note 14).

44. J Frith, Manchester discussion, JIEE 60, p.552.

45. WW Nobbs, London discussion, JIEE 60, p.276.

46. Editorial, 'The Use of Waste Heat', Elec Rev 90, 27 Jan 1922, p.109.

47. AC Pain, London discussion, JIEE 60, p.284.

48. CI Haden, op. cit. (note 14).

49. Frith, op. cit. (note 44).

50. Pain, op. cit. (note 47).

51. Some 35 military schemes were installed up to 1940, the earliest in Dover in 1908, the largest of 8.5$MW_h$ at a Chippenham barracks. (Orchard Partners, op. cit. (note 29).) See also 'Notes on DH Installations at RAF Stations', in DSIR 4/318. F Biggin mentions a scheme for heating the museums and other buildings in South Kensington from the Imperial College generator. (London discussion, Elec Rev 90, p.140.)

52. The records of pre-nationalisation undertakings are scattered and a

comprehensive search is impracticable. The National Register of Archives lists the locations of some 35 undertakings. The records of the Electricity Commission and associated papers are contained in POWE 10 - 13 in the PRO. The records of the CEB are held by the Electricity Council, but have not been consulted during this research. See also Hannah, 'A Note on Sources', op. cit., pp.357-9 (note 36). The Treforest Industrial Estate was supplied with steam from the South Wales Electric Supply Co Upper Boat station from 1936 till its demotion from base load operation, and hot water from a colliery power station supplied Markham Village, Monmouth. (Papers, Mar 1942, in DSIR 4/1910; papers, Nov 1943, in POWE 14/264; JG Howell, 'Treforest Industrial Estate: Bulk Steam Supply', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol, Sep 1969.)

53. Papers, Sep 1946, in POWE 14/266.

54. Except, e.g., in noting the powers given to Manchester in 1930. (Electricity Commissioners, Report 11, 1930/1, p.92.)

55. op. cit. (note 53). At Worksop the Corporation at first proposed transferring the authorised electricity undertaking to a new company which would build and run a CHP station. Threatened with a long delay for a public inquiry, the Corporation then wanted to retain the undertaking but purchase electricity in bulk from a CHP station owned and run by the new company. The EC insisted on an inquiry for this arrangement anyway, and in Mar 1936 rejected the proposal in that it did not afford 'a satisfactory basis for the association of a Municipal electricity undertaking with an Industrial Estate'. (EC, Report (16), 1935/6, pp.51-3.)

56. St. Marylebone Electricity Committee, Minutes, 9 Nov 1921, 7 Dec 1921 and 1 Feb 1922, in file ES 650.

57. Smith, op. cit. (note 27); O Faber, 'District Heating', HVE 8, Apr 1935, pp.401-4; SB Donkin, op. cit. (note 12); Margolis, op.cit. (note 3); Margolis, 'Heat Distribution', Steam Engineer 6 (68), 1937, pp.345-7; Margolis, 'Superheated Hot Water from the Point of View of District Heating', paper to IHVE 2 Mar 1938, abstracts in HVE 11, Apr 1938, pp.489-93; FW Shilstone and A Monkhouse, 'The Public Supply and Distribution of Steam and Hot Water', JIoF 9, Feb 1936, pp.200-7.

58. Smith, HVE 1 (10), p.284 (note 27).

59. Smith, 'District Heating and its Economic Relation to Housing and Town Planning', HVE 17, Mar 1944, pp.421-6.

60. Faber, op. cit. (note 57).

61. Donkin, op. cit. (note 12).

62. Margolis, op. cit. p.142 (note 3).

## Chapter 6

1. Any professional or commercial body deeply concerned about the post-war has had its appropriate sub-committee dealing with the subject for some time .... Eight professional and learned societies alone have 45 committees, and industrial and trade organisations between them must raise the number to nearly 100.

(Editorial, 'Directorate of Post-War Building', HVE 15, Mar 1942, p.263.) Among those bodies considering DH specifically, see Association for Planning and Regional Reconstruction, The Case for District Heating, Report No. 1 (Aug 1941), and District Heating, Review No. 4 (1944). On the fuel problems, see e.g. DN Chester, 'The Machinery of Government and Planning', in GDN Worswick and PH Ady (eds.), The British Economy 1945-50 (Oxford: Clarendon, 1952), p.342; H Pelling, The Labour Governments 1945-51 (London: Macmillan, 1984), p.166.

2. MFP, Fuel and the Future, London 8 - 10 Oct 1946, 3 vols (London: HMSO, 1948). The papers concentrated on use rather than supply. They were almost entirely technical, though they served as promotion of particular industries' views of future use patterns; e.g. P Honey, 'Improved Fuel Burning Appliances: Electricity', ibid., 3, pp.110-13.

3. In the short term, Minister of Fuel and Power Shinwell wanted voluntary energy savings of over 10% to replace the 'economies of direction' of the late war years. (Opening address, ibid., 3, pp.1-6.)

4. G Nott-Bower, ibid., 3, p.95.

5. e.g. LJ Overton, 'District Heating and Hot Water Supply', HVE 15, Jul 1941 - Apr 1942; O Faber, 'National Heating Problems and District Heating', presidential address to IHVE, London 9 Feb 1944, HVE 17, Mar 1944, pp.337-44, and Ind Htg Eng 6, Jul 1944, pp.106-7; EA Pearce, 'High Pressure Hot-Water Systems II', HVE 16, Sep 1942, pp.85-8; H Swaine, 'District Heating Schemes', JIHVE 9 (108), 1942, pp.354-68; TH Wood, 'District Heating', Proc Inst Mech Eng 154, 1946, pp.219-23; AE Margolis, 'Improvement of Climatic and Living Conditions by Public Heat Supply', Advancement of Science, 1942, pp.59-60; Margolis, letter, Financial News, cited in C Tasker, 'American District Heating Lessons for Britain', HVE 15, Sep 1941, pp.97-101; WRM Belcher, letter, HVE 14, May 1941, p.444; DVH Smith, letter, HVE 17, Jan 1944, p.286; LJ Fischer, letter, HVE 17, Mar 1944, pp.369-70; Margolis, letter, HVE 17, May 1944, p.452; Margolis, letter, Nature 153, 1 Jan 1944, p.27; CL Kempton, letter, HVE 17, Jun 1944, p.489.

6. DSIR 4/1912; 'District Heating in US Study Party', HVE 20, Mar 1947, p.422. By Aug 1949, for example, Smith's consultancy was engaged in schemes at Urmston, Salisbury, Dagenham, Paddington, East Kilbride, Woodside (Fife), Glenrothes and Priesthill (Glasgow), and had also produced reports for Chelsea, Huddersfield, Bacup, Airdrie and Edinburgh. (Bristol Corporation, Special DH Sub-Committee of Planning and Reconstruction Committee, Minutes, 18 Aug 1949.)

7. Estimates of requirements varied: e.g 750 000 needed at end of WW2, Capital Investment in 1948, Cmnd. 7268 (London: HMSO, Dec 1947); 1.25m, Housing, Cmd. 6609 (London: HMSO, 1945); MoH, Design of Dwellings (London: HMSO, 1944); MoW, Demonstration Houses (London: HMSO, 1944); papers, Oct 1944, in POWE 28/9. See also Pelling, op. cit., pp.108-10 (note 1).

8. It was the government's intention to start up to 20 new towns. 14 were actually started between 1947 and 1950: 11 in England and Wales: Basildon, Bracknell, Crawley, Harlow, Hatfield, Hemel Hempstead, Stevenage, Welwyn (already started), Corby, Cwmbran, Newton Aycliffe and Peterlee; and 2 in Scotland: East Kilbride and Glenrothes. Cumbernauld was started in 1956. (FJ Osborn and A Whittick, The New Towns: The Answer to Megalopolis (London: Leonard Hill, 1963), pp.83-95.)

9. Ministers of the Crown (Minister of Fuel and Power) Order 1942, SRO 1132, under Ministers of the Crown (Emergency Appointments) Act 1939, 2&3 Geo 6, ch.77; Ministry of Fuel and Power Act 1945, 8&9 Geo 6, ch.19.

10. ibid., s.1(1); see also DCFP 207, 'Statutory Provisions on Fuel and Power Policy' in POWE 14/554.

11. On general policy discussions, see POWE 25/145.

12. Papers, Dec 1943, in POWE 28/9. See also 'The Domestic Fuel Policy Report', Coke 8, May 1945, pp.100-2.

13. POWE 25/145 and 28/9.

14. POWE 25/145.

15. British Imperial Calendar and Civil Service List, various years; on the Fuel Efficiency Committee, see POWE 25/145 and 25/164.

16. Papers, Apr 1944, in POWE 14/23.

17. Papers, Mar-Apr 1944, in POWE 14/23.

18. ibid. The President of the Board of Trade, responsible for the industry in the early 40s, had likewise considered the EC to have assumed too much power.

19. Papers, Oct 1946, in POWE 14/23.

20. Papers, Nov 1945, in ibid.

21. Correspondence and other papers, Mar-Apr 1944, in POWE 14/23.

22. Papers, Dec 1945, in POWE 14/23.

23. On the organisation of the energy industries in general, including a comprehensive explanation of the many representative bodies, see PEP, The British Fuel and Power Industries (London: PEP, 1947), esp. part 4.

24. On the general development of the gas industry and its position in this period, see the Heyworth Committee report, The Gas Industry: Report of a Committee of Inquiry, Cmd.6699 (London: HMSO, Dec 1945), and TI Williams, A History of the British Gas Industry (Oxford: OUP, 1981).

25. The Gas Industry ..., p.8 (note 24).

26. Williams, op. cit., p.135 (note 24). See also, A. Sylvester, 'Some Immediate Problems of the Gas Industry', Gas J 244, 1 Nov 1944, pp.575-6; GE Currier, 'The Gas Industry: Four Major Problems', Gas J 244, 1 Nov 1944, pp.576-83; 'The Case for Gas in Post-War Housing', HVE 16, Feb 1943, pp.334-5.

27. For a critical view of the wartime government's effort, see ED Simon, Rebuilding Britain: A Twenty Year Plan (London: Gollancz/Left Book Club, 1945).

> (It) consistently refused to take any responsibility for the matter, or indeed any interest, with the exception of a small amount of research undertaken by the Fuel Research Station and the Building Research Station.

(ibid., p.47.)

28. Ministry of Works, District Heating, Report by the Heating and Ventilation (Reconstruction) Committee of the Building Research Board of the Department of Scientific and Industrial Research, Post-War Building Studies 31 & 32 (London: HMSO, 1953).

29. Fuel Research Board, Report of the Director of Fuel Research, Apr 1939 - Mar 1946 (London: HMSO, 1950), p.37. See also Simon, op. cit., pp.45-8 (note 27).

30. 'Directorate ...', op. cit. (note 1); 'News from the Reconstruction Front: Directorate of Post-War Building Set Up', ibid., pp.294-6; Building Research Board, Report, 1940-45.

31. BRB, Report, 1940-45; MoW, Heating and Ventilation of Dwellings, Post-War Building Studies 19 (London: HMSO, 1945), p.1.

32. FRB, op. cit. (note 29); op. cit., p.2 (note 28).

33. ibid.; Simon, op. cit. (note 27).

> It is now clear that the detailed study undertaken by this Committee has had a very large effect on the recommendations of subsequent Committees.

(BRB, op. cit. (note 30).)

34. MoW, op. cit. (note 31).

35. Papers, May 1944 in DSIR 4/1912; Editorial, 'District Heating Not Dead Yet', HVE 16, Sep 1942, p.175.

36. DSIR, Interim Memorandum on District Heating by the District Heating Sub-Committee of the Heating and Ventilation

(Reconstruction) Committee of the Building Research Board (London: HMSO, 1946), p.3.

37. Papers, Dec 1947, in POWE 14/264. See also Parl Deb Comm 404, 3 Nov 1944, c.1102-3 (w).

38. op. cit. (note 2): A Stubbs, 'District Heating as a Public Service', 2, p.151-4, Gas J 249, 1 Jan 1947, pp.43-4, and RIBAJ 54 (2), 1946, pp.78-9; WG Holford, 'District Heating in Relation to Town and Country Planning', 2, p.155-9, and Gas J 249, 1 Jan 1947, pp.35-6; AE Margolis, 'Continental Practice', 2, p.159-65, and Gas J 249, 1 Jan 1947, pp.40-3; SB Donkin, 'Prospects of District Heating in the UK', 2, p.165-70, and RIBAJ 54, Dec 1946, p.81. R Nicholas, 'The Wythenshawe Scheme', 2, p.171-6, Gas J 249, 8 Jan 1947, pp.94-5, and HVE 20, Dec 1946, pp.263-6; EL Leeming, 'Proposed District Heating Scheme at Urmston', 2, p.176-81, Gas J 249, 1 Jan 1947, pp.46-7, and RIBAJ 54, Dec 1946, p.83; AC Pallot, 'The Application of District Heating to Small Housing Estates', 2, p.181-201, and HVE 20, Dec 1946, pp.253-62; discussion, 2, pp.201-9. See also RF Brooks-Grundy, letter, HVE 20, Nov 1946, p.223; 'An Impression: The District Heating Session', HVE 20, Dec 1946, pp.251-3.

39. CM Keys, opening address, op. cit., 3, pp.6-9 (note 2).

40. See chapter 5, notes 57 and 59.

41. AE Margolis, 'District Heating and its Application to the New Towns', JIoF 23, Sep 1950, pp.247-54, and Engineer 189, 17 Mar 1950, pp.330-1, and 24 Mar 1950, pp.371-3.

42. DSIR 4/1919.

43. MTCP/DoH(Scotland), Final Report of the New Towns Committee, Cmd.6876 (London: HMSO, Jul 1946), pp.24-5 and app.4; see also MTCP/DoH(S), Second Interim Report of the New Towns Committee, Cmd.6794 (London: HMSO, Apr 1946).

44. Papers, 1945-6, in HLG 101/577.

45. MFP, Domestic Fuel Policy: Report by the Fuel and Power Advisory Council, Cmd.6762 (London: HMSO, Mar 1946). See also Wartime Social Survey, 'Heating of Dwellings Inquiry', App.1 in MoW, op. cit., pp.107-91 (note 31).

46. MFP, op. cit., p.3 (note 45).

47. ibid., pp.10-11.

48. ICDH, 'Progress Report', PLN/95/8/1, 3 Jan 1948, in POWE 25/150.

49. ibid.

50. Papers, Jan 1947, in HLG 101/577 and Dec 1947 in POWE 14/264. The DHSC examined outline schemes and advised whether they were sound in principle. MoH engineers checked the engineering details of those plans approved and studied tenders obtained.

51. MoH Circular 204/46, 4 Nov 1946.

52. Correspondence and summary in HLG 101/577.

53. Electricity Act 1947, 10&11 Geo 6, ch.54.

54. Papers, Sep 1946, in POWE 38/51. The section remained essentially unaltered by the Electricity Act 1957, 5&6 Eliz 2, ch.48, 4th schedule. See App.6.

55. ibid., and papers, Oct 1946, in POWE 14/264.

56. Electricity Bill, Part IV Miscellaneous and General, s.44; 2nd Reading, Parl Deb Comm 432, 3 Feb 1947, c.1406-535, 4 Feb 1947, c.1585-702; Commons Standing Committee E, 25 Feb - 22 May 1947; Report, 439, 23 Jun 1947, c.41-162, 24 Jun 1947, c.215-400, 25 Jun 1947, c.447-541; 3rd Reading, 439, 30 Jun 1947, c.968-1082; Lords Amendments, 441, 5 Aug 1947, c.1305-42.

57. DSIR 4/316 - 325, 4/1910 - 1922.

58. Papers, Feb 1942 - May 1943, in DSIR 4/1910, and Aug 1943 - Sep 1943, in DSIR 4/1911. DHSC: A Egerton (Imperial College); SB Donkin (Kennedy and Donkin); O Faber (consulting engineer); HL Guy (IMechE); GN Haden (Haden); WG Holford (MTCP); H Manzoni (Birmingham City Council); WW Nobbs (consulting engineer); AC Pallot (MoW); SL Pearce (Electricity Commission); RN Quirk, later LE Nichols (MFP); WM Selvey (consulting engineer); A Stubbs (Metropolitan-Vickers); J Wright (CEB); CC Handyside, later HE Beckett (DSIR). (Papers, Sep 1943 in DSIR 4/1911; DSIR, op. cit., p.2 (note 36).) Margolis was consulted early in the DHSC deliberations and was subsequently involved in much of its work. (DSIR 4/325.)

59. See esp. DHSC Minutes, Oct 1942 - Mar 1943, in DSIR 4/316 and 4/317.

60. DSIR 4/1911 - 1914. The DHSC considered Dundee, Craigton (Glasgow), Hillington, Gorton, Staveley, and Treforest Trading Estate. DSIR 4/1910. See e.g. BRS Library, Bibliography 55, District Heating, in DSIR 4/1910, and as App.1 to Part I, op. cit. (note 28); Part II 'Survey of District Heating Practice Abroad', ibid.

61. DSIR 4/316 - 321 and 4/1910.

62. Papers, Feb 1942 - Jan 1943, in DSIR 4/1910.

63. Note of Presentation, op. cit., p.i (note 28).

64. DHSC Minutes, Jul 1943, in DSIR4/317. Working Group: Beckett, Pallot and Stubbs, plus HS Horsman (LPC, later BEA); JR Kell (Faber); F Shakeshaft (CEB, later BEA); LCC Rayner (MoH); HH Bruce (Haden); CG Carrothers (Kennedy and Donkin). A Technical Panel directed the work of the Group: Pearce, Donkin, Haden, Selvey, Stubbs, Pallot. (DSIR 4/1910, 4/1911, 4/325; op. cit., p.1 (note 28).)

65. DHSC Minutes, 20 Oct 1942, in DSIR 4/316.

66. Papers, Jan 1943, in DSIR 4/1910.

67. Note of Presentation, op. cit. p.iii (note 28).

68. Editorial, 'District Heating', HVE 20, Aug 1946, p.50.

69. Kennedy and Donkin, 'City of Coventry: Memorandum of Suggested District Heating Scheme for the Reconstructed Areas: Preliminary and General Survey' (Sep 1943), in DSIR 4/317; summarised in DSIR, op. cit., pp.17-18 (note 28).

70. AE Margolis and SB Donkin, 'Memorandum on Suggested District Heating Scheme for the Duddeston and Nechells Redevelopment Area of Birmingham', PWR/DH 68, May 1945, and Minutes, 13 Aug 1945, in DSIR 4/320; included as pp.127-62, and summarised on pp.18-20, op. cit. (note 28).

71. Industrialist Oliver Lyle, an advocate of CHP, wrote prophetically to Beckett in Mar 1943: 'Your sub-committee will have its work cut out to get its report out and adopted before it is too late. I wish it God speed.' (Correspondence, Mar 1943, in DSIR 4/1910 and 4/317.) HVE reported optimistically that the report would appear by the end of 1943. ('Coventry and Bristol Schemes', HVE 17, Nov 1943, pp.167-70.)

72. Minutes, 24 Jan 1944, in DSIR 4/318.

73. See correspondence and summary, Dec 1946 - Aug 1947, in HLG 101/577; 'District Heating', loc. cit. (note 79); Editorial, 'Three-Fold Comment', HVE 19, Jul 1945, p.3; 'Heat Supplies', Elec Rev 138, 5 Jul 1946, p.15.

74. Parl Deb Comm 404, 28 Nov 1944, c.2372-3 (o); 'District Heating: Major Lloyd George's Statement', Elec Rev 135, 8 Dec 1944, p.808; Parl Deb Comm 397, 25 Feb 1944, c.1107 (w). See also correspondence, 1944, in DSIR 4/1911.

75. Minutes, 30 Apr 1945, in DSIR 4/319.

76. ibid.; 'Interim Statement', PWR/DH 67 in DSIR 4/1917.

77. PWR/DH 69, Aug 1945, in DSIR 4/320.

78. Correspondence in DSIR 4/1917; Minutes, 13 Aug 1945, in DSIR 4/320.

79. Papers, Apr - Oct 1945, in DSIR 4/1917.

80. Papers, Aug 1946, in DSIR 4/1917.

81. DSIR, op. cit. (note 36); reproduced in HVE 20, Feb 1947, pp.357-61; reported in Elec Rev 139, 11 Oct 1946, p.576, and HVE 20, Oct 1946, p.144. See also 'District Heating', IMEAJ 27, Oct 1946, pp.188 and 198.

82. This view was widely repeated. See e.g. PEP, Planning 14 (273), 24 Oct 1947; 'District Heating Possibilities', Electrician 137, 11 Oct 1946, p.982; 'District Heating in Practice: Methods Discussed

in Official Interim Report', Electrician 137, 11 Oct 1946, p.989; BRB, Report, 1946, p.37.

83. Summary, Sep 1946, in DSIR 4/1917.

84. Press Notice, 30 Sep 1946, in DSIR 4/1917.

85. JR Kell, 'District Heating', RIBAJ 54, Aug 1947, p.517.

86. DSIR 4/1915; op. cit., p.1 and Part VI (note 28).

87. BRB, Report, 1946, p.37. The Basic Scheme was presented to the IMechE in Apr 1948 and published as A Stubbs, 'District Heating', Proc Inst Mech Eng 160, 1949, pp.1-21.

88. Correspondence, Jul 1946, in DSIR 4/1917; op. cit. (note 45).

89. DSIR 4/1919.

90. PWR/DH 87 in DSIR 4/1916.

91. BRB, Report, 1949; Note of Presentation, Oct 1948, op. cit., p.iii (note 28).

92. JH Forshaw and P Abercrombie, County of London Plan (London: Macmillan, 1943), pp.123-4.

93. RIBA London Regional Reconstruction Committee, Greater London: Towards a Master Plan, 2nd Interim Report, May 1943, p.43.

94. AE Margolis, 'An Outline District-Heating Scheme for London', Engineering 157, 26 May 1944, pp.401-4. See also O Lyle, correspondence with MFP, Feb 1943, in DSIR 4/1910.

95. LCC, Administrative County of London Plan 1951: Statement (London: LCC, 1951).

96. See App.4 and 6.7, esp. notes 366-371 for details of other London schemes and proposals. See also 'Relation of Basic Scheme to London Area', App.19 in DSIR, op. cit. (note 28).

97. This account is based on material in BEA/CEA A25876; POWE 14/265; City of London Improvements and Town Planning Committee files 604E; and Minutes of the Proceedings of the Common Council. City interests were represented on the City of London Reconstruction Advisory Council.

98. Files 6 and 21 in 604E (note 97); Faber, op. cit. (note 5).

99. Motion from Sir George Elliston. (I&TP Committee, Minutes 50, 1946; Minutes of the Proceedings of the Common Council, 16 Oct 1947; 'District Heating Suggested for London', Elec Rev 137, 2 Nov 1945, p.637.)

100. Minutes of the Proceedings ..., 16 Oct 1947; SB Donkin, 'Report on District Heating for the Rebuilt Areas of the City', Apr 1947: DSIR, op. cit., pp.53-6 (note 28); 'District Heating Plan for the City of London', Electrician 139, 17 Oct 1947, p.1158; 'District Heating for

City of London', HVE 21, Dec 1947, p.265.

101. CH Holden and WG Holford, Reconstruction in the City of London, Final Report (London: Corporation of the City of London, 1947), included as Part 5 in The City of London: A Record of Destruction and Survival (London: Architectural Press, 1947). Holden and Holford refer to the thousands of coal vans, most horse-drawn, then needed to supply the City. See also 'The Reconstruction of the City of London', Engineering 163, 20 Jun 1947, p.526.

102. I&TP Committee, Minutes 51, 1947.

103. LCC Chief Engineer, papers, 1947, in LCC files.

104. Papers, Feb 1953, in BEA/CEA A25876.

105. The account of the Pimlico scheme is based on CEGB 118.4.1, esp. 'Pimlico District Heating Scheme', Memo 1710 to FM&CO, 25 Jun 1952; Westminster City Council, Minutes; AE Margolis, 'District Heating', Engineering 176, 9 Oct 1953, pp.509-10; as well as papers listed subsequently.

106. WCC, Minutes, 10 Oct 1946, and Report of Housing Committee, 24 Sep 1946. See also: DSIR, op. cit., pp.52-3 (note 28); 'Pimlico District Heating Scheme', Elec Times 110, 17 Oct 1946, p.553; 'District Heating at Pimlico: Proposal to Purchase Heat from Battersea', Electrician 137, 18 Oct 1946, pp.1053-4; SB Donkin, 'District Heating Scheme for Pimlico Housing Estate', HVE 20, Mar 1947, pp.390-4.

107. According to one report, at an early stage 2 x 1.5$MW_e$ ITOC sets were considered. ('Pimlico District Heating Scheme', loc. cit. (note 106).)

108. B Donkin, AE Margolis and CG Carrothers, 'The Pimlico District Heating Undertaking', Proc Inst Civ Eng 3, May 1954, p.281. 420$GJ_h$ for a 45$C^o$ temperature difference; 370$GJ_h$ for 40$C^o$. (Margolis, op. cit. (note 105).) Margolis is credited with introducing the idea of a heat accumulator into Britain, after its development in Hamburg. (B Donkin, CM Johnston and E Ockenden, 'The Pimlico District Heating Undertaking: Costs and Financial Results', Proc Inst Civ Eng, 5, Jul 1956, pp.323-44.)

109. Originally estimated at 3s7d - 9s5d/week. For comparison, Kell estimated that the average expenditure on energy in a working class household in 1947 was 7-8s/week. Under postwar rationing, solid fuel expenditure was limited to 5s/week. (JR Kell, op. cit., p.517 (note 85).) See also note 112.

110. Manchester City Council, Report of Housing Committee, Proceedings II, 4 Oct 1947, pp.477-8. See also Saunders and Taylor, 'District Heating Scheme for Proposed New Section of Wythenshawe Estate, Manchester', 1944, in DSIR 4/1911; and Simon, op. cit., p.139 (note 27). Besides Council proceedings, this account of the Wythenshawe scheme is based on BEA/CEA A25876; DSIR 4/1920 and 4/1921; POWE 14/266; RS Thwaites, 'Provision of Heat by an Electricity Supply Undertaking', Engineer 182, 12 Jul 1946, pp.30-3; Nicholas, op. cit. (note 49).

111. Manchester Corporation Act 1946, 9&10 Geo 6, ch.38, Pt.IV. See also 6.6, esp. note 224. The Finance Committee assumed there would be no problems in borrowing under the Housing Assisted Scheme arrangements. (Report ..., op. cit. (note 110).)

112. E Griffiths, 'On a District Heating System Serving the Residential Neighbourhoods and Industrial Areas of the Wythenshawe Estate', in Manchester City Council, Proceedings II, 5 Feb 1947, pp.198-219; Report of Housing and Wythenshawe Estate Special Committees, Proceedings, 3 Apr 1946, I, p.273, and II, 223-6; App.2, Part I, in DSIR, op. cit., pp.46-8 (note 28). The average weekly expenditure on fuel for a three-bedroom house was estimated at 6s11d, giving about 30GJ$_h$ useful heat. The new scheme was based on requirements of 19GJ$_h$ as washing water and 62GJ$_h$ of space heat - a much higher standard as advocated in the Simon Report published a few months later. Allowing for top-up heating, it was calculated that the average householder would save 5s3d on coal in return for the 4s5d weekly DH charge.

113. Letter to Electricity Commission, 5 Feb 1945, in POWE 14/266.

114. Proceedings (1944-5), I, 3 Oct 1945, pp.362-3, and II, p.494; letter from EC to Manchester Electricity Department, 29 Jan 1945, and other papers in POWE 14/266.

115. Capital costs: £1.6m; annual capital charges: £99 000; annual operating costs: £143 000; total annual outgoings: £264 000. Griffiths further argued from the relative prices of coal, gas and electricity that the flexibility of gas and electricity over coal for top-up would lead to increased sales over that to be expected if district heating was not adopted. (Griffiths, op. cit., pp.205-6 (note 112).)

116. Report ..., op. cit., (note 112).

117. City of Birmingham Public Works Committee, Minutes 54, 22 Oct 1942, p.120.

118. 'Birmingham', IMEAJ, Oct 1946, in POWE 14/264. See also Simon, op. cit., pp.188-90, on Duddeston and Nechells and on the concept of neighbourhood units (note 27).

119. Correspondence, Nov 1943, in DSIR 4/1911.

120. Correspondence, Apr 1944, in DSIR 4/1912.

121. City of Birmingham Reconstruction Committee, Social Survey 1944-45. Final Report, Dec 1945.

122. ibid., esp. Sociological Survey: Report No.5: 'Suggestions for Improvement'; Reconstruction Committee, 'Synopsis of Competitors' Essays', 1943.

123. op. cit. (note 121); HJ Black, History of the Corporation of Birmingham, vol.IV part 1, 1936-50 (Birmingham: Corporation GPC, 1957), ch.2.

124. Public Works Committee, Minutes 57, 10 May 1945, p.69.

125. 'Memorandum on Suggested District Heating Scheme for the Duddeston and Nechells Redevelopment Area', part III of DSIR, op. cit. (note 28). Around the same time, the Electricity Supply Department was preparing plans for the new Nechells station. Although the proposals came as a matter of course before the Public Works Committee, first in outline and later in detail, from late 1945 to late 1946, apparently no connection between the projects was acknowledged. (Public Works Committee, Minutes 58, 22 Nov 1945, p.77, and subsequent.)

126. City of Birmingham, Public Works Committee Report, Proceedings of the Council (1946-7), pp. 346-355.

127. City of Birmingham, Proceedings ... (1946-7), 11 Mar 1947.

128. 'Heating on Tap at Bristol?', HVE 15, Oct 1941, p.117.

129. Planning and Reconstruction Committee, Minutes, 29 Dec 1942, 1 Sep 1943; A Scull, 'Summary and Conclusion Report on a Heat Distribution Service for the Central District of the City of Bristol' (Jul 1943), in DSIR 4/317; also PWR/DH 37/22 in DSIR 4/1911.

130. P&R Committee, Minutes, 29 Sep 1943, 13 Oct 1943; 'District Heating: Basis of the Bristol Proposals', Elec Rev 133, 5 Nov 1943, p.606; 'Project to Heat a City: Hot Water and No Smoke', Times, 26 Oct 1943. Arthur Scull served as a representative of the Bristol Association of Trades Employers on the Bristol Replanning Advisory Committee (later the Bristol Replanning Association) established in Oct 1941 by the Chamber of Commerce. Despite a wide coverage of issues and the presence on the Committee of local architects, representatives of a gas company and engineering institutes, its reports contained little specifically on energy, electricity or heating matters and anticipated few problems with postwar housing. (Bristol Replanning Advisory Committee, papers, 1941-2, in Bristol City Council archives.)

131. After criticism, Scull had revised the figures in his original report: pay-back time from 21 to 30 years; cost of heat up from 3s2d to 3s7d; and electricity downwards from .3d/kWh. ('Addendum to the Preliminary Report ...', Nov 1942, in DSIR 4/317 and 4/1911; correspondence, Oct 1946 in DSIR 4/1921.)

132. City and County of Bristol, Comprehensive Redevelopment Area (1944).

133. City Engineer's Report on the Proposals for the Planning and Reconstruction of the Central Area of the City, 1943.

134. P&R Committee, Minutes, 6 Jun 1945, 14 Jun 1945.

135. Town and Country Planning (Interim Development) Act 1943, 6&7 Geo 6, ch.29; Coventry Town Planning and Building Committee, Minutes, 18 Aug 1943, 20 Oct 1943.

136. Coventry Corporation Planning and Redevelopment Department, Development and Redevelopment in Coventry (Dec 1959).

137. ibid.

138. TP&B Committee, Minutes, 20 Oct 1943.

139. Redevelopment Committee, Minutes, 9 Jun 1942; DSIR/DHSC, Minutes, 4 Oct 1943, in DSIR 4/317.

140. op. cit. (note 69); also PWR/DH 36 in DSIR 4/1911.

141. Redevelopment Committee, Minutes, 22 Sep 1943.

142. Correspondence, Oct 1943 and Apr 1944, in DSIR 4/1912.

143. Redevelopment Committee, Minutes, 6 Oct 1943; papers, Oct 1943, in DSIR 4/1911.

144. Planning and Redevelopment Committee, Minutes, 29 Jul 1947.

145. ibid., 14 Jul 1948.

146. ibid., 30 May 1947, 3 Jun 1947 and 3 Oct 1948; Coventry Corporation Act 1948, 11&12 Geo 6, ch.37, Pt.IV.

147. EA Pearce, 'Is the Bugbear of District Heating a Matter of Finance?', HVE 23, Sep 1949, pp.139-41.

148. e.g. DSIR/DHSC, Minutes, Oct 1942 - Mar 1943 in DSIR 4/316 - 317.

149. Smith, discussion on Margolis, op. cit., Sep 1950, p.253 (note 41).

150. Editorial, 'The Threat of District Heating', HVE 9, Nov 1935, p.165.

151. Editorial, 'District Heating', HVE 14, Jun 1941, p.451.

152. Editorial, 'Planning After-the-War Britain', HVE 15, Nov 1941, p.139.

153. Editorial, 'District Heating Development', HVE 16, Nov 1942, p.155.

154. 'District Heating Not Dead Yet', loc. cit. (note 35).

155. 'Coventry and Bristol Schemes', loc. cit. (note 71); 'District Heating', HVE 17, Sep 1943, pp.83-5.

156. Editorial, 'District Heating on a National Basis?', HVE 17, Apr 1944, pp.377-8; Editorial, 'District Heating: Action Wanted', HVE 18, Dec 1944, pp.227-9; Editorial, 'District Heating Points Not to be Ignored', HVE 18, Jan 1945, pp.501-2; Editorial, 'Do District Heating Enthusiasts Paint Too Rosy a Picture?', HVE 21, Jun 1948, p.513; Editorial, 'No District Heating for the City of London?', HVE 23, Jul 1949, p.1; Editorial, 'The Factual District Heating Picture as We See It', HVE 23, Sep 1949, pp.111-12; Editorial, 'Is District Heating too Expensive for Lower Income Groups?', HVE 24, Aug 1950, p.57.

157. Editorial, 'The IHVE and District Heating', HVE 20, Mar 1947, p.380; 'District Heating Discussion', HVE 21, Dec 1947, p.264.

158. Papers, Apr 1944, in POWE 14/23. On the records of the CEB and EC, see chapter 5, note 52.

159. ibid. It was thought within the MFP that 'the Commissioners have definitely ruled that (DH) falls outside the scope of the Electricity Supply Acts.' (ibid.)

160. Possibly only because he accorded it such little significance and never regarded it as a challenge to the industry's organisation and responsibilities, John Kennedy, the Commission Deputy Chair, was keen to see CHP developed at least experimentally. (Correspondence, Jan 1945, and notes of meetings, Jul 1945, in POWE 14/266.) See also 6.3.

161. > ... the issue is fundamentally whether the CEB element in the BEA can be induced to interpret s.50 of the Electricity Act 1947 in a liberal way - that is, depart from its past desire to extract most units from the least amount of coal ...

(Papers, Dec 1947, in POWE 14/264.) One member frequently dismissed the idea, citing technical grounds that were far from accepted. (Papers, 1945, in POWE 14/264.)

162. 'District Heating: Information Required on Many Aspects', Elec Rev 134, 31 Mar 1944, pp.433-4.

163. Editorial, 'District Heating', Elec Rev 135, 1 Sep 1944, p.290. Other electrical press commentators were more tolerant: e.g. Editorial, 'Power-Heat Stations: Very High Thermal Efficiency', Elec Rev 135, 1 Dec 1944, pp.761-2 and Editorial, Elec Times 104, 30 Sep 1943, pp.381-2. For a brief dismissal, see LF Jeffrey, 'Efficiency and the ESI', JIoF 18, Feb 1945, pp.85-8. For an outspoken attack, see WD Hayes (Edmonsons Electricity Corporation), letter, Evening Standard, 19 Jan 1945, reported in Elec Rev 136, 2 Feb 1945, p.166. For more positive views, see 'District Heating Requires Cooperation of ESI', Electrical Industries, Dec 1946, also in POWE 14/264; and from a BEA engineer, HS Horsman, 'District Heating', J Roy Soc Arts 96, 4 Jun 1948, pp.400-17. On the concern of the electrical appliance industry over DH, see JH Fella, 'District Heating and Appliances', Electrician 138, 21 Mar 1947, p.698. For an early argument for all-electric provision, see DH Parry, 'Heating Large Buildings: Limitations of Back-Pressure Plant', Elec Rev 131, 23 Oct 1942, pp.517-9.

164. Papers, Dec 1947 - Jun 1948, in POWE 14/264.

165. Papers, Feb 1948, in POWE 14/264.

166. The following account is based except where noted on papers, Nov 1948 - Jan 1949, in BEA/CEA A25876.

167. L Hannah, Electricity Before Nationalisation: A Study of the Development of the Electricity Supply Industry in Britain to 1948 (London: Macmillan, 1979), pp.14-16.

168. See also papers, Nov 1949, in CEGB 118.4.1.

169. Papers, 1948, in CEGB 118.4.1.

170. Correspondence between Gaitskell and Citrine, Dec 1948, in BEA/CEA A25876 and POWE 14/264. Citrine indicated that the BEA would give detailed policy by Jan 1949. See also papers, May 1949, in POWE 14/264.

171. Papers, Jun 1949, in POWE 14/264.

172. JE Davis, 'District Heating', Gas J 242, 4 Aug 1943, p.135.

173. Williams, op. cit., p.74 (note 24). See the list in the Heyworth Report, The Gas Industry ... (note 24).

174. For the composition of the BGF, see ibid.

175. Gas Journal, Gas Times.

176. S Everard, The History of the Gas Light and Coke Company, 1812-1949 (London: Benn, 1949)

177. Editorial, 'District Heating', Gas J 242, 11 Aug 1943, p.165; also correspondence, National Gas Council/DSIR, Apr 1944, in DSIR 4/319 and 4/1912.

178. British Gas Federation, Press Release, Nov 1945, accompanying IGE, '1st Report of the District Heating Committee', Trans Inst Gas Eng 95, 1945-6, pp.89-125.

179. Editorial, 'District Heating', Gas J 244, 20 Dec 1944, p.797.

180. BGF, op. cit. (note 178).

181. IGE, op. cit., p.100 (note 178).

182. Editorial, 'District Heating', Gas J 276, 28 Oct 1953, p.240.

183. IGE, op. cit., p.1 (note 178).

184. Editorial, 'District Heating', Gas J 246, 5 Dec 1945, p.797.

185. BGF, op. cit. (note 178); IGE, op. cit. (note 178).

186. IGE, op. cit., p.98 (note 178); BGF, op. cit. (note 178).

187. Editorial, loc. cit. (note 184).

188. e.g. leading to an increase in the cost of electricity (Editorial, op. cit. (note 177); IGE, op. cit., p.95 (note 178)), contradicting fears expressed elsewhere that CHP operation would reduce its price.

189. CA Masterman, letter, Gas J 243, 10 May 1944, p.590. See also GE Foxwell, 'District Heating: A Study in Costs and Fuel Technology', Mun J 57, 25 Nov 1949, pp.3019-21.

190. Editorial, 'District Heating Schemes', Gas J 243, 3 May 1944, pp.557-8.

191. IGE, op. cit. (note 178).

192. BGF, op. cit. (note 178).

193. Editorial, op. cit. (note 190).

194. British Gas Federation, Report on the Planning of the Gas Industry (London: BGF, Oct 1943), summarised in 'Post-War Planning: the Planning of the British Gas Industry', JIoF 16, Dec 1943, pp.61-2.

195. Masterman, op. cit. (note 189).

196. e.g. Editorial, 'District Heating', Gas J 248, 18 Dec 1946, p.1080.

197. Editorial, op. cit. (note 177).

198. Editorial, op. cit. (note 190).

199. e.g. Editorial, op. cit. (note 196).

200. IGE, op. cit., p.125 (note 178).

201. Editorial, op. cit. (note 190).

202. IGE, op. cit. (note 178).

203. BGF, op. cit. (note 178).

204. Foxwell, op. cit. (note 189).

205. e.g. WK Tate, discussion on IGE, '2nd Report of the District Heating Committee', Trans Inst Gas Eng 97, 1947-8, p.172. There was at least one suggestion of gas-fired DH: Report of Gas Engineer to Gas and Electricity Committee, Middlesborough Council, 21 May 1944, abstracts in correspondence, loc. cit. (note 177); 'District Heating at Middlesborough', HVE 17, May 1944, pp.450-1.

206. Editorial, 'District Heating' Gas J 249, 29 Jan 1947, p.250; editorial, op. cit. (note 196).

207. IGE, op. cit., p.145 (note 205).

208. IGE, op. cit., p.143 (note 205).

209. e.g. TA Beecroft, 'District Heating', Gas Times 74, 9 Jan 1953, pp.42-5.

210. IGE, op. cit., p.419 (note 205). The IGE DH Committee was pressed to continue with at least a watching brief after its 2nd report.

211. 'Gas and Coke in Homes of Tomorrow', Gas J 246, 5 Sep 1945, pp.332-3.

212. DVH Smith, 'The Economic Spheres of Alternative Methods of Space and Water Heating: by Solid Fuel Appliances, Gas, Electricity and District Heating', HVE 19, Feb 1946, pp.345-55.

213. IGE, op. cit., App.7 (note 178).

214. LJ Fischer, letter, HVE 21, May 1948, p.503.

215. e.g. E Bellingham, letter, Times, 31 Oct 1953; JS Williams, letter, Ind Htg Eng 18, Nov 1956, p.331. The CUC was formed in 1932, and from 1950 was responsible to the MFP for advising the public on domestic solid fuel use. For its composition, see CUC, Annual Report, various years. It set up a Joint Investigating Committee on DH in 1949. (Correspondence, Jul 1949, in HLG 101/578.)

216. e.g. GE Foxwell, 'The Bristol District Heating Project', Coke 6, Jan 1944, pp.7-8; 'District Heating Pipes a Confused Tune', Coke 7, Apr 1945, p.63.; 'District Heating', Coke 7, Dec 1945, pp.236-43; 'Fuel in the New Towns', Coke 8, Sep 1946, pp.85-6; Editorial, 'More about District Heating', Coke 8, Nov 1946, p.236. In criticism of Foxwell's evaluation of the Bristol scheme, see CE Holmes, 'District Heating', Coke 6, Mar 1944, pp.57-9.

217. Editorial, 'Coke for Housing', Coke 7, Jul 1945, pp.125-6. See also 'The Domestic Fuel Policy Report', loc. cit. (note 12).

218. Editorial, 'National Fuel Policy', Coke 6, Mar 1944, p.41. See also 'A Fuel Policy', Coke 6, Mar 1944, pp.49-51.

219. HLG 101/185.

220. ibid.

221. Papers, Aug 1949, in HLG 101/578. Essex County Council Act, 1952, 15&16 Geo 6 & 1 Eliz 2, ch.50, Pt.XIV. On parliamentary opposition to the Dagenham scheme, see 'Parliamentary News: District Heating Schemes', Elec Rev 151, 4 Jul 1952, p.37, and Parl Deb Comm 502, 25 Jun 1952, c.2309-331.

222. Correspondence, 1945, in HLG 101/577. See also correspondence on LCC (General Powers) Bill 1948-9, in LCC Legal and Parliamentary Department files; correspondence, Apr - May 1947, in HLG 101/577 on compulsory purchase powers.

223. e.g. DH powers formed the entire Swindon Corporation Act 1949 and Aycliffe Bill 1950. On the DH Bills, see HHH Helby, 'Parliamentary and Local Authority Powers Relating to District Heating', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969. On Local Acts in general, see PG Richards, The Local Government System (London: Allen and Unwin, 1983), pp.60-1. The question of general legislation for local authorities is dealt with in 6.8.

224. Manchester Corporation Act 1946, 9-10 Geo 6, ch.38, Pt.IV. Manchester had already obtained powers in 1930 to cover schemes from its city centre power stations; powers for breaking up streets were deemed available under the Electricity Acts 1882-1928 and the Electric Lighting (Clauses) Act 1899. (Manchester Corporation (General Powers) Act 1930, 20&21 Geo 5, ch.78, Pt.III, s.15.)

225. Papers in LCC Legal and Parliamentary files; LCC, Report of the Housing Committee, 22 Sep 1948.

226. HLG 101/185.

227. Petition, 'Proposed Additional Provision'; 'District Heating in London', Elec Rev 140, 7 Mar 1947, p.359.

228. Listed in 'Petitions Deposited Against the Bill in the House of Lords', against Pt.V: Supply of Heat to Housing Estates, etc. In addition, the FBI submitted amendments to prevent the Council manufacturing equipment for DH schemes. This proscription on local authorities became general practice in DH powers as with many other activities. (Correspondence, loc. cit. (note 225).)

229. Harrow UDC, Hendon Corporation.

230. Surrey County Council, Colne Valley Water Co.

231. e.g. Surrey County Council, Essex County Council, Colne Valley Water Co, Metropolitan Water Board.

232. e.g. Metropolitan Water Board.

232. Correspondence, loc. cit. (note 225).

234. Conjoint Conference of Public Utility Associations, Annual Report 1947, pp.11-12. This was the first petition against a Bill by the Conference, and was considered 'successful in all material matters'. The Conjoint Conference, formed in 1922, consisted of representatives of the British Gas Council, British Waterworks Association, Conference of Joint Electricity Authorities and Joint Boards, Gas Companies Protection Association, Incorporated Association of Electric Power Companies, Incorporated Electrical Association, London Electricity Supply Association, London Hydraulic Power Company, Provincial Electric Supply Association, Public Transport Association Incorporated, Water Companies Association. (Petition, loc. cit. (note 225).)

235. Correspondence, loc. cit. (note 225).

236. Sherwood and Co. for the Conjoint Conference, 'Heads of Proposed Amendments', Jul 1947, loc. cit. (note 225).

237. e.g. LCC Chief Engineer, Report, 12 Jul 1947, in papers, loc. cit. (note 225).

238. Note of conference LCC/Boroughs, 10 Jul 1947, loc. cit. (note 225).

239. Select Committee, House of Lords, 15-21 Jul 1947. London County Council (General Powers) Act 1947, 10-11 Geo 6, ch.46, Pt.V.

240. Namely London Power Company and City of London Electricity Company; Metropolitan Water Board; Gas Light and Coke Company.

241. Dudley Corporation Act 1947, 10&11 Geo 6, ch.27. See also papers, Jan 1950, in HLG 91/317.

242. Commons Committee Minutes of Evidence, 23 May 1950, in Wolverhampton Corporation file C/WCA/1950.

243. Coventry Corporation Act 1948, 11&12 Geo 6, ch.37, Pt.IV; Birmingham Corporation Act 1948, 11&12 Geo 6, ch.39, Pt.II; Darwen Corporation Act 1948, 11&12 Geo 6, ch.44, Pt.II; Rochdale Corporation Act 1948, 11&12 Geo 6, ch.47, Pt.IX; Smethwick Corporation Act 1948, 11&12 Geo 6, ch.49, Pt.IV.

244. Papers, Jan - Jun 1948, in POWE 14/264 and HLG 101/577.

245. Papers, Feb - May 1948, in POWE 14/264.

246. Papers, Jul 1947 and Feb - May 1948, in POWE 14/264.

247. Papers, Jul 1948, in HLG 101/577.

248. Papers, Jun 1948, in POWE 14/264.

249. Papers, Apr 1948, in POWE 14/264.

250. Correspondence, LCC/MoH/etc., loc. cit. (note 225).

251. Note of meeting at MoH, 24 Oct 1947, prior to drafting of Bill, in correspondence, loc. cit. (note 225), and in papers, Oct 1947, in POWE 14/264. See also 6.8 on general legislation.

252. List of petitions, loc. cit. (note 225).

253. e.g. Croydon Corporation, Surrey County Council.

254. LCC Solicitor, Report, and correspondence with MoH, Feb 1949, and subsequent correspondence, loc. cit. (note 225).

255. 12&13 Geo 6, ch.55, Pt.II. A further clause was needed in 1950 merely to allow easements in specific property in one street during construction of the Pimlico scheme. London County Council (General Powers) Act 1950, 14 Geo 6, ch.42, Pt.VI; WCC, Minutes, 17 Nov 1949.

256. Nottinghamshire County Council Act 1951, 14&15 Geo 6, ch.45, Pt.XII.

257. For Bolton, Bradford, Crewe, Huddersfield, Oldbury, Slough, Swindon, Urmston, West Bromwich, Twickenham.

258. Swindon Corporation Act 1949, 12&13 Geo 6, ch.50. See Commons Committee, Minutes of Evidence, loc. cit. (note 242).

259. C/WCA/1950 (note 242), esp. Report of General Purposes Committee, 15 Dec 1950, and Commons Committee, Minutes of Evidence. Commons 2nd Reading, Parl Deb Comm 475, 5 Apr 1950, c.1263-5; Committee proceedings, 9 - 25 May 1950.

260. Wolverhampton Corporation Act 1950, 14 Geo 6, ch.58, Pt.II.

261. Instructions to Counsel and other papers on Twickenham Corporation Bill, 1949, in Richmond BC files.

262. Lords Select Committee proceedings, 28 - 29 Apr 1949.

263. HLG 91/317, 91/326 and 91/327.

264. Papers, Mar 1950, in HLG 91/317.

265. ibid.; papers, Mar - Jun 1950, in HLG 91/327; Parl Deb Comm 475, 9 May 1950, c.169.

266. DCFP 201 in POWE 14/554.

267. POWE 14/496; LCC Town Planning Committee, Minutes 5, (1945-6), and 6, (1947-8), various dates, and report TP683, 30 Sep 1946.

268. Parl Deb Lords 147, 19 May 1947, c.813-60. See also Commons questions e.g. Parl Deb Comm 436, 22 Apr 1947, c.780-3 (w); 436, 29 Apr 1947, c.219 (w); 438, 10 Jun 1947, c.79 (w).

269. POWE 14/496. By May 1947, with the cost of fuel oil nearly 2½ times that of coal, it was estimated that oil-firing would add £0.4-0.5m/y to the station's running costs. (Parl Deb Comm 437, 22 May 1947, c.275 (w).)

270. Especially from the FEBr. (Papers, Nov 1947, in POWE 14/264.) Henry Tizard was among supporters of CHP at Bankside. (Correspondence, Jul 1947, in POWE 14/265.)

271. Correspondence EC/LCC/CoL/City of London Electric Lighting Co, May 1947, in POWE 14/265 and 14/496.

272. Parl Deb Comm 439, 3 Jul 1947, c.175-6 (w).

273. Improvements and Town Planning Committee, Minutes 52, various dates 1948-9. City Engineer, report to I&TP Committee, Sep 1949, in file 6, 604E.

274. City Engineer, report to I&TP Committee, Dec 1949.

275. ibid.

276. I&TP Committee, Minutes 53 (1950); papers, Feb 1953, in BEA/CEA A25876. See also VJ Wilmoth, letter, Times, 9 Aug 1951, and O Lyle, letter, Times, 15 Aug 1951, in support of the CoL scheme.

277. Papers, Feb 1953, in BEA/CEA A25876. The account here from 1952 onwards is based largely on CEGB 118.3.1.

278. Papers, Feb 1953, in BEA/CEA A25876.

279. Bankside was running on a 2-shift schedule and was not expected to run at all in the summer from 1955 onwards. (ibid., and papers, Feb 1953, in CEGB 118.3.1.)

280. Papers, Feb 1953, in BEA/CEA A25876; papers, Jul 1952 - Feb 1953, in CEGB 118.3.1.

281. Papers, Jan 1954 - Oct 1955, in CEGB 118.3.1.

282. BEA engineers used a single station basis for heat costing, considering system marginal costing desirable but in practice too

complex at the time. Heat from Bankside was costed at 5s10d/$GJ_h$, and from City Road/Shoreditch at 8s8d - 15s4d/$GJ_h$. (Papers, Oct 1955, in CEGB 118.3.1.)

283. Correspondence in POWE 14/265; correspondence with LCC Chief Engineer, 1947-8, in LCC files.

284. Correspondence and notes of meetings in POWE 14/265; correspondence and notes of meetings, 1949, in LCC files; papers, Apr 1949, in BEA/CEA A25876; papers, Nov 1949, in CEGB 118.4.1.

285. Notions of the heat load varied; figures of 59$MW_h$ and 88$MW_h$ are mentioned. (ibid.)

286. POWE 14/496.

287. Correspondence and notes of meetings, 1949-50, in LCC files.

288. Papers, Feb 1953, in BEA/CEA A25876. The BEA's own offices at Bankside were already heated from the station, using up to 2$MW_h$ of live steam.

289. Correspondence and notes of meetings, Aug 1952 - Aug 1954, in LCC files.

290. WCC, Minutes, 10 Jun 1948; papers, 1947-8, in CEGB 118.4.1; Memo 1710 in CEGB 118.4.1.

291. WCC, Minutes, 20 Mar 1947, 24 Jul 1947, 9 Oct 1947; Memo 1710 in CEGB 118.4.1.

292. Papers, Jun 1950 and subsequent, in CEGB 118.4.1, esp. Memo 1710.

293. WCC, Minutes, 10 Jun 1948.

294. Abbotts Manor Housing Estate in Warwick Way, Russell House, and a church in Winchester Street. (WCC, Minutes, 17 Nov 1949; Memo 1710 in CEGB 118.4.1.)

295. Margolis, op. cit. (note 105); papers, 1957, in CEGB 118.3.1.

296. Each element of the charges included a 12% addition over costs. The service charge was a 4% annuity over 20 years on the cost of the works needed for heat supply. The distinction in the running charges between the sources of steam was a late amendment to the agreement. (Papers, Nov 1949 - Jul 1950, and Memo 1710, in CEGB 118.4.1.)

297. Papers, 1950-52, in CEGB 118.4.1, esp. Memo 1710. Provisionally a 50% capacity credit was allocated to the BP sets. It amounted to £1400 for the six months assessed, significant relative to the marginal return. (Memo 1710.) The credit remained controversial within the industry. (e.g. papers, Oct 1958, in CEGB 118.4.1.)

298. Memo 1710, and papers, Nov 1951, in CEGB 118.4.1.

299. The Pimlico DH Sub-Committee of the Generating Station Operation - Research Liaison Committee set up in 1951 consisted of

representatives of the MFP, BEA HQ and Land Division, North Thames Gas Board, Westminster City Council, Kennedy and Donkin and the London Electricity Board. (Papers, 1951, and Memo 1710, in CEGB 118.4.1.)

300. WCC, Minutes, 12 Nov 1953.

301. Donkin et al., op. cit., 1954, (note 108). See also CP Russell, 'The Westminster City Council's District Heating Scheme', Industrial Heating Engineer 17, Nov 1955, pp.336-8.

302. Donkin et al., op. cit., 1954, p. 275 (note 108).

303. Discussion, ibid., p.303.

304. Discussion, ibid., pp.285-305.

305. B Donkin, 'The Pimlico District Heating Undertaking: Costs and Financial Results', paper to IoF Open Meeting, Special Study of Domestic Heating in the UK - Present and Future, Westminster, May 1956, and Donkin et al., op. cit., 1956 (note 108). The costs of delivered heat were given as 7s11d/$GJ_h$ in 1953, 8s7d in 1954, and ultimately as 7s7d. See also 'District Heating in Pimlico', Elec Rev 158, 10 Feb 1956, p.211; 'District Heating in Pimlico: Economics of Scheme Discussed', Elec Rev 158, 17 Feb 1956, p.252; RME Diamant, 'District Heating III: Operating Conditions of Selected Existing Systems', HVE 36, Mar 1963, p.496.

306. Proceedings II, 31 Jul 1946, p.524.

307. Memorandum of Officers on Report by Consultants, Proceedings I, 5 Feb 1947, p.188; and note of meeting, 22 May 1946, and other papers in POWE 14/266.

308. Papers in DSIR 4/1921.

309. Proceedings I, 3 Apr 1946, p.273.

310. Note of meeting, 22 May 1946, in POWE 14/266; notes of meetings, May 1946, in DSIR 4/1921.

311. Report in DSIR 4/1912; Proceedings, 5 Feb 1947, I, p.218 and II, p.173.

312. Correspondence, Jul 1945, in POWE 14/266.

313. Papers, Nov 1946, in POWE 14/266.

314. Papers, 1945-6, in POWE 14/266; PLN 85/8/2, Jan 1948, in HLG 101/577.

315. Papers, Jul 1945, in POWE 14/266.

316. Papers, Nov 1946, in POWE 14/266; and DSIR 4/1912.

317. Papers, Dec 1946, in POWE 14/266.

318. Papers, Oct - Dec 1946, in DSIR 4/1921.

319. Note of meeting, 23 Jan 1947, in DSIR 4/1921. An interim paper by Griffiths on plant was reassuring both for the Council and the EC: boiler makers could deliver in 36 months and turbine manufacturers in 30, and neither would suffer interference with their work for the CEB; the small CHP turbines would take up manufacturing capacity in a different category from the larger CEB machines, and indeed orders for smaller sets could balance the manufacturers' programme. (E Griffiths, 'Wythenshawe District Heating: Thermal-Electric Stations: Memorandum on Electricity Output, Fuel Savings and Manufacturing Position', 2 Oct 1947, in POWE 14/266.)

320. Proceedings I, 5 Feb 1947, p.218. For a full acount of events after the original approval, see Report of the Housing and Wythenshawe Estate Committees, Proceedings II, 6 Dec 1950, pp.780-9.

321. ibid. and POWE 14/266. By Oct 1946 the plan had been revised to include a total of 31.3$MW_e$ CHP plant at the two sites, and sale of 75GWh/y electricity. (Nicholas, op. cit. (note 38).)

322. Papers, Jul 1948, in POWE 14/266; papers, Nov - Dec 1948, in BEA/CEA A25876.

323. Correspondence, Jul - Aug 1948, in POWE 14/266.

324. Papers, Jun 1949, in POWE 14/264.

325. Correspondence, Aug 1947, in POWE 14/266.

326. Correspondence, Oct 1947, in POWE 14/266.

327. Report ..., op. cit. (note 324); 'District Heating: Manchester Corporation and BEA', Elec Rev 143, 19 Nov 1948, p.775; 'Manchester District Heating: Discussions with BEA', Elec Rev 143, 3 Dec 1948, p.854.

328. See 8.5; papers, Nov 1948 - Apr 1949, in BEA/CEA A25876.

329. Papers, Nov 1948 - Apr 1949, in BEA/CEA A25876. BEA calculations showed that the heat cost based on the NWEB offer and the revised BEA offer would be 33% and 23% greater than that based on BST rates. See also correspondence and other papers, Jun 1949, in POWE 14/264.

330. Report ..., op. cit. (note 320).

331. 'Manchester District Heating', Elec Rev 145, 26 Aug 1949, p.375; 'District Heating', ibid., p.366.

332. Report ..., op. cit. (note 320); 'Wythenshawe District Heating', Elec Rev 146, 21 Apr 1950, p.778; 'Manchester Heating: New Talks', Mun J 58, 21 Apr 1950, p.1070; 'Manchester May End District Heating Plan', Mun J 58, 30 Jun 1950, p.1657.

333. Proceedings I, 6 Dec 1950.

334. Report ..., op. cit., p.787 (note 320).

335. ibid.

336. City of Birmingham Public Works Committee, Minutes 62, 22 May 1947, p.118.

337. PW Committee, Minutes 66, 3 Jul 1948, p.35, and 10 Jun 1948, p.50.

338. ibid., 14 Oct 1948, p.131. The revisions appeared to reinforce Manzoni's general loss of enthusiasm for the technique; see correspondence, Aug 1946, in DSIR 4/1917.

339. Correspondence, Dec 1948, in POWE 14/264.

340. PW Committee, Minutes, loc. cit. (note 337).

341. Birmingham City Council, Proceedings (1948-9), 9 Nov 1948, p.87; 'District Heating Plan Shelved', Birmingham Post, 5 Nov 1948; 'Birmingham Heat Scheme', HVE 22, Dec 1948, p.252.

342. The first flats in the Duddeston and Nechells area were fitted with CH able to be adapted to DH later. (City Council, Proceedings (1950-1), 25 Jul 1950, p.286.)

343. The Engineer contacted six firms and of these started discussions with Kennedy and Donkin, Smith Seymour and Rooley, and Hoare Lea and Partners. (Planning and Reconstruction Committee, Minutes, 25 Jun 1947, p.326.) While the proposals were in abeyance, the Council's Housing Committee was seeking advice on heating for new council housing. The Corporation Electrical Committee refused to cooperate in a joint report with the city's private gas company and was keen to establish a monopoly of advice to the Housing Committee. The Housing Committee considered the Dundee DH scheme, 'as district heating might be a serious competitor to electricity.' (Electrical Committee, Minutes, 22 Dec 1944 and 26 Jan 1945.)

344. On national constraints, see 6.8., esp. note 379. Though the necessary Declaratory Order for the Bristol Central Area was obtained in Jan 1947, the MoH criticised the Corporation in 1949 for its lack of a firm plan for the whole city, and advised that the Central Area should not be dealt with until an overall plan was fixed. The Planning and Reconstruction Committee disagreed strongly, and though the Engineer's Department was understaffed, with the Engineer himself doubling as Chief Planning Officer, would not engage private consultants for planning work. It was highly critical of plans produced in other cities. (P&R Committee, Minutes, 20 Apr 1949, p.734, and 11 Aug 1949, p.353.)

345. P&R Committee, Minutes, 23 Feb 1949, p.652. See also note 6.

346. ibid., 20 Apr 1949, p.374.

347. ibid., 13 Jul 1949, p.141.

348. ibid., 31 Oct 1949, p.307, 31 May 1950, p.12, 26 Jul 1950, p.146; 'Bristol District Heating', HVE 23, Oct 1949, p.198.

349. P&R Committee, Minutes, 11 Jan 1950, p.437, 25 Jan 1950, p.451, 22 Mar 1950, p.549.

350. ibid., 19 Apr 1950, p.602, 31 May 1950, p.21.

351. ibid., 12 Jul 1950, p.121, 27 Jul 1950, p.151.

352. Coventry Planning and Redevelopment Committee, Minutes, 5 Jan 1949 and 18 Jan 1950.

353. Letter to City of London Engineer cited in App.F, Report to CoL Improvements and Town Planning Committee, Dec 1949.

354. From Brian Colquhoun and Partners. (P&R Committee, Minutes, 21 Jun 1950, p.72, 19 Jul 1950, p.83.) Coventry's own Foleshill gasworks was being extended but would not be completed till 1953. (Coventry: The Development Plan, 1951 (Coventry: City Council, 1952).)

355. P&R Committee, Minutes, 26 Jul 1950, pp.84-5; 'Coventry Heating Scheme', HVE 24, Sep 1950, p.138.

356. P&R Committee, Minutes, 28 Feb 1951, p.141, 7 Mar 1951, p.144, 20 Mar 1951, p.157, 18 Jun 1952, p.259, 13 Jan 1954, p.40.

357. Papers, May 1949, in HLG 101/577.

358. Papers, Oct 1949, in HLG 101/578.

359. Papers, Oct 1951, in POWE 14/264.

360. HLG 91/317, 91/326, 91/327.

361. Papers in HLG 91/327, esp. O Faber, 'Report on 1st Stage Development', Sep 1948, including notes on meeting MFP/MTCP/ BEA/Aycliffe DC, Aug 1948.

362. Correspondence, Apr 1950, in HLG 91/327.

363. Parl Deb Comm 478, 25 Jul 1950, c.219-20 (o); papers, Jun 1950, in HLG 91/327.

364. LAM Fraser, JC Weston and IWL Hendry, 'Whitemoss, East Kilbride: District Heating Scheme', JIHVE 20, Feb 1953, pp.445-56; Diamant, op. cit., p.496 (note 305). Individual gas CH was installed in 1979-80. (BGC, 'Communal Heating Schemes Changing to Individual Heating', App.10 in Select Committee on Energy, Third Report, 1982/3 Combined Heat and Power, vol.II, HC 314-2 (London: HMSO, 1983).)

365. Papers, Jan 1953, in HLG 101/578. See also note 444.

366. Papers, Jun 1952, Dec 1952, Sep - Oct 1953, in BEA/CEA A25876; papers, Jul 1954 in POWE 14/264; DCFP 149, Mar 1952, in POWE 14/556. The size of the envisaged scheme is not clear; figures of 956 and later 4000 dwellings are mentioned. A final plant configuration of 2 x 2MW$_e$

BP sets was suggested in Jul 1954, indicating the lower figure. The BEA's offer in Dec 1952, based on supply from Brunswick Wharf, was 4s6d/$GJ_h$.

367. 'Dagenham District Heating Scheme', HVE 24, Nov 1950, p.212; HLG 101/578. See also 6.6 and note 221.

368. 'Paddington District Heating Scheme', HVE 24, Nov 1950, p.218; HLG 101/578; POWE 14/267.

369. DCFP 149 in POWE 14/554; 'District Heating for a Housing Estate', Ind Htg Eng 14, Nov 1952, pp.333-7.

370. Kingslake (LCC), Lancaster (LCC) and Penrose (Southwark LB). (Annex 3.1 in Orchard Partners, Present State and Future Evolution of the Heat Market in the Member States: District Heating in the UK, 266/1/R1 (London: Orchard Partners, Mar 1983).)

371. Wendelsworth. (B Colquhoun, 'Regional District Heating', Consulting Engineer 6, Dec 1950, pp.304-8.)

372. See 6.6, esp. note 265.

373. HLG 101/577 and 101/578, various dates; 'District Heating at Moredon', HVE 22, Jun 1949, p.626; RJD Powdrill, 'District Heating in Swindon', Surveyor 108, 25 Nov 1949, pp.699-702, and J Inst Mun Surveyors 76, 7 Feb 1950, pp.493-521.

374. HLG 101/578; Leeming, op. cit. (note 38); Leeming, discussion on Kell, op. cit., pp.519-20 (note 85); Editorial, 'District Heating', Mun J 60, 4 Jul 1952, p.1238; 'District Heating Progress at Urmston', Ind Htg Eng 11, 1949, pp.87-9; App. 1, Pt.I, DSIR, op. cit., pp.48-9 (note 28). CHP was suggested from a proposed Manchester Corporation power station at Carrington, Cheshire. (Parl Deb Comm 431, 12 Dec 1946, c.268-9 (w).)

375. HLG 101/578; Editorial, 'District Heating', loc. cit. (note 68); 'District Heating at Salisbury', HVE 20, Oct 1946, p.184; 'District Heating Schemes', HVE 20, Nov 1946, p.230; App.1, Pt.I, DSIR, op. cit., pp.49-50 (note 28). Local authority support for the Salisbury scheme appeared particularly precarious, with a decision not to proceed being reversed in a few weeks. ('Bemerton Heath District Heating Scheme', HVE 22, Oct 1948, p.182; 'District Heating at Salisbury', HVE 23, Mar 1950, p.465.) See also Parl Deb Comm 477, 6 Jul 1950, c.627 (o).

376. The BEA offered heat at 5s4d - 6s1d/$GJ_h$, compared to the consultants' original figure of 3s4d/$GJ_h$. (Papers, Sep 1953, in POWE 14/679; 'Darwen District Heating Scheme', Elec Rev 142, 2 Jan 1948, p.22; 'District Heating', Elec Rev 147, 8 Dec 1950, p.953.) On other schemes or proposals, see: 'Cardiff Proposed District Heating', HVE 24, Sep 1950, p.138; 'Cardiff District Heating', HVE 24, Nov 1950, p.217; 'District Heating in Northern Ireland', HVE 20, Mar 1947, p.387.

377. In 1946 the MFP claimed it was 'anxious to give every help possible ...' (Parl Deb Comm 421, 12 Apr 1946, c.357-8 (w).) The MoH was doing all it could 'to encourage and foster the extension of

district heating'. (Parl Deb Comm 427, 17 Oct 1946, c.232 (w).) See also Parl Deb Comm 427, 17 Oct 1946, c.261-2 (w), and 428, 31 Oct 1946, 140-1 (w). A joint delegation (MFP, MoW, MoH, DSIR/BRS) to study US DH practice reported enthusiastically in 1947. (MFP, District Heating in American Housing (London: HMSO, 1947); 'District Heating in US Study Party', loc. cit. (note 6).)

378. HLG 101/577 and 101/578, various dates. See also GDN Worswick, 'Direct Control', in Worswick and Ady (eds.), op. cit., pp.278-312 (note 1).

379. Capital ..., op. cit. (note 7); Parl Deb Comm 460, 25 Jan 1949, c.738-40 (o), and 470, 16 Dec 1949, c.360-2 (w).

380. Papers, Jan - Sep 1947, in HLG 101/577. See also Parl Deb Comm 441, 29 Jul 1947, c.42-3 (w).

381. Papers, Aug 1947, in HLG 101/577.

382. e.g. papers, Aug - Sep 1947, in HLG 101/577.

383. DSIR 4/1921. See also papers, May - Jul 1949, in HLG 101/577.

384. HLG 101/577; Parl Deb Comm 459, 9 Dec 1948, c.550-1 (o).

385. e.g. Association of Metropolitan Corporations, correspondence, Oct 1948, in HLG 101/577.

386. Papers, Dec 1946, in HLG 101/185. See also papers, Aug - Sep 1947, in HLG 101/577.

387. Note on meeting LCC/MoH, 24 Oct 1947, in papers, loc. cit. (note 225).

388. Papers, Oct 1947, in POWE 14/264, and Oct 1948, in HLG 101/577.

389. Papers, Jan - May 1947 and Oct 1948, esp. PLN 95/8/2, in HLG 101/577. It was established that some flexibility could legally be obtained in the structure of finance by postponing debt provision, depending on the source of the loan. (Papers, Aug - Sep 1949, in HLG 101/578.) See also AE Margolis, letter, HVE 24, Sep 1950, p.135.

390. Papers, Sep - Dec 1947, in HLG 101/577, and Oct 1947 in POWE 14/264.

391. Papers, Jul 1951, in HLG 101/577.

392. ICDH, 'Progress Report', PLN 95/8/1 and ICDH/DHSC, 'Review of Proposed DH Schemes', PLN 95/8/2, 3 Jan 1948, in POWE 25/150 and HLG 101/577.

393. Correspondence Gaitskell/Bevan, Apr 1948, in HLG 101/577.

394. The MoH also set up a working party in Mar 1948 to consider the implications of DH for public water supplies. It reported in 1951, recommending indirect connection for both space heating and washing water supplies. This would limit total water usage and in

particular the availability of washing water - much greater quantities than anticipated were being used in early schemes - according to the capacity of the heat exchanger. (MLGP, Working Party on District Heating in Relation to Public Water Supplies: Interim Report (London: HMSO, 1951); 'District Heating', Elec Rev 148, 22 Jun 1951, p.1325.) Several authorities had to withdraw powers for supplying washing water in their Local Bills after action by water authorities. In the absence of guidance from central government until the MoH Working Party report, there was considerable confusion over the matter and little consistency in arguments or outcomes. (See e.g. C/WCA/1950, loc. cit. (note 242).)

395. Correspondence, loc. cit. (note 393).

396. Papers, May 1948, in HLG 101/577.

397. ibid.

398. Correspondence, Oct - Dec 1948, in HLG 101/577, and Aug 1949, in HLG 101/578. One exasperated consultant replied

> This information will enable us to make progress with other work such as large Mental Colonies and Hospitals and not devote our efforts to fuel economy schemes which are unlikely to proceed. We have already lost much time and money on this type of abortive work and therefore thank you again ...

(Correspondence, Dec 1948, in HLG 101/577.)

399. Papers, Jul 1948, in HLG 101/577.

400. Papers, Jul - Sep 1949, in HLG 101/578.

401. See 6.7.

402. op. cit. (note 363).

403. BEA, Report, 1948/9, paras.314-9.

404. 1949/50, para.195.

405. 1951/2, paras.263-5.

406. DCFP 122 in POWE 14/554; Minutes, 3 Mar 1952, in POWE 14/555. See also HS Prosser and AW Pedder, 'Combined Electricity and Heat Supplies', Proceedings. 5th British Electrical Power Convention, 1953.

407. See Memo 1710 in CEGB 118.4.1 for the full argument.

408. BEA/CEA A25876. See note 170 above. See also App.C, Report of CoL Engineer to Improvements and Town Planning Committee, Dec 1949, in CoL file 6/604E.

409. Papers, Mar 1949, in POWE 14/264. The view was echoed in Electrical Review:

> Our immediate concern is with the provision of a more reliable supply of electricity during the next few winters. That can be achieved, we believe, only through going straight ahead on the well-tried lines of orthodox condensing steam practice.

(Editorial, 'District Heating: Relationship with Electricity Supply', Elec Rev 149, 24 Aug 1951, pp.361-2.) See also Parl Deb Comm 459, 2 Dec 1948, c.2157 (o).

410. Report, 1952/3, paras. 98-9, 121-3; 1953/4, paras.121-2; 1954/5, paras.95-7.

411. e.g. papers, Mar 1949, in POWE 14/264.

412. Gaitskell claimed that coordination of the energy industries had already started: H Gaitskell, speech to Annual Luncheon IoF, 22 Apr 1948, in POWE 25/150. On the treatment of the idea of a national energy policy within the MFP, see also Fuel Efficiency Committee, 'Memorandum on the Problem of a National Fuel and Power Policy', in POWE 25/150; and brief for Minister's meeting with TUC Fuel and Power Committee, in POWE 25/150, stressing difficulties of formulating and implementing a general policy and dismissing the approach advocated by the Committee as 'complicated, cumbersome and misdirected'. A TUC suggestion of regional surveys of energy demands and local resources was considered unnecessary on the grounds that the nationalised energy industries would perform this function.

413. e.g. Correspondence, Citrine/Lloyd, May 1952, in POWE 14/551.

414. Report of the Committee on National Policy for the Use of Fuel and Power Resources, Cmnd.8647, (London: HMSO, Sep 1952); POWE 14/551, 14/552, 14/554, 14/555, 14/557, 28/194, 28/198, 28/200, 28/201, 28/232.

415. POWE 14/554.

416. Papers, May - Jun 1951, in POWE 14/551.

417. ibid.; briefing material, May 1952, in POWE 14/552; papers, Sep 1952, in POWE 28/232.

418. op. cit., p.iii (note 414); and papers, Sep 1952, in POWE 28/232.

419. Papers, Sep 1952, in POWE 28/232.

420. ibid.: papers, May - Jun 1951, in POWE 14/551.

421. Papers in POWE 14/554, esp. DCFP 3.

422. DCFP 41 in POWE 14/554

423. DCFP 2 in POWE 14/554; POWE 14/551.

424. Papers in POWE 14/554, esp. DCFP 33, 58, 209.

425. DCFP 33 in POWE 14/554. Conversion was considered 'generally impracticable' and could not be contemplated while generating capacity was short.

426. e.g. Smoke Abatement Society, DCFP 98; National Housing and Town Planning Council, DCFP 104; Director, Fuel Research, DSIR, DCFP 117, in POWE 14/554.

427. DCFP 201 in POWE 14/554 and POWE 28/194; BEA, 'General Views on National Fuel and Power Policy' in POWE 14/551.

428. Minutes, 25 Mar 1952, in POWE 14/555.

429. DCFP 122 in POWE 14/554; Minutes, 3 Mar 1952, in POWE 14/555.

430. op. cit., p.237 (note 414).

431. DCFP 149 in POWE 14/556.

432. op. cit. p.223 (note 414); POWE 28/201.

433. Minutes, 21 Mar 1952, in POWE 14/555.

434. op. cit., p.214 (note 414); DCFP 118 in POWE 14/554; POWE 28/200.

435. op. cit., p.48 (note 414).

436. Papers, Sep 1952, in POWE 28/232.

437. ibid. See also POWE 14/557 and 14/552.

438. Papers, Sep 1952, in POWE 28/232; briefing material in POWE 14/552; papers in POWE 25/209.

439. POWE 14/557 and 28/232.

440. POWE 28/232.

441. Parl Deb Comm 525, 29 Mar 1954, c.1612-13 (o).

442. POWE 25/209 and 28/232.

443. POWE 25/209.

444. Papers, Aug 1949 - Aug 1950, in HLG 101/578; memo, Jun 1952, in POWE 25/216; J Madge, 'The Popularity of District Heating', Architect's Journal 123, 26 Jan 1956, pp.140-5. Protests took place at Woodside, Fife, where DH charges were 8s/week. ('Miners Protest but District Heating Charges are Upheld', Mun J 58, 24 Feb 1950, p.517.) See also Parl Deb Comm 477, 6 Jul 1950, c.627 (o), on charges for the Salisbury scheme.

445. Memo, Jun 1952, in POWE 25/216.

446. Papers, Mar 1953, in BEA/CEA A25876; POWE 25/216; POWE 14/679. The MFP's suggestion of further work on CHP, and the manner of its intervention, were not well received in the BEA. (Papers, Feb 1953, in BEA/CEA A25876.)

447. Papers, Apr - May 1953, in BEA/CEA A25876, and Apr 1953, in POWE 14/679.

448. Papers, Apr - May 1953, in BEA/CEA A25876.

449. Papers, Dec 1952, in POWE 25/216, and Jul 1953, in POWE 14/679. Group industrial schemes had been the subject of three IoF conferences on Combined Heat and Power Supplies, London 25 Jan and 27 Apr 1949, and Manchester 11 May 1949. (HE Partridge, 'Coordinating Heat and Power Supplies in a District', JIoF 22, Jun 1949, pp.262-5, including summary of other papers.) See also J Hacking, 'Developments and Possibilities in Electricity Generation', presidential address to Junior Inst of Engineers, 11 Dec 1953, extracts in Engineering 176, 12 Dec 1953, p.828.

450. Papers, Jul - Nov 1953, in BEA/CEA A25876, Nov 1953 - Jul 1954, in POWE 14/264, and Oct 1953 - Mar 1954, in POWE 14/679. Configurations for Warrington varied: one mention is of 15$MW_e$, another 24$MW_e$. The Warrington proposal dated back to 1945. (BEA, Report, 1952/3, para.98.)

451. Correspondence, Oct 1953, in BEA/CEA A25876; papers, Dec 1953, in POWE 14/679. See also Parl Deb Comm 529, 28 Jun 1954, c.871 (o).

452. Papers, Sep 1953 - Apr 1954, in BEA/CEA A25876, and Nov 1953 - Apr 1954 in POWE 14/679.

453. A ceiling of £700m had been set on the BEA's capital expenditure. (Papers, Dec 1953, in BEA/CEA A25876.)

454. Papers, Nov 1953, in POWE 14/264, and Nov 1953, in POWE 14/679.

455. ibid.

456. Papers, Nov 1953, in POWE 14/679; e.g. conversion of boilers from hand to mechanical fuelling (discussion on Donkin et al., op. cit., 1956, p.338); and installation of standard turbines to replace reciprocating engines (F Shakeshaft, discussion on A Stubbs, op. cit. (note 87), in Engineer 185, 16 Apr 1948, p.376.) See also 'District Heating: Fuel Economy Aspect', Elec Rev 142, 16 Apr 1948, p.584; 'District Heating in Pimlico: Economics of Scheme Discussed', Elec Rev 158, 17 Feb 1956, p.252. See also chapter 4, note 226.

457. Papers, Feb 1954, in POWE 14/679.

458. Report, 13 Apr 1954, in BEA/CEA A25876 and POWE 14/679.

459. Papers, Feb 1954, in BEA/CEA A25876.

460. Report, op. cit. (note 458).

461. Correspondence and other papers, Jun - Jul 1954, in BEA/CEA A25876 and POWE 14/679; Parl Deb Comm 532, 9 Nov 1954, c.1086-90. See also Parl Deb Comm 497, 7 Mar 1952, c.955.

462. POWE 25/216 and POWE 14/679.

463. Building Research Board, Report, 1949, 1950.

464. op. cit. (note 28). Five members of the DSIR/DHSC had died by the time the report appeared.

465. ibid., p.29.

466. ibid., p.30.

467. Note of Presentation, Oct 1948, ibid., p.iii.

468. Note Added by Chairman, Nov 1952, ibid., p.iv.

469. ibid., p.iv.

470. Editorial, 'The Report on District Heating', HVE 27, Nov 1952, p.205.

471. ibid. See also: Editorial, 'A Disgraceful Delay', Elec Times 124, 22 Oct 1953, pp.745-6; 'District Heating', ibid., pp.753-5; Editorial, 'Thermal Electric Stations', Elec Rev 153, 23 Oct 1953, pp.921-2; 'District Heating: Results of DSIR Investigations', ibid., pp.927-8; 'District Heating Advantages: Fuel Economy: National Policy Urged', Times, 19 Oct 1953; 'District Heating', Manchester Guardian, 19 Oct 1953; FH Slade, 'District Heating', Mun J 61, 23 Oct 1953, p.2297.

472. Manzoni considered

> ... by present fuel prices (it) would be an expensive way of raising the standard of living to an extent unwarranted by most people ... (there were) probably not more than twenty days in a year when it would serve any real purpose.'

('District Heating Scheme Revived', Birmingham Gazette, 19 Oct 1953.) See also 'Big Coal Saving with District Heating: High Cost Stops Midland Schemes', Birmingham Post, 19 Oct 1953.

473. Madge, op. cit. (note 444).

474. Editorial, 'District Heating and Dirigibles', HVE 36, Oct 1962, pp.197-8.

475. e.g. LJ Fischer, 'Review of Continental Practice: Combined Heat and Power Generation', HVE 30, Aug 1956, pp.89-96; Fischer, 'District Heating: A Reminder', HVE 33, Mar 1960, pp.373-7, and Apr 1960, pp.425-30; FB Turpin, letter, HVE 36, Nov 1962, p.292; L Walter, letter, HVE 36, Dec 1962, p.352; Walter, 'Progress in District Heating', HVE 38, Sep 1964, pp.125-7; RME Diamant, 'District Heating: Overall Survey and Costs', HVE 36, Jan 1963, p.375.

476. Annex 3.1 in Orchard Partners, op. cit. (note 370).

477. Nationalisation gave the gas industry a better structure for technical and commercial development, and a national body in the Gas Council. The industry pursued new technologies and commercial methods, but it was a long time before sales increased significantly. The position of electricity in the domestic market was aided by

much smaller price rises: 17% in the years 1951-7, compared to 51% for gas. Domestic gas consumption increased by only 8% in this period. Much of the gas industry's investment went into production development, first of complete coal gasification, and then oil-based production. Though there some exhibitions of domestic appliances, there was little promotion, and concerted commercial campaigns did not start until the late 50s. (Williams, op. cit. (note 24).) On the politics of the post-nationalisation gas industry, see the Gas Council's submission to the Ridley Committee, DCFP 139 in POWE 14/554, and App.XI (iv) in Report ..., op. cit., (note 414). The Council argued similar principles to those of the ESI. The right to 'freedom of choice' was not to be distorted by the abuse of monopoly power, and the control of such was seen as the only valid restriction by the state. Specifically the Council attacked the ESI for promoting electrical heating and cooking and subsidising them from non-competitive lighting and power loads.

478. Annex 3.1 in Orchard Partners, op. cit. (note 370). See also chapter 7, note 107.

479. 'District Heating in Whitehall', HVE 26, Nov 1952, pp.223-30; 'The Whitehall Gardens Heating Scheme', Ind Htg Eng 14, (76), 1952, pp.41-9; 'Whitehall Gardens and the Whitehall District Heating Scheme', JIHVE 20, Feb 1953, pp.415-44; 'The Ministry of Works Approach', Engineering 201, 28 Jan 1966, p.187. Eventual total boiler capacity was planned as 41$MW_h$. In 1965 the total load was given as 28$MW_h$. (AE Haseler, 'District Heating in New Cities', JIHVE 33, Sep 1965, p.181.)

480. Haseler, op. cit., p.181 (note 479); 'The Ministry of Works Approach', loc. cit. (note 479). See also chapter 5, note 51, on an earlier South Kensington scheme, and 'Heating Bills Fall in Corridors of Time', Building 248, 15 Mar 1985, p.9, on refurbishment of the scheme in the 80s.

481. Annex 3.1 in Orchard Partners, op. cit. (note 370).

482. Haseler, op. cit. (note 479); 'The Ministry of Works Approach', loc. cit. (note 479); papers, Jul 1953, in POWE 14/679.

483. IEE Information Unit, Facts About Combined Heat and Power (London: IEE, 1983); 'The Ministry of Works Approach', loc. cit. (note 479); 'From New Power Station: District Heating', Engineering 199, 4 Jun 1965, pp.730-1; 'Electricity/Heat Station', Elec Rev 176, 25 Jun 1965, p.1001. The capacity was given as 14$MW_e$ and 41$MW_h$ by 1965 (Haseler, op. cit. (note 479)) and as 18$MW_e$ in 1983. (IEE, op. cit.)

484. Papers, Apr 1954 - Jan 1957, in BEA/CEA A25876; BEA, Report. 1954/5, para.96.

485. ibid.; 'The Bloom Street District Heating Scheme', Ind Htg Eng 17, Jan 1955, pp.3-5; GS West, 'The Electricity Supply Industry's Role in District Heating', paper to DHA 4 Feb 1975 (London: Electricity Council, 1975). The CEGB finally sold Bloom Street to AHS in 1984 after assessing a 7.5$MW_e$ oil-fired CHP scheme to serve its largest customer, UMIST, but abandoning the idea because of financial constraints. (P Millbank, 'Britain's First CHP Plant to be Sold Off',

Elec Rev 214, 10 Feb 1984, p.8; 'Bloom Street Combined Heat and Power', App.4 in Select Committee on Energy, op. cit. (note 364).) See also 8.6, esp. note 332.

486. 3 x 9MW$_e$ BP turbines. (West, op. cit. (note 485).) British Cellulose Ltd had constructed the original Spondon station in WW1. It was taken over by the Derbyshire and Nottinghamshire Power Co in 1922 and extended. (Electricity Commission, Annual Report 3, 1922/23, p.45.) See also 7.2, esp. note 139.

487. The original suggestion was that a private group would buy the 18MW$_e$ Hammersmith power station. The BEA considered various arrangements, including a joint venture, but decided to investigate its own refurbishment and conversion of the station. The final configuration suggested, using existing coal boilers, new oil boilers, and BP sets, would have cost £1.75m. (Papers, Dec 1953 - Sep 1957, in BEA/CEA A25876.)

488. Papers, Nov 1955, in BEA/CEA A25876; CEGB Annual Report, various dates.

489. A Egerton, Note, in DSIR, op. cit., p.iv (note 28).

490. Papers, May 1972, in CEGB 118.4.1. See also CEA, Report, 1955/6, para.102. WCC issued a leaflet on efficient usage in 1959 in an attempt to reduce consumption. (WCC, Minutes, 21 Jul 1950.)

491. Papers, Oct 1957 - Jul 1958, in POWE 14/265; papers, Sep 1957, in BEA/CEA A25876; papers, Apr 1957 - Jun 1958, in CEGB 118.3.1; CM Johnston and VG Newman, 'Combined Heat and Electricity Generation for District Heating', in EM Ackery (ed.), Electricity and Space Heating, IEE Symposium 3-4 Mar 1964 (London: Blackie, 1964), pp.339-48.

492. cf. Donkin's original plan for 388MW$_h$. See 6.4.

493. Papers, Sep 1957, in CEGB 118.3.1. See also correspondence CEA/MFP, Oct 1957, in POWE 14/265; correspondence, CEA/CoL, Nov 1957, in CEGB 118.3.1.

494. 10s4d/GJ$_h$ initially, decreasing to 8s8d, compared to CH costs estimated at 10s10d - 12s2d/GJ$_h$.

495. Papers, Sep 1957, in CEGB 118.3.1. The LEB raised the problem of competition with electric heating, claiming a load of 60MW$_e$ in the City already; that off-peak electric heating could compete well with CH and possibly DH; and that DH mains would cause problems of congestion under streets. The Board did not object to the scheme formally. (Papers, Nov 1957 - Jan 1958, in CEGB 118.3.1.)

496. Papers, Jan 1958, in CEGB 118.3.1.

497. Papers, Jun 1958, in CEGB 118.3.1; correspondence CEGB/MoP, Jul 1958, in POWE 14/265. It appears, however, that the CEGB itself was not satisfied with a return of 7% on what it regarded as an optional investment. (Discussion on Johnston and Newman, op. cit., p.404 (note 491).) See also CEGB, Annual Report, 1958/9, para.68.

498. Papers, Jul 1958, in POWE 14/265. The CEA also investigated heat loads in the new Barbican area, as an additional load were the Coi. scheme to go ahead. The total heat load was about 20MW$_h$. The City rejected the idea in 1959. (ibid.; P Betts, interview, Feb 1985; CEGB, Memorandum, in Select Committee on Energy, Minutes of Evidence, 8 Mar 1982, HC 60-vii, p.303.)

499. No mention of CHP was made in key statements of the industry's view of its own future: e.g. J Eccles, 'The Generation of Electricity: BEA Ten Year Forecast', Proceedings: 7th British Electrical Power Convention, 1955.

500. Discussion on Johnston and Newman, op. cit., p.390 (note 491).

## Chapter 7

1. In addition to the 14 new towns from the 40s and 50s, a further 20 were proposed in the 60s. By 1970 13 had been designated: Central Lancashire, Milton Keynes, Northampton, Peterborough, Redditch, Runcorn, Skelmersdale, Telford, Warrington, Washington, Mid-Wales (Newtown), Irvine and Livingston. (App.1 in FJ Osborn and A Whittick, New Towns: Their Origins, Achievements and Progress (London: Leonard Hill, 1977); App. in H Evans (ed.), New Towns: The British Experience (London: Charles Knight, 1972).)

2. e.g. F Medhurst, 'Environmental Studies', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969; PL Martin, 'The Role of District Heating', HVE 48, Sep 1974, p.96. 58% of new local authority housing in 1964 had total building heating from a single plant, 90% in 1969, and 99% by 1979. (B Sheldrick, 'Local Authorities and Energy Conservation: the Institutional Environment', Univ of Leeds School of Geography Working Paper 374, Dec 1983, p.17a.)

3. e.g. the GLC in 1963. (JP Macey, 'The Economics of District Heating', paper to Univ. of Nottingham Dept. of Architecture and Civic Planning conference District Heating for the New Britain, Apr 1969.) Specific Parker-Morris Standards were made mandatory in 1968. (DA Miles, 'Loan Sanction and Subsidies in Public Sector Housing', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969.) See also AE Haseler, 'District Heating Facts and Figures', Mun J 75, 1 Sep 1967, pp.2291-3.

4. e.g. A Marsh, 'Urban Air Pollution and District Heating as an Aid to its Prevention', paper to IHVE Symposium District Heating, 21-22 Mar 1967; B Manifold, 'District Heating and the Forces of Change', Clean Air 6, Autumn 1976, pp.27-32. On the pattern of events and legislation on air pollution, see HA Scarrow, 'The Impact of British Domestic Air Pollution Legislation', Brit J Pol Sci 2 (3), 1972, pp.261-82.

5. e.g. 'Domestic Heating Developments in Scotland', HVE 32, Oct 1958, p.194; Editorial, 'Electric Floor Heating in Scotland', HVE 32, Jul 1958, p.1. On consumer views of underfloor heating, see also A Rew, 'Consumer Acceptance of Community Heating Systems', paper to CHPA 6th National Conference, CHP: Developments and Decisions, Jun 1985.

6. MoP, Fuel Policy, Cmnd.2798 (London: HMSO, Oct 1965); MoP, Fuel for the Future (London: HMSO, 1967); MoP, Fuel Policy, Cmnd.3438 (London: HMSO, Nov 1967); PL Cook and AJ Surrey, Energy Policy: Strategies for Uncertainty (London: Martin Robertson, 1977).

7. Fuel for the Future, p.14 (note 6).

8. Fuel Policy, 1965, p.13 (note 6).

9. ibid.

10. Fuel for the Future, p.14 (note 6).

11. The National Plan, Cmnd.2764 (London: HMSO, Sep 1965), esp. pp.118-25 on energy.

12. Cook and Surrey, op. cit., p.14 (note 6). The MoP set up an Energy Advisory Council in Jan 1965 of industry and government representatives. (Fuel Policy, 1965 (note 6).)

13. Fuel for the Future, p.11 (note 6).

14. See note 80.

15. Cook and Surrey, op. cit., p.23-6 (note 6).

16. DJ Ezra, 'District Heating: Foreword', Solid Fuel (106), Apr 1970, p.i. See also RC Huxford, 'How Solid Fuel Became Involved', DHA J (14), Jun 1976, pp.23-4; NCB, Report and Accounts, 1969/70, p.22; NCB, District Heating for the New Britain (London: NCB, 1968).

17. NCB, Report and Accounts, 1963-4, p.10; DJ Ezra, 'District Heating in a Changing Environment', HVE 45, Jul 1972, pp.17-20; Design and Heating Study Group, District Heating: A Survey of Practice in Europe and America (London: NCB, 1968).

18. Other promotion activities included joint NCB/AHS conferences, 21 Feb 1968, Warrington ('District Heating Conference', HVE 41, Mar 1968, p.496) and 27 Jun 1968, Coalville, Leics. ('District Heating Conference', HVE 42, Aug 1968, pp.67-70).

19. 'This Has Happened to District Heating', Engineering 201, 28 Jan 1966, pp.185-7; JM Blacklock, 'Billingham: Some Design Considerations', Solid Fuel (106), 15 Apr 1970, pp.xxiv-xxvi; 'District Heating for Billingham Town Centre', Surveyor 123, 11 Apr 1964, pp.53-5; W Reid, 'Solid Fuel: with Particular Reference to District Heating', proceedings National Society for Clean Air conference, 1965, p.127; RME Diamant and D Kut, District Heating and Cooling for Energy Conservation (London: Architectural Press, 1981), pp.363-4.

20. e.g. Doncaster: 'District Heating by Coal for Doncaster', Mun J 77, 2 May 1969, p.1131; M Briggs, 'British District Heating', Surveyor 136, 17 Apr 1970, p.31; 'Doncaster District Heating', Steam Heating Engineer 38, Jul 1969, pp.24-31; NCB, District Heating in Doncaster (London: NCB, 1969). Penicuik: 'District Heating for Penicuik', HVE 42, Jan 1969, p.363; 'District Heating for Low Density Housing', HVE 43, Jun 1970, pp.649-50.

21. J Scott, 'District Heating is Growing', Housing Monthly 11, Apr/May 1975, pp.12-13. For those authorities operating their own heat supply, the Board made advice available through its Technical Services.

22. H Roper, 'The Development of Heat Management in this Country', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969. Heat management in individual firms had traditionally been an in-house function, and treated, except where heat was a major requirement of production

processes, as a marginal activity often regarded with disdain - 'something people retired into'. In commercial and public buildings its status was worse, frequently one of several duties of a caretaker. There had been some advice in wartime from, e.g. the MFP/FEBr, and subsequently from its industrial fuel efficiency service which became NIFES in 1954.

23. First Leicester then Nottingham. Two-person teams took over fuel and ash handling and maintenance; the break-even point for such teams was reckoned to be 35 customers. (ibid.)

24. ibid.; BC Smith, 'Clean Air and the Market for Solid Fuel', Solid Fuel (106), Apr 1970, p.ix; 'NCB Form District Heating Company', HVE 40, Aug 1966, p.74. AHS initially consisted of NCB, Compagnie Generale de Chauffe, and Solar Industries Ltd.

25. 'NCB Form ...', op. cit. (note 24). In 1968 AHS absorbed Wm. Cory Ltd and thus took on oil as well as solid fuel schemes. By 1969 it was running 200 installations, including 12 DH schemes. (Roper, op. cit. (note 22).) By the mid-70s it had over 400 heat service contracts. (Scott, op. cit. (note 21).)

26. Roper, op. cit. (note 22); CJ Jones and JH Boddy, 'Piped Oil Supplies for District Heating', paper to IoP/IHVE District Heating Symposium, 25 Nov 1964, JIHVE 32, Mar 1965, pp.441-7. Some 20 non-military oil-fired schemes over 0.1$MW_h$ were completed between 1960 and 1970, totalling 43$MW_h$. (Annex 3.1 in Orchard Partners, Present State and Future Development of the Heat Market in Member States: District Heating in the UK, 266/1/R1 (London: Orchard Partners, Mar 1983).) e.g. Greenock: 'Oil District Heating', Mun J 77, 24 Oct 1969, p.2695; Brunswick: M Briggs, op. cit., pp.31-2 (note 20); 'District Heating in Bloomsbury: The Brunswick Centre Development', HVE 43, May 1970, pp.603-4; Aviemore: 'An Oil-Fired District Heating System', HVE 41, Sep 1967, pp.121-6.

27. Powell-Duffryn and a French Company set up Corrall-Montenay in 1967. Haden Union Heat Supplies, set up in 1968, was a joint venture of GN Haden and SERC, another French firm. (Roper, op. cit. (note 22).) UK DH Consortium comprised Brightside Heating and Engineering Co, Bruun and Sorensen A/S, and Christiani and Nielsen. (DHA Handbook, 1972.)

28. Roper, op. cit. (note 22).

29. 'Plant Offers District Heat for Resale', Mun J 74, 25 Nov 1966, p.3913.

30. App.13, Housing Subsidies Manual; MHLG Circular 36/67, 'Housing Standards', 25 Apr 1967; A DH Consultant, letter, HVE 43, Mar 1970, pp.439-40.

31. e.g. FB Turpin, letter, HVE 43, Apr 1970, p.555; A DH Consultant, op. cit. (note 30).

32. AE Haseler, 'District Heating', Mun J 31 Jul 1970. pp.1715-16; Haseler, 'District Heating and Telethermics: New Data on Heat Mains', JIHVE 38, Dec 1970, pp.194-214, and Building Services Engineer 42, Feb 1975, pp.257-72, and Mar 1975, pp.273-85;

'Historical Problems with Buried Distribution Systems for Hot Water in the UK', in DHA, Evidence Submitted to the Select Committee on Energy, in Minutes of Evidence, 1 Mar 1982, 60-vi (London: HMSO, 1982), pp.255-9; Haseler, 'Evidence to the Select Committee on Energy', ibid., pp.260-1, and Note, ibid., pp.262-3; Diamant and Kut, op. cit., pp.364-5 (note 19).

33. e.g. Shell Mex and BP central computer control of some 75 schemes in the mid-70s; flow control in GLC Thamesmead scheme. (AE Haseler, 'District Heating Progress in the UK: Past, Present and Future', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969.)

34. Fisk and Eastwell found that only about 40% of evaporative meters (fitted to surface of house internals) had accuracies better than 10%; and only 17% of distillation meters (fitted to pipe or heat exchanger). The accuracy of the latter was thus comparable with that of flat-rate charging. (DJ Fisk and AS Eastwell, 'Evaporative Heat Meters in District Heating Schemes', IP 15/81 (Watford: BRE, Sep 1981).) See also National Consumer Council, Heat Metering: A Consumer's View (London: NCC, May 1978). For technical details, see e.g. Diamant and Kut, op. cit., pp.264-90 (note 19).

35. See e.g. Select Committee on Energy, Minutes of Evidence, 15 Feb 1982, HC 60-iv, pp.126-7 on Nottingham; RG Courtney and PJ Jackman, A Study of Three District Heating Schemes, CP 27/76 (Watford: BRE, Mar 1976); RG Courtney and PJ Hobson, The Performance of 15 District Heating Schemes, CP 34/78 (Watford: BRE, Mar 1978). Birch reckoned customers on unmetered schemes could use 150GJ$_h$/y for space heating and washing water, compared to 85-110GJ$_h$/y for metered dwellings. Estimates of savings from metering varied up to 60%, and the cost of metering should have been less than the expected savings. (JH Birch, 'Charging for Heat', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969.) Levermore's investigation also suggested substantial savings from metering in GH schemes. (GJ Levermore, 'Group Heating Schemes', Building Services Engineering Research & Technology 6 (1), 1985, pp.7-12.)

36. On the history of refuse incineration see WA Clennell and DT Lowe, 'The Contribution to Energy Conservation of a National Refuse Incineration/Recovery Policy', paper to DHA 5th National Conference Planning for CHP Heat, Jun 1983; DoE, Refuse Disposal: Report of a Working Party on Refuse Disposal (London: HMSO, 1971). 338 incinerators were in use by 1914, 225 of them with heat recovery of some sort. Several refuse-fired generating stations were built in the late 19th century, the earliest probably at Halifax in 1893. There were over 40 by 1905. (Electricity Council, Electricity Supply in the UK: A Chronology (London: Electricity Council, 1982), p.20.) One incinerator at Govan, Glasgow, generated electricity from 1927 to 1960. Heat recovery schemes are reported to have operated up to or during WW2 at Hull, Huddersfield, Leicester, Hereford, and Rhondda. (ES Hobson, 'Hot Water Supplies to Domestic Dwellings by the Utilisation of Waste Heat at Refuse Disposal Works', HVE 17, Feb 1944, pp.313-7.) Local authorities were given powers to produce heat and/or electricity from refuse incineration in the Control of Pollution Act 1974, ch.40, s.21 (App.6). See also AW Carter, 'Jersey: An Island Approach', IEE Colloquium, CHP: The

Way Forward, IEE Colloquium Digest 1980/59.

37. W Short, 'Refuse Incineration', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969.

38. Clennell and Lowe, op. cit. (note 36).

39. DoE, op. cit. (note 36).

40. 'Fuel from Waste: Byker Plant Breakthrough', DHA J (27), Jan 1980, p.13; 'Warmth from Waste: the Byker District Heating Scheme', pt.V in City of Newcastle upon Tyne, Energy: Newcastle Tackles the Energy Problem (1980).

41. WGE Rowe, 'The Nottingham Combined Refuse Incineration and District Heating Scheme: A Review of its Development', paper to DHA 3rd National Conference, A National Plan for Heat, Apr 1979; City of Nottingham, 'Nottingham's Incineration and District Heating Scheme', undated paper; H Lawson and P Mason, 'The Nottingham Refuse Incineration and District Heating Scheme', Proc Inst Civ Eng I 56, 1974, pp.11-29; 'Memorandum by the National Coal Board on the Nottingham District Heating Scheme', in Select Committee on Energy, Minutes of Evidence, 15 Feb 1982, HC 60-iv, pp.122-60; ibid., pp.161-167; 'Turning on the Heat', Mun J 82, 9 Aug 1974, pp.971-5; DF Woodyard, 'District Heating Now', Engineering 211, Sep 1971, pp.641-2; Scott, op. cit. (note 21).

42. Woodyard, op. cit.; Rowe, op. cit. (note 41). See also AW Brown, 'Environmental Considerations of District Heating', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969.

43. Select Committee, op. cit., p.124; Rowe, op. cit. (note 41).

44. Select Committee, op. cit., p.124 (note 41).

45. 433$TJ_h$ in 1980/1. (ibid., pp.122-3.)

46. ibid., p.128-60; Rowe, op. cit. (note 41).

47. Select Committee, op. cit., p.123 (note 41).

48. ibid., pp.127-8; Rowe, op. cit. (note 41); A Crewe, 'District Heating: A Political Football Bounces Back', Energy in Buildings, Mar 1986, pp.20-1.

49. City of Nottingham, op. cit. (note 41).

50. Select Committee, op. cit., p.123 (note 41).

51. Rowe, op. cit. (note 41). See also NCB, 'Income and Costs from the Nottingham Scheme', App.15 in Select Committee on Energy, Third Report 1982/3, Combined Heat and Power, HC 314-2 (London: HMSO, 1983). See also the findings of a survey of consumer acceptance of the Nottingham scheme, in Rew, op. cit. (note 5), and NCB, 'Memorandum ...', op. cit., p.127 (note 41).

52. NCB, 'Memorandum ...', op. cit., p.125 (note 41).

53. On Thamesmead, see App.A in Macey, op. cit. (note 3).

54. M Briggs, 'British District Heating', Surveyor 136, 17 Apr 1970, p.30; E Clatworthy, The Future Uses of Gas', paper to CHPA 6th National Conference, CHP: Developments and Decisions, Jun 1985.

55. For general criticisms and defence, see Minutes of Evidence, 15 Mar 1982, HC 60-viii; Third Report ..., HC 314-1, op. cit. pp.34-5 (note 49); 'Majority View of British Gas Corporation Policy Relating to CHP', Ann.3 in DEn, Combined Heat and Electrical Power Generation in the United Kingdom, Energy Paper 35 (London: HMSO, 1979), p.54.

56. BGC, 'Telford Development Corporation/Total Energy Scheme', App.11 in Third Report ..., op. cit. (note 51); MEB, 'Comments on Document by British Gas', App.12 in ibid.; 'Correspondence between the Gas Board and MEB about Telford', in Select Committee, Minutes of Evidence, 24 Nov 1981, HC 60-i, pp.3-4; ibid., pp.30-1; Third Report ..., op. cit., pp.34-5 (note 51); E Clatworthy, memorandum, Mar 1982, in Select Committee, Minutes of Evidence, loc. cit., p.376 (note 55); ibid., pp.390-2; BGC, 'Berryfields Farm Group Heating Scheme', App.13 in Third Report ..., op. cit. (note 51).

57. e.g. DL Williams, 'The Architect's Role in District Heating', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969; 'Casting Vote Defers £650 000 Scheme for District Heating', South Wales Echo and Evening Express, 27 Sep 1966.

58. J Macadam, interview, Nov and Dec 1984.

59. Third Report ..., op. cit., p.35 (note 51). Prices to industrial generators were based on that of the alternative fuel, i.e. an appropriate fuel oil; see e.g. Select Committee, Minutes of Evidence, 11 May 1982, HC 60-ix, p.422; 'Majority View ...', op. cit. (note 55). The justification for the industry's practices was based on reserving gas for 'premium uses'; the definition and its use have been contentious. (e.g. ibid., pp.423-9.)

60. e.g. A Roberts, 'A View on Heating Policies in Local Authority Housing', paper to 2nd DHA National Conference, Better Energy Investment: The Role of District Heating, Mar 1977; Select Committee, Minutes of Evidence, 1 Mar 1982, HC 60-vi, p.283. The Select Committee accepted that in 1983 the BGC had stopped this practice. (Third Report ..., op. cit. (note 51).)

61. e.g. Select Committee, Minutes of Evidence, loc. cit., p.276 (note 60).

62. e.g. FJ Eaton, discussion on LG Hadley, 'Future Aspects of District Heating in Britain', JIoP 51, Mar 1965, pp.86-7.

63. Select Committee, Minutes of Evidence, loc. cit. (note 60), and 3 Feb 1983, HC 60-ii, pp.48-9; BGC, 'Communal Heating Schemes Changing to Individual Heating', App.10 in Third Report ..., II,

op. cit. (note 51); 'Majority View ...', op. cit., (note 55).

64. Select Committee, Third Report ..., op. cit., HC 314-1, p.41 (note 51). See also BGC, 'The Provision of Gas for CHP Schemes', App.7; BGC, 'BGC Pricing Policies for Supplies of Gas for Use in Gas Turbines', App.8; BGC, 'Comparison of Gas Consumption of Group Heating Schemes and Individual Gas Boiler Schemes', App.9; in Select Committee, Third Report ..., op. cit., HC 314-2 (note 51).

65. Annex 3.1 in Orchard Partners, op. cit. (note 26); 'The Ministry of Works Approach', Engineering 201, 28 Jun 1966, p.187. Under the DoE, the Property Services Agency became responsible for these schemes.

66. MPBW, 'New City in Buckinghamshire', Report of Working Party, 1964; AE Haseler, 'District Heating in New Cities', JIHVE 33, Sep 1965, p.189; Haseler, 'District Heating Warms Up', Consulting Engineer 35, Feb 1971, pp.49-53. The Working Party contained representatives of Buckinghamshire CC, NCB, CEGB, MoP and MPBW. Cumbernauld DC had already considered DH in the late 50s. ('Domestic Heating Developments ...', loc. cit. (note 5).) See also note 1.

67. AE Haseler, interview, Jun 1982; JC Knight, 'Heat Distribution', paper to IoP/IHVE District Heating Symposium, 25 Nov 1964, loc. cit., pp.441-7 (note 26) and HVE 38, Jun 1965, pp.382-5; 'District Heating Lessons in Russian Housing', Mun J 75, 18 Aug 1967, p.2185.

68. JC Knight and AW Loten, 'District Heating: Practice and Prospects in the UK', paper 1A6 to Ist IDHC, London, 1970.

69. MPBW, op. cit. (note 66); Haseler, 'District Heating in New Cities', loc. cit., pp.189-91 (note 66); D Gibson, presidential address to RIBA, RIBAJ 71, Dec 1964, pp.501-3; Gibson, 'District Heating for New Cities', paper to IHVE Symposium, District Heating, 21-22 Mar 1967.

70. Combustion Engineering Association conference, Nov 1966, reported in 'Energy Supplies for a New City', Engineering 202, 11 Nov 1966, p.838. See also RH Phillips, 'The All-Electric New Town', Electricity, Nov/Dec 1966, pp.295-306.

71. Haseler, 'District Heating in New Cities', loc. cit., pp.191-2 (note 66). See also 'Cross-Compound Units for District Heating', Elec Rev 175, 25 Sep 1964, p.462; Editorial, 'New District Heating Hope', Elec Times 146, 24 Sep 1964, p.435.

72. P Betts, interview, Feb 1985; CEGB, Memorandum, in Select Committee, Minutes of Evidence, 8 Mar 1982, HC 60-vii, p.303; App.3 in JK Wright, 'Alternative Methods of Electricity Generation', Proof of Evidence CEGB/P3, Sizewell B Power Station Public Inquiry, pp.46-56. The CEGB considered GTs for a scheme at Milton Keynes.

73. In one of the first attempts at a rough cost-benefit analysis for heating, the study put the potential benefits of clean air and adequate warmth for the expanded town of 230 000 people at

£3.3m, and incoporated an allowance for this where appropriate in the assessment. (WC Wilson and JC Knight, 'Integrated Heat and Power Services for a New City in Great Britain', paper to 7th World Power Conference, Moscow Aug 1968, abstracts in HVE 52, Dec 1968, pp.299-307.)

74. Proposed in Haseler, 'District Heating in New Cities', loc. cit., p.181 (note 66). Haseler, interview, Jun 1982; Editorial, 'District Heating Association', HVE 41, Feb 1968, pp.381-2. See also: Haseler, op. cit. (notes 3, 32, 33 and 66); 'District Heating: a Revolution in the Pipeline', Mun J 75, 25 Aug 1967, pp.2231-3; 'District Heating Prospects for Britain', Steam Heating Engineer 36, Sep 1967, pp.8-12, and 37, Oct 1967, pp.24-9; 'District Heating: Action Now', Coal and Energy Quarterly (7), Winter 1975, pp.34-45; 'Contribution of District Heating to Energy Conservation Based on Measured Data', HVE 50, Nov 1976, pp.4-11; 'Hot Water from the Mains', Financial Times, 14 Apr 1966.

75. Editorial, 'Encouraging Signs for District Heating', HVE 40, Aug 1966, p.59.

76. DHA Handbook, 1972, p.9.

77. '1st IDHC: London 1970', HVE 43, May 1970, pp.583-9; 'Fuel Interests and Local Authorities Warm to District Heating', Elec Rev 186, 1 May 1970, p.642. Other output included the DHA Journal and DHA Handbook, and the representative study, Thermville: An Exercise in District Heating.

78. 'Total Energy Approach Needed in Housing Development: Minister Advocates Use of District Heating', Elec Rev 183, 29 Nov 1968, p.783.

79. ibid; R Freeson, opening speech to IHVE Symposium, Mar 1967; Freeson, 'District Heating: Efficient, Flexible and Economical Way of Heating New Dwellings', Solid Fuel (106), 15 Apr 1970, pp.iii-iv; 'Ministry Urges District Heating', Mun J 76, 22 Nov 1968, p.2925; 'District Heating Conference', loc. cit. (note 3); Freeson, speech to 1st IDHC, Apr 1970, reported in 'Fuel Interests ...', loc. cit. (note 77).

80. MHLG, op. cit. (note 30); App.13, loc. cit. (note 30); Housing Subsidy Act 1967, ch.29; Miles, op. cit. (note 2); Macey, op. cit. (note 3); Parl Deb Comm 745, 24 Apr 1967, c.1124-5.

81. e.g. J Wallington, 'Power and the Acts: District Heating in the Public Sector', DHA J, 1st issue 1971, pp.6-7, 11, 38. See also P Channon, 'District Heating', ibid., pp.15-18; Parl Deb Comm 806, 17 Nov 1970, c.377-9 (o).

82. JC Knight, 'Early Days: Success and Failure', DHA J, 1st issue 1972, p.13; DoE Circular 82/71 / WO Circular 181/71, District Heating: A Checklist and Commentary, Jul 1971.

83. ibid. See also report on DHA Seminar, 3 Jul 1972, in 'Government Circular on District Heating', HVE 46, Aug 1972, p.87; Editorial, 'Checklist for District Heating', Steam Heating Engineer 41, Jan 1972, pp.3-5, and Feb 1972, pp.3-5.

84. Greater London Council (General Powers) Act 1969, ch.52, s.45. The Act extended the powers of Pt.II of the 1949 Act to the outer London Boroughs, except Hounslow, and subsumed the powers for Barking under the Essex County Council Act 1952. See section 6.6.

85. Leeds Corporation Act 1956, 4&5 Eliz 2, ch.75, Pt.XII; papers, May - Jun 1956, in BEA/CEA A25876. On proposals for city centre DH in Leeds, see PD Spawforth, 'Resource Planning and Local Authorities', in NJD Lucas, Local Energy Centres (London: Applied Science, 1978), pp.190-5.

86. HHH Helby, 'Parliamentary and Local Authority Powers Relating to District Heating', paper to DHA South Wales and South West Branch conference, Heating for the Community, Bristol Sep 1969.

87. ibid.

88. Papers, Apr - Sep 1969, in CEGB 118.2.1.

89. Papers, Nov 1969, in CEGB 118.2.1.

90. 'Local Government Bill 1972', DHA J, 1st issue 1972; D Ezra, op. cit. (note 16). See also 'Government Circular ...', loc. cit. (note 82).

91. 'Government Plans New Law to Aid District Heating', Elec Rev 196, 25 Apr 1975, p.491; Local Government (Miscellaneous Provisions) Act 1976, ch.57 (App.6); 2nd Reading, Parl Deb Comm 906, 23 Feb 1976, c.39-80, esp. 42, 59.

92. Scott, op. cit. (note 21).

93. D Carpenter, 'District Heating: Slowly Warming Up', Statist, 7 Apr 1967, p.708-10.

94. NCB, Report and Accounts, various dates; DHA Handbook, various dates.

95. Smith, op. cit., p.ix (note 24); D Cory-Wright, 'District Heating and the Coal Trade', Solid Fuel (106), Apr 1970, p.xiii.

96. 320MW$_h$ at assumed 40% load factor and 80% efficiency: $5 \times 10^{15}$ J$_h$/y = $1.4 \times 10^5$ tce/y. Haseler confirms this figure ('District Heating: Action Now', loc. cit., p.44 (note 74).)

97. Domestic sales 1960 35.5Mt; 1974/5 14.2Mt; 1975/6 11.2Mt. (NCB, Report and Accounts, 1969/70; DEn, Digest of UK Energy Statistics, 1976 (London: HMSO, 1976).)

98. Annex 5.1 in Orchard Partners, op. cit.. (note 26).

99. Haseler indicates the number of GH and DH schemes in England grew by about 40%/y till 1974. (Fig.4 in Haseler, 'District Heating: Action Now', loc. cit. (note 74).) Sheldrick's figures, derived from DoE housing statistics, show the percentage of new local authority dwellings being connected to GH/DH peaking at 10% in 1972. (Sheldrick, op. cit., p.17a (note 2).) This would indicate a maximum

rate of installation of new capacity of about 200MW$_h$/y. A CPRS report of 1974 claimed 14% for the same. (CPRS, Energy Conservation (London: HMSO, 1974), p.49.) Orchard Partners' data, excluding the GLC, shows the number of installations dipping in 1972, rising again and peaking in 1976. (Figs.3.1 and 3.2 in Orchard Partners, op. cit. (note 26).)

100. DHA Handbook, 1981 onwards; Orchard Partners, op. cit., figs. 3.1 and 3.2 (note 26).

101. Annex 3.1 in Orchard Partners, op. cit. (note 26).

102. Levermore, op. cit. (note 35); GLC Industry and Employment Committee, 'Report and Recommendations on Developing an Alternative Energy Strategy for London', 7/IEC663, 24 Jan 1983; Camden LB, personal communication, Sep 1983.

103. Energy Policy and London (London: GLC, 1978), 7.22-.27; GLC, 'Heating and Hot Water Installation in Council Dwellings', Report Hg521, 1970.

104. Annex 3.1 in Orchard Partners, op. cit. (note 26).

105. On Bretton, see PAD Jenks, 'Local Heat Management and Operation', paper to DHA 3rd National Conference, A National Plan for Heat, Apr 1979.

106. Annex 3.1 in Orchard Partners, op. cit. (note 26). On the specific problems affecting Northern Ireland housing and heating schemes, see RT Spence, 'Heating Homes in Difficult Times', paper to DHA 2nd National Conference, Better Energy Investment: the Role of District Heating, Mar 1977; 'Heat on Tap', Esso Magazine (94), Spring 1975, pp.15-17.

107. Annex 3.1 in Orchard Partners, op. cit. (note 26); Sheffield City Council, Memorandum 9 in Select Committee on Energy, Combined Heat and Power Lead City Schemes: Memoranda, 1985/6 (London: HMSO, Feb 1986), p.30.

108. ibid.

109. DHA Handbook, e.g. 1982, pp.24-8.

110. Huxford, op. cit. (note 16); Scott, op. cit. (note 21). Similarly GH was installed during renovation in the Leavengreave Redevelopment Project, Lancs. (M Woollacott, 'District Heating: A Majority Alternative', Design 256, Apr 1970, p.57) and in 30s houses at Rochdale (Diamant and Kut, op. cit., pp.359-61 (note 19); 'District Heating in a Municipal Uprating Scheme', HVE 46, Mar 1973, pp.451-5.) For examples of other GH and DH schemes, see 'Group and District Heating: a Look at Some Current Schemes', Steam Heating Engineer 37, Jun 1968, pp.10-17; DHA Handbook, various years.

111. e.g. GLC Economic Policy Group, The Energy Economy: Building Employment by Investing in the Rational Use of Energy, Strategy Document 5, May 1983, pp.24-5; Crewe, op. cit. (note 48). On Brent LB's experience with its 13 oil-fired GH/DH schemes, see

P Heslop, 'Lower Bills for Brent', Public Service and Local Government 15, Feb 1985, p.20.

112. Martin, op. cit., p.96 (note 2). See also Select Committee on Science and Technology, First Report 1974/5, Energy Conservation, HC 487 (London: HMSO, Jul 1975), p.41. For relative capital and running costs of DH and CH in the early 70s, see Haseler, 'District Heating Warms Up', loc. cit., p.51 (note 66).

113. H Ryding, 'An Alternative Appraisal of District Heating', unpublished paper, Oct 1981, and abridged as 'Alternative Appraisal', Building Services 4, Oct 1982, pp.35-7.

114. GLC, Energy Policy ..., op. cit. (note 103); GLC Industry and Employment Committee, op. cit. (note 102).

115. Levermore, op. cit. (note 35). Oil prices for DH increased by 300%, 1977-83, compared to 160% for gas for CH. Several authorities pooled charges on their estates so as to avoid penalising tenants on exceptionally expensive schemes; the policy remained controversial. (GLC Industry and Employment Committee, op. cit. (note 102); Westminster City Council, personal communication, Sep 1983.)

116. Courtney and Jackman, op. cit. (note 35); Courtney and Hobson, op. cit. (note 35). The unreliability of heat mains has probably been overstated; see E O'Sullivan, 'District Heating Mains', Building Services 6, Oct 1984, p.73; AB Birtles and E O'Sullivan, 'Operator Experience of Underground Heat Mains Reliability in the UK', paper to DHA 5th National Conference, Planning for CHP Heat, Jun 1983; 'BRE Kills District Heating Myth', Building 250, 7 Mar 1986, p.55.

117. Levermore, op. cit., pp.10-11 (note 35).

118. Ryding, op. cit. (note 113). See also WS Atkins and Partners, CHP Feasibility Programme Interim Report: Shortlisting of Cities for Lead City Selection (Dec 1980), p.10.

119. GLC Industry and Employment Committee, op. cit. (note 102); R Owens, 'A Heated Debate', Architect's Journal 5, 29 Jan 1986, pp.38-9; Parl Deb Comm 26, 28 Jan 1982, c.243.

120. WCC, op. cit. (note 115).

121. GLC, 'Methods of Water and Space Heating with Relative Costs', Report Hg957, 1976; GLC, Energy Policy ..., op. cit. (note 103).

122. See list in BGC, 'Communal Heating ...', op. cit. (note 63). In Birmingham, 18 GH or block installations had been changed to individual CH by 1982. See also Basingstoke and Deane BC, memorandum to Select Committee on Energy, in Minutes of Evidence, 1 Mar 1982, HC 60-vi, pp.263-4.

123. GLC Industry and Employment Committee, op. cit. (note 102).

124. Craigbank, Berryknowes. (City of Glasgow, personal communication, Sep 1983.)

125. On the decline in DH, and arguing for its long-term benefits, see

LR Pincott, 'Is There a Future for District Heating in the UK?', HVE 51, Mar 1977, pp.13-14.

126. Cardiff City Council approached the South Wales Board in 1969 about heat supplies for two schemes. (Papers, Sep 1969, in CEGB 118.2.1.) See also note 137.

127. For outspoken allegations of opposition, see e.g. N Jenkins, 'Preparing for the Day', Mun J 83, 5 Dec 1975, pp.1541-2; Jenkins, 'True Energy Economy Lies in Combined Heat and Power Production', Energy International 12, Sep 1975, p.13; Jenkins, 'District Heating Finds Keen British Audience', Energy International 11, Aug 1974, p.38.

128. Editorial, 'A Case for District Heating', Elec Rev 175, 18 Dec 1964, p.911; Editorial, 'Enterprise in District Heating', Elec Rev 183, 25 Oct 1968, p.592; Editorial, 'District Heating', Elec Rev 185, 25 Jul 1969, p.116; 'Arguments on District Heating', Elec Rev 186, 1 May 1970, p.136; Editorial, 'Dialogue on District Heating', Elec Rev 191, 20 Oct 1972, p.498; GM Hoyle, 'Some Home Truths about District Heating', Elec Rev 195, 13 Dec 1974, pp.769-70.

129. > ... the CEGB must employ some of the finest engineers and administrators in the land; they must then have a well-argued case to support their policies. Why is it not heard or seen? The Board ... ought not to be shy at displaying its case in public.

(PL Martin, letter, Financial Times, 20 Jun 1973.) See also A Tucker, 'Energy-Wasting Charges Against Power Board', Guardian, 29 Nov 1973.

130. e.g. Electricity Council/DHA London Branch, 11 Oct 1972 (Editorial, 'Dialogue ...', loc. cit. (note 128); 'The Electricity Supply Industry and District Heating', HVE 46, Dec 1972, pp.295-300) and DHA Seminar, Nottingham, Nov 1975 ('The Challenge to Electricity', Consulting Engineer 40, Jan 1976, pp.22-3). See also G Brown, 'Fuel Abundance Blinds Britain to Energy Waste', Energy International 10, Mar 1973, pp.15-17.

131. DHA Handbook.

132. Papers, May - Jul 1967, and May - Jul 1974, in CEGB 118.2.1; DHA Handbook, various years.

133. e.g. papers, Apr - May 1967, Jul 1971, Oct 1972, Mar 1973, Nov 1973, in CEGB 118.2.1; papers, Jan 1971, in CEGB 118.3.1.

134. CM Johnston and VG Newman, 'Combined Heat and Electricity Generation for District Heating', in EM Ackery, Electricity and Space Heating, IEE Symposium 3-4 Mar 1964 (London: Blackie, 1965); PE Betts and TA Boley, 'Electricity Alone Can Supply All the Consumer's Energy Requirements', Elec Rev 185, 25 Jul 1969, pp.128-30 (it should be noted that the title of this paper bears no relation to the subject matter); GS West, 'The Economic Viability of Private Generation or Total Energy Schemes', IEE Conference Publication 73, 1970, pp.325-37; West 'Combined Production of Electricity and Heat', DHA J, 2nd issue 1972, pp.17, 20;

JA Burchnall, 'The Electricity Supply Industry's Attitude to District Heating', ibid., p.24.

135. 'Electricity Council Cool on District Heating', Elec Rev 186, 24 Apr 1970, pp.599-60; 'Arguments on District Heating', loc. cit. (note 128).

136. JA Burchnall, op. cit. (note 134); GS West, op. cit. (note 134).

137. Papers, Jun - Dec 1973, in CEGB 118.2.1. The consultancy had already assessed a larger 165$MW_h$/1600$TJ_h$/y scheme for Manchester in the late 60s, covering UMIST and existing and projected buildings nearby in an area of 110ha, with possible extensions to an adjacent hospital and housing development. A substantial existing heating load for immediate connection, a quarter of the total, gave a favourable pattern of finance, despite the exclusion of loads already served by the CEGB's Bloom Street heat station till the end of their contracts. The plan favoured oil-fired ITOC plant of 20$MW_e$ producing only as much electricity as required for the area, as the likely income for electricity sales from BP plant sized for the heat load gave no advantage over a HO source. (FB Turpin, 'A District Heating Feasibility Study', HVE 42, Jan 1969, pp.339-43.) UMIST was subsequently supplied from the Bloom Street station. (See chapter 6, note 485.)

138. The reasons cited prejudged several matters. (Papers, Mar 1974, in CEGB 118.2.1.)

139. P Betts, interview, Feb 1985; papers, Dec 1978, in CEGB 118.4.1.

> After its unfortunate experience with the Battersea/Pimlico installation, the CEGB has apparently set its face against any further development, although its economic arguments for doing so are open to question.

(Editorial, 'More Efficient Use of Fuel', Elec Rev 178, 7 Jan 1966, p.2.) Spondon H was finally sold to Courtaulds Acetate Ltd in Oct 1982. (CEGB, 'Note on Sale of Spondon H Power Station', 3 Feb 1982, in Select Committee, Minutes of Evidence, 8 Mar 1982, HC 60-vii, pp.320-1.)

140. Papers, Apr 1961, in CEGB 118.4.1.

141. Papers, Jun 1974, in CEGB 118.4.1.

142. Papers, May - Apr 1966, in CEGB 118.4.1. In 1966 the turbines were out of action for several months, necessitating live steam supply. Extensive renovation of the network was carried out in the late 60s. (SAF Duplock, 'Modernising the Pimlico District Heating Scheme', HVE 43, Jul 1969, pp.7-9.)

143. WCC, Report of Housing Committee, 17 Jun 1968; papers, 1970, in CEGB 118.4.1. The City's cumulated deficit was about £60 000 by 1968 and its yearly losses £3-5000/y. The CEGB was losing some £12 000 on fuel costs alone, and of the order of £40 000/y total.

144. Papers, Mar 1972, in CEGB 118.4.1 and CEGB 118.2.1.

145. ibid.

146. Papers, Jul 1972, in CEGB 118.4.1.

147. £40 - 50 000/y. The Board anticipated 8-900 hours out-of-merit running costing an extra £12-13 000/y; this might increase to £100 000 by the end of the agreement. (Papers, Aug 1974, in CEGB 118.4.1.)

148. Papers, Aug 1978, in CEGB 118.4.1.

149. Correspondence, Dec 1978 - Jan 1979, in CEGB 118.4.1. Losses had escalated sharply from 1975 to £156 000 in 1978/9 and were to rise to £350 000 in 1979/80. (Papers, May 1980, in CEGB 118.4.1.)

150. Papers, May 1980 - Apr 1983, in CEGB 118.4.1; App.3 in Wright, op. cit. (note 72).

151. Report of the Committee of Inquiry into the Electricity Supply Industry, Cmd.9672 (London: HMSO, Jan 1956), p.62.

152. ibid., p.62.

153. ibid., p.62.

154. ibid., p.62.

155. P Betts, interview, Feb 1985; GT Shepherd, interview, Feb 1985. See chapter 4, note 213. For allegations of outright opposition by Area Boards to private CHP installation, see Power Management Associates, Memorandum, in Select Committee on Energy, Minutes of Evidence, 8 Feb 1982, HC 60-iii, pp.52-4, and Minutes of Evidence, pp.59-60.

156. GT Shepherd, interview, Feb 1985; Shepherd, 'A Particular Approach to Non-Industrial Applications of Total Energy', IoF Total Energy conference, Brighton 1971, pp.87-97; Shepherd, 'Combined Heat and Power: The Present Position', paper to DHA Annual Open Meeting, London 30 Jan 1979, in DHA J (24), Mar 1979, pp.5-10, extracts in 'Making the Best Use of Combined Heat and Power', HVE 53, Mar 1979, pp.18-19; GT Senior, 'London Electricity Board Looks at Local Generation with Heat Recovery', Elec Times (4238), 5 Jul 1973, pp.16-17; Select Committee, Minutes of Evidence, 24 Nov 1981, HC 60-1, pp.22-3. On total energy technical options, see e.g. RME Diamant, 'Cheap Heat and Electricity from one Primary Fuel', Elec Rev 185, 25 Jul 1969, pp.125-7. For examples of TE installations, see 'Natwest Total Energy Initiative', and 'Lloyds Bank on Total Energy', Energy Digest 8, Jun 1979, pp.32-4.

157. Senior, op. cit. (note 156).

158. The account of the LEB Bankside scheme is based on: GT Shepherd, interview, Feb 1985; 'South Bank District Heating Scheme Underway', Elec Rev 191, 29 Oct 1972, p.500; PP Hartley, letter, HVE 46, Jun 1972, pp.627-8; Hartley, 'London Electricity's 100MW Heat Distribution Scheme', Elec Times 162, 16 Mar 1972, pp.52-4; PP Hartley, 'Thermal Energy', DHA J, 2nd issue 1972; papers, Dec 1970 - Aug 1974, in CEGB 118.3.1. The area was bounded

thus: N: Thames; W: Waterloo Bridge; S: Stamford, Southwark and St. Thomas's Streets; E: St. Saviour Dock. See also Editorial, 'Electric Heat by Pipe', HVE 45, Apr 1972, p.489.

159. Hartley, 'London Electricity's ...', op. cit. (note 158); papers, Dec 1970 - Jan 1971, in CEGB 118.3.1.

160. Papers, Dec 1970, in CEGB 118.3.1.

161. Estimates of heat costs at station, Jan 1971: 61p/$GJ_h$ from extraction; 47p/$GJ_h$ from HOBs. (Papers, Jan 1971, in CEGB 118.3.1.)

162. Papers, Jun 1971, in CEGB 118.3.1.

163. 'Heating Deal May Earn LEB £½m a Year', Circuit News, Oct 1973, p.11.

164. 'District Heating Scheme Planned for Bankside Power Station', Elec Times 160, 1 Oct 1971, p.21; 'South Bank ...', op. cit. (note 158); Hartley, letter, loc. cit. (note 158).

165. London Electricity Board Heating Scheme Order, 1971, Statutory Instruments 1972, No.152. See also papers, Aug 1971, in CEGB 118.3.1.

166. Hartley, letter, loc. cit. (note 158).

167. Hartley, 'London Electricity's ...', op. cit. (note 158).

168. Papers, Jan 1971, in CEGB 118.3.1.

169. The CEGB pressed for a 3-rate tariff for live steam reflecting the anticipated merit-order running of the station; a fuel escalation clause from a given level; a charge for live steam supply coinciding with notified potential peaks of electricity demand; and an additional hourly charge for night running. The contract would run for 20 years with a review of charges every 5 years. Disagreements would be arbitrated by the Electricity Council. The LEB would pay all the capital and for works and services provided by the CEGB. Some of the additional equipment would be paid for by the LEB but would remain the property of the CEGB. The CEGB would operate the boiler and heat exchanger plant according to a schedule in an operating agreement, referring to the LEB only in abnormal circumstances. The CEGB would retain prior claim to the steam and could stop supply to suit its operation; it would not be liable for any claims arising from cessation except through negligence. (Papers, Jan 1971 - Mar 1973, in CEGB 118.3.1.)

170. Papers, Feb - Mar 1973, in CEGB 118.3.1. Bloom Street offered the only reasonable comparison. (Papers, Mar 1971, in CEGB 118.3.1.)

171. Papers, Mar - May 1974, in CEGB 118.3.1.

172. The price of delivered heat was by that time around 170p/$GJ_h$. (Papers, May 1974, in CEGB 118.3.1.)

173. Papers, Aug 1974, in CEGB 118.3.1, and Aug 1975 in CEGB 118.2.1;

CEGB, Memorandum, in Select Committee, Minutes of Evidence, 8 Mar 1982, HC 60-vi, p.303; GLC, Add.7 to GLC/P2, Sizewell B Power Station Inquiry, Aug 1984; App.3 in Wright, op. cit. (note 72).

174. GT Shepherd, interview, Feb 1985; papers, Dec 1973 - Jan 1974, in CEGB 118.2.1; Shepherd, 'Combined Heat and Power: the Present Position', loc. cit. (note 156); JD Lycett, paper to DHA 2nd National Conference, Better Energy Investment: The Role of District Heating, Mar 1977.

175. Papers, Jan 1974, in CEGB 118.2.1.

176. ibid.; GT Shepherd, interview, Feb 1985; Shepherd, 'Combined Heat and Power: the Present Position', loc. cit. (note 156); J Moss, 'Energy's Cinderella: Time for a Ball?', New Scientist 82, 24 May 1979, p.640;

177. GT Shepherd, interview, Feb 1985; Lycett, op. cit. (note 174); BGC, 'Telford ...', op. cit. (note 56); MEB, op. cit. (note 54); Select Committee, Third Report ..., HC 314-1, op. cit., p.36 (note 51).

178. In addition, the density of housing envisaged was halved, and commercial tenants were reluctant to accept supply. (Shepherd, 'Combined Heat and Power: the Present Position', loc. cit. (note 156); Lycett, op. cit. (note 174).)

179. Correspondence and papers, in Select Committee, Minutes of Evidence, 24 Nov 1981, HC 60-i, pp.4-13, 21; DEn, 'Industrial CHP Schemes Run by Area Electricity Boards', App.1 in Third Report ..., op. cit. (note 51); ME Price, Hereford Combined Heat and Power Station', paper to IEE Future Energy Concepts conference, Jan 1981; GT Shepherd, interview, Feb 1985; Shepherd, 'Combined Heat and Power: the Present Position', loc. cit. (note 156).

180. The MEB considered coal-fired plant at the request of the DEn, but site constraints and potential pollution problems ruled it out. (DEn, op. cit. (note 179).)

181. It is a matter of interpretation whether other sections of the industry could be considered to have opposed the scheme. (Papers, Jan 1978, in CEGB 118.2; GT Shepherd, interview, Feb 1985; Select Committee, Minutes of Evidence, loc. cit., p.24 (note 179).)

182. DEn, op. cit. (note 179); 'Hereford Scheme Opened', Elec Rev 206, 16 May 1980, pp.12-13. The scheme had cost £7.3m by 1981. (Select Committee, Minutes of Evidence, loc. cit., p.27 (note 179).)

183. e.g. Power Management Associates, op. cit. (note 155). Other allegations included threats to cut off public supply if industrialists installed private generating plant. (ibid., p.53, and Minutes of Evidence, pp.63-4.) See also 8.6.

184. N Jenkins, 'District Heating Can Answer Refuse Disposal Problems', Energy International 10, Oct 1973, p.13.; Electricity Council, Handbook of Electricity Supply Statistics, 1971.

185. Select Commitee, Minutes of Evidence, loc. cit., p.57 (note 155); Third Report ..., op. cit., p.41 (note 51). See also 8.6, esp. note 267.

186. RJR Budden and DL Tolley, 'The Role of the Electricity Supply Industry in CHP', in Electricity Council, CHP Bureau brochure (1984); C Gronow, 'The Impact of the Energy Act for CHP Users', paper to Energy Week, Polytechnic of the South Bank, London, Jun 1984.

187. Papers, Aug - Sep 1975, in CEGB 118.2.

188. ibid.; papers, Mar 1976 and Jan 1978, in CEGB 118.2.1.

189. Papers, Dec 1973 - Jan 1974, in CEGB 118.2.1, and Aug - Sep 1975 in CEGB 118.2 and CEGB 118.2.1.

190. Cheddleton, for a paperworks. (GT Shepherd, interview, Feb 1985; papers, Aug 1975, in CEGB 118.2.)

191. ibid.; P Betts, interview, Feb 1985.

192. Papers, Jun 1975 - Mar 1976, in CEGB 118.2.1.

193. Papers, Apr 1974, in CEGB 118.2.1; P Betts, interview, Feb 1985.

194. GT Shepherd, interview, Feb 1985.

195. ibid.; P Betts, interview, Feb 1985.

196. Papers, Aug 1975 - Jan 1976, in CEGB 118.2.1; P Betts, interview, Feb 1985.

197. 'Supply Industry Considers 21 District Heating Schemes', Elec Rev 196, 7 Feb 1975, p.140; GS West, Electricity Supply Industry's Role in District Heating, talk to DHA 4 Feb 1975 (London: Electricity Council, 1975); Sizewell B Power Station Inquiry, Transcripts, 64, 12 May 1983; App.3 in Wright, op. cit., pp.46-56 (note 72); Budden and Tolley, op. cit. (note 186).

198. Papers, Jun 1975 - Jan 1976, in CEGB 118.2, and Sep 1974 - Aug 1975, in CEGB 118.2.1; P Betts, interview, Feb 1985; J Dart, interview, Feb 1985. On Wakefield, see RA Peddie, 'CHP: A Utility's View' in Lucas, op. cit., p.72 (note 85); Spawforth, op. cit., pp.196-200 (note 85).

199. CEGB, Peterborough DC and EEB, Peterborough: District Heating for Castor (Dec 1976). See also Jenks, op. cit. (note 105).

200. 3 x 25$MW_e$ oil BP sets feeding 3 x 100$MW_h$ heaters; 2 x 50$MW_e$ GTs feeding 2 x 85$MW_h$ heaters; and 4 x 100$MW_h$ RFO HOBs. (Central London District Heating Scheme (London: CEGB, Feb 1977).)

201. SSEB, Central Glasgow District Heating Study April 1975 - March 1976 (May 1976); 'District Heating for Pinkston Uneconomic', Elec Times (4371), 19 Mar 1976, p.1; F Tombs, 'Energy Savings but at a Price', DHA J (14), Jun 1976, pp.10-12. In particular, the criticisms were that the study did not use NEC or marginal costing, and the electricity credits did not include all avoided costs. (P Byrne, 'Has the SSEB Given District Heating a Fair Chance?', Energy

International 13, Aug 1976, pp.31-2; papers, Jun - Oct 1976, in CEGB 118.2.1; Byrne, letter, Elec Times (4380), 21/28 May 1976; NJD Lucas, 'Alternative Appraisal of District Heating in Glasgow', Applied Energy 2, 1976, pp.309-315; J Macadam, interview Nov and Dec 1984.) On the three published studies, see WRH Orchard, 'District Heating is Better than Drax B', Elec Rev 201, 1 Jul 1977, pp.16-17; and discussion on Peddie, op. cit., pp.84-8 (note 198). In defence of ESI costings, see C Gronow, letter, Energy International 13, Oct 1976; Gronow, letter, Elec Times (4382), 11 Jun 1976, p.3; JK Wright, letter, Elec Rev 201, 5 Aug 1977, p.8. For an earlier suggestion of DH from Pinkston, see DVH Smith, 'District Heating and its Relation to Housing and Town Planning', HVE 14, Jun 1941, pp.461-71.

202. The staff of the Boards would be less than human if they did not recognise the desirability of finding a successful scheme at the present time - if only to silence those critics who maintain that the Industry is opposed to the principle of district heating.

(JA Burchnall, The Supply Industry and Private Generation (London: Electricity Council, 1976).)

203. GS West, 'What is the Future of Combined Heat/Electricity Generation?', IEE Conference Publication 112, 1974, p.45.

204. One has the unfortunate impression at the present time that vast effort is devoted to analysing a multitude of reasonable proposals with only one objective in mind - and that is to discover a thoroughly plausible reason for not upsetting the status quo by accepting change.

(AKL McCrone, discussion on Peddie, op. cit., p.90 (note 198).) See also N Jenkins, 'Britain's District Heating Experts Reply to Electricity Industry Attack', Energy International 13, Feb 1976, pp.31-2.

205. West, 1975, op. cit., pp.5-6 (note 197); JE Platt and MN Eggleton, 'Merit Order Influence', DHA J (11), Dec 1974, pp.18, 26, 42.

206. West, 1974, op. cit. (note 203); West, 1975, op. cit., p.7 (note 197); Burchnall, op. cit., citing Eric Varley, Jun 1974 (note 202).

207. PA Lingard, Electricity and Heat Production: Energy Efficiency versus Cost Efficiency, 4th DHA Derek Ezra Award Lecture, 13 May 1975 (London: CEGB, Aug 1975), and HVE 49, Jun 1975, pp.12-14.

208. ibid.; West, 1974, op. cit., p.44 (note 203); Burchnall, op. cit. (note 202).

209. 'Long Term Prospects for Electrical Energy Examined by CEGB', Elec Rev 195, 1 Nov 1974, p.563.

210. Transcripts, loc. cit. (note 197).

211. Burchnall, op. cit. (note 202).

212. The Board claimed later to reassess schemes rejected at 15% against a 5% rate of return before making a final decision. It is not clear how strictly such appraisals were applied nor when the practice of assessing at 15% was discontinued. (CEGB, 'Rate of Return on CHP/DH Schemes', App.5 in Select Committee on Energy, Third Report ..., HC 314-2, op. cit. (note 51); J Dart, interview, Feb 1985; Johnston and Newman, op. cit., p.404 (note 138); papers, Jun 1976, in CEGB 118.2.; discussion, loc. cit. (note 201).) Such discriminatory appraisal was argued to have become unjustifiable under the Energy Act 1983. The ESI however continued to stress the extra risk involved in CHP projects as justifying more stringent appraisal. (Electricity Council, Memorandum 13, in Select Committee on Energy, Minutes of Evidence, 25 Jun 1986, HC 488-i, pp.32-3.) Moreover the treatment of projects as optional and thus subject to capital rationing could continue; see 8.6.

213. R Forman, 'Large Scale Distribution and Sale of Heat', paper to DHA 3rd National Conference, A National Plan for Heat, Apr 1979.

## Chapter 8

1. Responsibility for energy had passed from the MoP to MinTech in 1969, and to the DTI in 1970. (Civil Service Yearbook, various dates.) The formal structure of government responsibilities on energy matters at this time is meticulously documented in LF Pearson, The Organisation of the Energy Industries (London: Macmillan, 1981). Energy still impinged on several other departments, notably the Treasury, DoE, DoI, Welsh and Scottish Offices.

2. Civil Service Yearbook, 1977.

3. Pearson, op. cit., pp.29-30 (note 1). See also M Ince, Energy Policy: Britain's Electricity Industry (London: Junction Books, 1982), pp.10-17.

4. R Williams, 'Britain's Energy Institutions', paper to RIPA symposium Facing the Energy Future: Does Britain Need New Energy Institutions?, Jan 1981.

5. Civil Service Yearbook, various years.

6. The evolution of the conservation section can be traced in Civil Service Yearbook, 1974 onwards. It did not achieve divisional status till 1978/9.

7. Select Committee on Energy, Eighth Report, 1984/5, The Energy Efficiency Office, HC 87 (London: HMSO, Oct 1985).

8. Select Committee on Science and Technology, First Report, 1974/5, Energy Conservation, HC 487 (London: HMSO, Jul 1975), p.38; G Taylor, 'Contradiction in Conservation Policy', Building Services 5, Apr 1983, p.5; Taylor, 'Officials Clash on Energy Conservation', Elec Rev 213, 5/12 Aug 1983, p.20; DEn, 'Investment in Energy Use as an Alternative to Investment in Energy Supply', Jan 1983. See also Memoranda 8: CPRE and ERR; 12: National Gas Consumers' Council; 13: Electricity Consumers' Council; and 13: Association for the Conservation of Energy; in Select Committee on Energy, 1984/5, The Energy Efficiency Office: Minutes of Evidence, 19 Jun 1985, HC 87-iii (London: HMSO, 1985).

9. For useful reviews, see International Energy Agency, Energy Policies and Programmes of IEA Countries (Paris: IEA, 1977 onwards); B Sheldrick, 'Energy Conservation as a UK Government Policy (up to mid-1982)', Univ of Leeds School of Geography Working Paper 354 (Mar 1983); A Porter, M Spence and R Thompson, The Energy Fix (London: Pluto, 1986), chs.4, 5.

10. T Benn, Foreword, in DEn, Energy Policy: A Consultative Document, Cmnd.7107 (London: HMSO, Feb 1978).

11. DEn, National Energy Conference, 2 vols., Energy Paper 13 (London: HMSO, 1976); Energy Commission Paper series.

12. IEA, Energy Policies and Programmes of IEA Countries: 1978 Review (Paris: IEA, 1979), p.137.

13. DEn, op. cit. (note 10).

14. IEA, 1978 Review, p.135; IEA, 1979 Review, p.203.

15. IEA, 1978 Review, p.138.

16. British National Oil Corporation, established 1976 under Petroleum and Submarine Pipelines Act 1975, ch.74. NCB and BGC oil interests were transferred to BNOC in 1976-7.

17. NCB, Plan for Coal (1974).

18. Parl Deb Comm 883, 9 Dec 1974, c.27-30; reproduced as Ann.1 in SCST, First Report ..., op. cit., pp.54-8 (note 8). On the emergency measures taken in 1973 see Sheldrick, op. cit., p.7 (note 9).

19. Energy Act 1976, ch.76.

20. Parl Deb Comm 941, 12 Dec 1977, c.30-9; IEA, 1978 Review, p.135. For comments on the delays, see Sheldrick, op. cit., p.13 (note 9).

21. SCST, op. cit. (note 8); Energy Conservation: The Government's Reply to the First Report of the Select Committee on Science and Technology, Cmnd.6575 (London: HMSO, 1976).

22. ACEC, Report to the Secretary of State for Energy, Energy Paper 40 (London: HMSO, 1979), esp. pp.4-5.

23. e.g. J Bradshaw and T Harris (eds.), Energy and Social Policy (London: RKP, 1983).

24. For a general review, see DEn, 'Proof of Evidence for the Sizewell B Public Inquiry', DEN/P1, Oct 1982, esp. pp.1-3.

25. IEA, 1982 Review, pp.361-2.

26. IEA, 1983 Review, pp.429.

27. Parl Deb Comm 39, 18 Mar 1983, c.296-7 (o). The letter to the CEGB Chair is cited in IEA, 1983 Review, p.431.

28. MG Webb, 'Energy Policy and the Privatisation of the UK Energy Industries', Energy Policy 13, Feb 1985, pp.27-35, esp. 29-30 detailing the actions to date.

29. J Moore, 'Why Privatise?', speech cited in ibid., p.27.

30. Webb, op. cit., pp.31-6 (note 28).

31. Parl Deb Comm 976, 18 Dec 1979, c.287-304; DEn, op. cit., pp.3-5 (note 24); The Government's Statement on the New Nuclear Programme, Cmnd.8317 (London: HMSO, 1981); IEA 1981 Review, p.348.

32. IEA, 1982 Review, p.361.

33. Sheldrick, op. cit., pp.22-3 (note 9).

34. ACEC, Report to the Secretary of State for Energy, Energy Paper 49, (London: HMSO, 1982), p.8. The ACEC was retained in the purge of public bodies in 1980, but disbanded in 1985.

35. Sheldrick, op. cit., pp.22-3 (note 9).

36. Select Committee on Energy, Minutes of Evidence, 15 Mar 1982, HC 60-viii; 'Majority View of British Gas Corporation Policy Relating to CHP', Ann.3 in DEn, Combined Heat and Electrical Power Generation in the United Kingdom, Energy Paper 35 (London: HMSO, 1979), p.54.

37. Select Committee on Energy, Minutes of Evidence, 15 Feb 1982, HC 60-iv; Apps.18, 19 in SCST, op. cit., HC 156-iii (note 8).

38. ibid., p.161.

39. M Davis, paper to Energy Week, Polytechnic of the South Bank, London, Jun 1984; M Smith, 'Local Authorities Reap Energy Efficiency Rewards', Elec Rev 213, 30 Sep 1983, p.15.

40. D Green, paper to Energy Week, Polytechnic of the South Bank, London, Jun 1984.

41. B Sheldrick, 'Local Authorities and Energy Conservation: the Institutional Environment', Univ of Leeds School of Geography Working Paper 374, Dec 1983.

42. ibid., esp. pp.34-7.

43. SCST, op. cit., p.31 (note 8); Energy Conservation: the Government's Reply ..., op. cit. (note 21).

44. D Hutchinson, 'Local Authorities and Energy Planning', paper to Energy Week, Polytechnic of the South Bank, London, Jun 1984.

45. Sheldrick, op. cit., pp.40-1 (note 41); Davis, op. cit. (note 39).

46. B Sheldrick, 'Local Authority Involvement with Energy Conservation: An Analysis of a National Survey', Univ of Leeds School of Geography Working Paper 393 (Jun 1984).

47. NEDO, Energy Conservation in the UK (London: HMSO, 1974), pp.86-88.

48. SCST, op. cit. (note 8).

49. ibid., p.38.

50. ibid., p.42.

51. ibid., p.51.

52. ibid., pp.49-52.

53. ibid., p.43.

54. ibid., p.41.

55. The fullest exposition of its potential came from consultant JD Davis (App.29). A memorandum from Power Management Consultants anticipated opposition from the energy industries (App.30). None of the local authority associations mentioned CHP/DH (App.27, 30, 31), nor the CEGB (App.20).

56. SCST, op. cit., pp.32-4 (note 8).

57. ACEC, EP40, p.vi (note 22).

58. ACEC, Report to the Secretary fo State for Energy, Energy Paper 3 (London: HMSO, 1975); ACEC, Industry Group Report, Session 1975-6, Energy Paper 15 (London: HMSO, 1976); ACEC, Report to the Secretary of State for Energy, Energy Paper 31 (London: HMSO, 1978); ACEC, EP40 (note 22).

59. ACEC, EP15, p.19.

60. ACEC, EP31, p.20.

61. ACEC, EP40, p.2.

62. CPRS, Energy Conservation (London: HMSO, Jul 1974).

63. ibid., p.13.

64. ibid., pp.4-6.

65. ibid., p.6.

66. ibid., pp.48-9.

67. ibid., pp.32-3.

68. Royal Commission on Environmental Pollution, Sixth Report, Nuclear Power and the Environment (London: HMSO, 1976), pp.165-90.

69. ibid., p.188.

70. For a review and comparison of several such scenarios, see Ann.D in DEn, Energy Technologies for the UK: An Appraisal for R, D & D Planning, Energy Paper 39, vol 2 (London: HMSO, 1979).

71. G Leach et al., A Low Energy Strategy for the United Kingdom (London: International Institute for Environment and Development / Science Reviews, 1979), esp. pp.26-9 and 112-13 on CHP and DH.

72. DEn, op. cit. (note 70).

73. Similar cases for CHP/DH were made in evidence to the Windscale Inquiry, but only brief mention was made in the inspector's report in a cursory treatment of alternative energy futures. (The Windscale Inquiry (London: HMSO, 1978), p.33.)

74. Energy Conservation ..., op. cit. (note 21).

75. Working Document on Energy Policy, Energy Commission Paper 1, 1978.

76. DEn, op. cit., p.24 (note 10).

77. ibid., p.112.

78. e.g. Association of County Councils, RIBA, NUM. (Energy Commission Paper 23, Mar 1979).

79. District Heating Working Party of the Combined Heat and Power Group, District Heating Combined with Electricity Generation in the United Kingdom, Energy Paper 20 (London: HMSO, 1977), p.3.

80. G Bevan, interview, Jun 1984; Select Committee on Energy, Minutes of Evidence, 3 Feb 1982, HC 60-ii, pp.48, 52. See also Select Committee, Minutes of Evidence, 1 Mar 1982, HC 60-iv, pp.276-7, on objections to its composition.

81. G Bevan, interview, Jun 1984.

82. G Bevan, interview, Jun 1984.

83. EP20, p.3 (note 79).

84. ibid., p.11.

85. ibid., p.3.

86. ibid., p.3.

87. ibid., p.29.

88. ibid., p.29.

89. ibid., p.4.

90. ibid., p.11.

91. ibid., p.13.

92. ibid., pp.4-5. See also JK Wright, 'The Findings of the DH Working Party of the Combined Heat and Power Group', paper to DHA 2nd National Conference, Better Energy Investment: The Role of District Heating, Mar 1977.

93. See 'Discussion of Energy Paper No 20', Ann.1 in DEn, EP35, op. cit. (note 36); and e.g. J Sutton, 'District Heating's Place in a National Energy Policy', HVE 52, Feb 1978, p.13; R Armson, Combined Heat and Power: A Discussion of Energy Paper 20, ERG-018 (Milton Keynes: Open University Energy Research Group, Jun 1977). The Watt Committee was commissioned by the DEn to produce a critique. (Select Committee, Minutes of Evidence, 22 Feb 1982, HC 60-v, p.226.)

94. Ann.1, loc. cit. (note 93).

95. EP35, p.xii (note 36). See also JM Cassels, 'CHP: The Attempt at Quantitative Assessment', DHA J (21), Mar 1978, p.15.

96. Leeds, Bradford, London and Merseyside. (Reports listed in Ann.12, EP35.)

97. op. cit. (note 36). In response, see e.g. D Olivier, 'Combined Heat and Electrical Power Generation in the United Kingdom: Comments on the Report to the Secretary of State for Energy by the Combined Heat and Power Group', (London: Friends of the Earth, Jul 1979); NJD Lucas and J Holmes, 'Comments on the Marshall Report on Combined Heat and Power', (Dept of Mechanical Engineering, Imperial College, Jul 1979). A substantial part of EP35 (pp.16-21) and associated reports deal with industrial CHP, and are not considered here.

98. Heat Loads in British Cities, Energy Paper 34 (London: HMSO, 1979), summarised in Ann.2, EP35. Interestingly EP34 asserted the importance of the regeneration of the inner cities for maintaining conditions in which CHP/DH could be introduced, and in particular the commitment of the Labour government's 1977 White Paper Policy for the Inner Cities. 'This is as substantial a guarantee as could be envisaged that CHP/DH would not founder because of impossible social conditions developing within its bailiwick.' (EP34, p.12.)

99. EP35, p.xiii.

100. ibid.

101. W Marshall, 'Whither Now with CHP?', Coal and Energy Quarterly (23), 1979, pp.17-23. See also Marshall, 'Energy Conservation Using Combined Heat and Power', Physics in Technology 11, Mar 1980, pp.46-8, 73.

102. EP35, p.xi.

103. EP35, p.xii.

104. EP35, p.xiv.

105. EP35, p.xiv.

106. EP35, pp.13-14. See also Wright, op. cit. (note 92). In support of such a body, see e.g. I Fells, 'The Administration of Energy and the Role of CHP/DH', AE Haseler, 'National and Regional Heat Boards for Heat Distribution Services', JH Birch, 'National Heat Board: The Way Ahead', papers to 3rd DHA National Conference, A National Plan for Heat, Apr 1979. In opposition, see e.g. the Watt Committee, Select Committee on Energy, Minutes of Evidence, loc. cit. (note 93). The DHA and Haseler in particular had been arguing for a Heat Board much earlier. (e.g. AE Haseler, 'Contribution of District Heating to Energy Conservation Based on Measured Data', HVE 50, Nov 1976, p.10; Haseler, 'The National Heat Board', DHA J (22), Sep 1978, pp.11-13.)

107. J Dart, interview, Feb 1985; R Forman, 'Large Scale Distribution

and Sale of Heat', paper to 3rd DHA National Conference, A National Plan for Heat, Apr 1979; Select Committee, Minutes of Evidence, 8 Mar 1982, HC 60-vii, p.344-5.

108. J Macadam, interview, Nov and Dec 1984.

109. E Clatworthy, Minority Report, EP35, pp.79-82.

110. e.g. N Jenkins, letter, Energy World 44, Jan 1978, p.16; Jenkins, 'British District Heating Report Faces Criticism', Energy International 14, Jun 1977, pp.28-9; K Goldsmith, 'Local Energy Centres: Competition with Public Services', in NJD Lucas, Local Energy Centres (London: Applied Science, 1978), p.153.

111. P Betts, interview, Feb 1985; papers, Feb 1975, in CEGB 118.2.1 and Nov 1976, in CEGB 118.2. On the workinngs of the Marshall Committee, see Select Committee on Energy, Minutes of Evidence, loc. cit. (note 80); and 14 Jun 1982, HC 60-xi, pp.467-9.

112. Parl Deb Comm 982, 2 Apr 1980, c.207-10 (w). For summaries of the events in this section, see G Bevan, 'Progress Report on CHP/DH Development', paper to paper to 4th DHA National Conference, Heating Britain with CHP, Jun 1981; DEn/WS Atkins, Combined Heat and Power District Heating Feasibility Programme: Stage 1, Energy Paper 53 (London: HMSO, 1984), pp.2-3.

113. Bevan, op. cit. (note 112); G Bevan, interview, Jun 1984.

114. Bevan, op. cit. (note 112).

115. ibid.

116. G Bevan, interview, Jun 1984; Parl Deb Comm, loc. cit. (note 112).

117. An account of the procedure is given in WS Atkins and Partners, CHP Feasibility Programme Interim Report: Shortlisting of Cities for Lead City Selection (Dec 1980). Belfast's candidacy was promoted initially by the Department of Commerce for Northern Ireland, and Milton Keynes by its Development Corporation.

118. G Bevan, interview, Jun 1984.

119. 'Note from the Watt Committee', loc. cit., p.225 (note 93).

120. City of Newcastle upon Tyne Planning Dept, 'Combined Heat and Power District Heating: A Local Authority Perspective from the City of Newcastle upon Tyne' (Sep 1979), p.1. For other early responses to EP35 , see proceedings of Scottish DHA conference Combined Heat and Power Networks for Scottish Cities, Livingston 1980.

121. J March, 'Newcastle's Interest in CHP/DH', paper to Energy Costs and Conservation conference, Polytechnic of the South Bank, London, Dec 1981.

122. Parl Deb Comm 989, 7 Aug 1980 c.215-6.

123. Atkins, op. cit., p.5 and Ann.4.1, p.39 (note 117).

124. DEn/Atkins, op. cit., p.3 (note 112).

125. Atkins, op. cit., esp. ch.6, 7, Anns.4.2 and 7.2 (note 117).

126. Ann.7.2, ibid.

127. op. cit. (note 117); 'Atkins Propose Six CHP Cities', Building Services 3, Mar 1981, p.7.

128. ibid., pp.18-22.

129. City of Manchester and Lothian RC, personal communications, Sep 1983; G Roberts, interview, Jan 1985; RA Moodie, 'A Lead City Development Prospectus', paper to 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985; Parl Deb Comm 1000, 12 Mar 1981, c.377 (w).

130. Tower Hamlets LB and Lothian RC, personal communications, Sep 1983; Moodie, op. cit. (note 129).

131. Responses to questionnaires, Sep 1983. See App.7.

132. Parl Deb Comm, loc. cit. (note 129).

133. Parl Deb Comm 7, 23 Jun 1981, c.60-1 (w); DEn/Atkins, op. cit., pp.4-5 (note 112).; ibid., pp.15-18 and App.A. See also CEGB, Combined Heat and Power at Six English Cities (London: CEGB, Apr 1983).

134. The report was eventually published as Energy Paper 53, op. cit. (note 112). Summarised in 'Combined Heat and Power: Atkins Approach', Building Services 4, Oct 1982, pp.33-5; reported in e.g. 'Belfast Chosen in CHP Lead Study', ibid.; J Moss, 'Big City CHP is Now a Hot Prospect', Elec Rev 211, 17 Sep 1982, pp.14-15; R Johns, 'Planning of Urban Heat and Power Schemes Urged', Financial Times, 5 Oct 1982.

135. DEn/Atkins, op. cit., pp.vii-viii and 57-8 (note 112).

136. ibid.

137. Atkins' estimate of national potential, based on a threshold of $20MW_h/km^2$ and $100MW_h$ total load, was lower than the Marshall Group's, however, at $23GW_h$. (ibid., pp.54-6.) Orchard and Macadam argue that it is economic to connect somewhat lower densities in particular circumstances, thereby greatly increasing the potential total. (WRH Orchard and JA Macadam, 'The Potential of CHP/DH as a Major Supply Option for the UK', paper to 5th DHA National Conference, Planning for CHP Heat. Jun 1983.)

138. DEn/Atkins, op. cit., p.58 (note 112).

139. ibid., p.59.

140. ibid., p.60.

141. ibid., p.59.

142. JA Macadam et al., 'District Heating Combined with Electricity Generation: A Study of Some Factors which Influence Cost-Effectiveness' (DEn, 1981); JA Macadam and RJ Brogan, 'District Heating Combined with Electricity Generation: Cost-Effectiveness Factors', IP17/81 (Watford: BRE, Oct 1981). See also DJ Fisk and JA Macadam, 'Optimisation of CHP', in WRH Orchard and AFC Sherratt (eds.), Combined Heat and Power (London: Godwin, 1980), pp.159-72; Orchard and Macadam, op. cit. (note 137); Select Committee on Energy, Minutes of Evidence, 15 Mar 1982, HC 60-viii, pp.395-404. For another case indicating better economics, see G Taylor, 'A Clearer Case for District Heating of Cities', Elec Rev 205, 9 Nov 1979, pp.38-9.

143. G Bevan, interview, Jun 1984.

144. Civil Engineering EDC, 'Prospects for Combined Heat and Power in the UK', Market Brief 12; P Millbank, 'CHP a Multi-Million Pound Market Says NEDO', Elec Rev 213, 16 Sep 1983, p.5.

145. Parl Deb Comm 57, 5 Apr 1984, c.602 (w).

146. ibid. Up to the point when the government's preferred pattern of organisation was made explicit and its ability to enforce it became evident, there had been considerable discussion on organisational forms, accepting for the time the absence of a National Heat Board. See e.g. D Hutchinson, 'Who Should Market CHP Heat?', paper to 5th DHA National Conference, Planning for CHP Heat, Jun 1983; National CHP Liaison Group, 'Administration of Combined Heat and Power for District Heating', drafts; A Atkinson, 'CHP and Our Energy Institutions', NATTA Newsletter, Mar/Apr 1983, pp.27-9.

147. M Smith, 'Lead City CHP Overcomes First Obstacles', Elec Rev 216, 26 Apr/3 May 1985, pp.16-17.

148. P Millbank, 'Government Puts £3/4m into CHP', Elec Rev 214, 13/20 Apr 1984, p.6. See also Editorial, 'Disengaging from Combined Heat and Power', Elec Rev 216, 27 Apr/3 May 1985, p.15; comments on Edinburgh's response, in Moodie, op. cit. (note 129).

149. P Millbank, 'Cities Jostle for Heat and Power Cash', Elec Rev 215, 24/31 Aug 1984, p.5. The one completely private sector application proposed a $15MW_e/35MW_h$ refuse-fired scheme for London Docklands. (JB Thring, 'Refuse-Fired Combined Heat and Power: London Docklands' (Jul 1983); JB Thring, 'Refuse Makes CHP Scheme Viable', Elec Rev 212, 25 Feb 1983, pp.14-15.) See also note 283.

150. Parl Deb Comm 71, 25 Jan 1985, c.547 (w). Edinburgh's 18 month programme started in Apr 1985. At the earliest, the 20 year construction programme might start in 1988. For the terms of involvement, see Moodie, op. cit. (note 129). On Leicester's programme, see Leicester Consortium, 'Combined Heat and Power in Leicester' 'Jul 1984); Smith, op. cit. (note 147); App.5 in Electricity Council, Memorandum 13 in Select Committee on Energy, Minutes of Evidence, 25 Jun 1986, HC 488-i, p.32. Belfast's case had been pursued until the formation of a consortium by the Northern Ireland Economic Council. (CHP Steering Group, Combined Heat and Power: The Belfast Case (Belfast: NI Economic Development Office,

Jan 1984).) The government continued to exert pressure on cities outside the programme to retain private sector involvement: e.g. 'Sheffield Gets Belated Backing for CHP', Elec Rev 216, 26 Apr 1985, p.9.

151. 'Council Abolitions May Threaten CHP', Elec Rev 216, 15 Feb 1985, p.9; Smith, op. cit. (note 147); 'London Loses out on CHP Cash', Building Services 7, Mar 1985, p.5.

152. CHPA, Memorandum 25, in Select Committee on Energy, loc. cit. (note 7).

153. e.g. Parl Deb Comm 56, 12 Mar 1984, c.1-2 (o).

154. W Marshall, Foreword, in EP35, op. cit., p.v (note 36).

155. Select Committee on Energy, Minutes of Evidence, 15 Feb 1982, HC 60-iv, p.111.

156. ibid., p.111.

157. ibid., p.119.

158. Select Committee on Energy, Third Report 1982/3, Combined Heat and Power, HC 314-1 (London: HMSO, Apr 1983), p.39. See also Editorial, 'Foolish Drifting on Energy', Elec Rev 212, 29 Apr 1983, p.15; App.1, Memorandum 12, in Select Committee on Energy, Minutes of Evidence, 25 Jun 1986, HC 488-i, p.13-14.

159. J Moss, 'Make or Break Year for Big City CHP', Elec Rev 208, 12 Jun 1981, pp.16-17; Watt Committee, op. cit. (note 119); P Warner, 'The Long Road to Whole City Heating', Elec Rev 210, 23 Apr 1982, pp.16-17.

160. EP35, op. cit., p.12 (note 36). The concept itself was never well-defined; see e.g. Marshall, Foreword, ibid., p.iv.

161. Bevan, op. cit. (note 112). Critics also argued that concentration on major cities detracted from the possibility of viable schemes for smaller towns. (e.g. CD Chandler, DC Andrews and JH Birch, 'Combined Heat and Power for Small Cities and Towns', paper to 4th DHA National Conference, Heating Britain with CHP, Jun 1981.)

162. cf. the government's approach to proposals for the Severn Barrage. ('Severn Barrage Would Bring £1000m Electrical Bonanza', Elec Rev 219, 25 Jul/8 Aug 1986, p.4.)

163. The stipulation and subsequent pattern of private sector involvement has generated much discussion on financing arrangements and problems. This aspect is not considered in depth in this thesis. See e.g. MH Cadman and RL Cohen, 'Private Sector Financing of CHP/DH Schemes', paper to 5th DHA National Conference, Planning for CHP Heat, Jun 1983; MJN Barnett, 'Provision of Finance: A Merchant Banker's View', paper to 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985; P Millbank, 'What Prospects for Investment in Combined Heat and Power?', Elec Rev 212, 25 Mar/1 Apr 1983, pp.14-15; 'District Heating: Looking for the Fundable Scheme', Elec Rev 213, 15 Jul 1983, pp.17-18; and much of

the discussion in proceedings of the 5th DHA National Conference, Planning for CHP Heat, Jun 1983.

164. Some cities dropped out of the Group, especially following the DEn decision of Jan 1985. Kingston upon Hull City Council joined. (Memorandum 12, loc. cit., p.17 (note 158); FE Woodage, personal communication, Feb 1983; G Roberts, interview, Jan 1985.) See also comments in Moodie, op. cit. (note 129).

165. Memorandum 12, loc. cit. (note 158). A figure of 20% of turnover had been suggested, compared to 2% for the ESI. (CHPA Parliamentary and Local Government Committee, Minutes, 23 Apr 1986; PC Warner, 'The Whole City CHP Assessments', Energy World (137), Jun 1986, pp.2-4.)

166. K Ternent, 'Thoughts on the Power Engineering Industries', unpublished paper, Jan 1979; Porter et al., op. cit., pp.137-8 (note 9); North East Trade Union Studies and Information Unit, 'CHP/DH: A Trade Union Response', undated paper. The account of Tyneside's programme is based on A Smith, interview, Feb 1985; City of Newcastle upon Tyne, op. cit. (note 120); March, op. cit. (note 121); 'CHP/DH: Newcastle's Interest One Year On', in City of Newcastle upon Tyne, Energy: Newcastle Tackles the Energy Problem (1980); City of Newcastle upon Tyne, Gateshead MDC, Tyne and Wear CC, 'Submission to Department of Energy', (Nov 1982); LN Elton, 'Developing a CHP/DH System on Tyneside', paper to 5th DHA National Conference, Planning for CHP Heat, Jun 1983; A Clarke, personal communication, Sep 1983; Hill Samuel and Co for the Association for Tyneside CHP, CHP for Tyneside: A Submission to the Secretary of State for Energy (Aug 1974); Newcastle upon Tyne City Council, Memorandum 8, in Select Committee on Energy, Combined Heat and Power Lead City Schemes: Memoranda, 1985/6, HC 235 (London: HMSO, Feb 1986). Within the City Council, the programme was run for the Economic Development Committee by a small group in the Policy Services Department, supported by an interdepartmental officer working group.

167. City of Newcastle upon Tyne, op. cit. (note 120).

168. 'Submission ...', op. cit., esp. timetable (note 166).

169. ibid.

170. March, op. cit., p.1 (note 121).

171. ibid., p.9.

172. City of Newcastle upon Tyne, op. cit., p.1 (note 121).

173. 'Submission ...', op. cit., (note 166).

174. ibid.

175. ibid.

176. ibid.; Clarke, op. cit. (note 166).

177. ibid.; A Smith, interview, Feb 1985.

178. 'Submission ...', op. cit. (note 166).

179. City of Newcastle upon Tyne, Gateshead MDC, Tyne and Wear CC, Combined Heat and Power for Tyneside: Stage 2 Studies: Content, Organisation, Funding (Apr 1983).

180. A Smith, interview, Feb 1985.

181. Atkins had access to the detailed information compiled for the DEn in Stage 1, and the authorities were reasonably satisfied with its approach. (A Smith, interview, Feb 1985; WS Atkins, 'Tyneside Study' (Mar 1984).)

182. A Smith, interview, Feb 1985; Memorandum 8, op. cit., p.24 (note 166).

183. A Smith, interview, Feb 1985.

184. ibid.

185. Hill Samuel and Co for the Association for Tyneside CHP, op. cit. (note 166).

186. A Smith, interview, Feb 1985; Memorandum 8, op. cit., p.25 (note 166).

187. ibid., p.25; 'Newcastle Goes for CHP', Energy Manager 8, Apr 1985, p.4. Gateshead MDC withdrew from the consortium.

188. A Smith, interview, Feb 1985; Memorandum 8, op. cit., p.25 (note 166).

189. P Millbank, 'Heat and Power is No Match for Gas, CEGB Study Shows', Elec Rev 215, 23 Nov 1984, p.9; AF Postlethwaite and JC Waterton, 'Developments in Converting Power Stations to CHP Operation', paper to 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985.

190. A Smith, interview, Feb 1985; Select Committee on Energy, Minutes of Evidence, 25 Jun 1986, p.21.

191. City of Newcastle upon Tyne, op. cit., p.2 (note 120).

192. On NEI's involvement, see 'CHP: A Manufacturer's Comment', App. II in ibid.; timetable in 'Submission ...', op. cit. (note 166); Select Committee, Minutes of Evidence, 8 Mar 1982, HC 60-vii, pp.351-63.

193. 'CHP/DH: Newcastle's Interest ...', op. cit. (note 166).

194. A Smith, interview, Feb 1985.

195. 'Submission ...', op. cit. (note 166).

196. ibid.

197. ibid.

198. Combined Heat and Power ..., op. cit., p.11 (note 179); Elton, op. cit. (note 166).

199. ibid.

200. A Smith, interview, Feb 1985.

201. ibid.

202. The account of Sheffield's programme is based on: D Lawrence, interview, Jan 1985; Lawrence, 'Developing a CHP Scheme in a Local Authority Area', paper to IEE Conference, Energy Options, London Apr 1984, pp.280-4; Lawrence, personal communication, Sep 1983; Lawrence, 'A CHP Scheme for Sheffield: Technical, Financial and Social Considerations', paper to 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985; Sheffield City Council, Memorandum 9 in Select Committee on Energy, Combined Heat and Power Schemes: Memoranda, 1985/6, HC 235 (London: HMSO, Feb 1986), pp.29-39.

203. D Lawrence, interview, Jan 1985; Lawrence, personal communication, Sep 1983; 'A CHP Scheme ...', op. cit. (note 202). The city's effort was coordinated by the Programme and Energy Controller, responsible to the Chief Executive.

204. D Lawrence, interview, Jan 1985.

205. 'Developing a CHP Scheme ...', op. cit., p.282 (note 202).

206. ibid.; D Lawrence, interview, Jan 1985.

207. DEn/Atkins, op. cit., pp.121-8 (note 112).

208. CEGB Corporate Strategy Dept, 'A Preliminary Feasibility and Economic Study into a Possible Combined Heat and Power Scheme at Sheffield' (Oct 1983).

209. 'Developing a CHP Scheme ...', op. cit., p.282 (note 202).

210. WS Atkins and Partners, 'CHP/DH Studies: Stage 2a: The Core Scheme for Sheffield City Council' (Oct 1983).

211. See also P Millbank, 'Sheffield Could Lead Britain into CHP', Elec Rev 213, 7 Oct 1983, p.5.

212. DEn/Atkins, op. cit., pp.121-8 (note 112).

213. 'Developing a CHP Scheme ...', op. cit., p.282-3 (note 202).

214. D Lawrence, interview, Jan 1985.

215. The studies were completed in early 1986: synopsis in Memorandum 9, op. cit., pp.32-9 (note 202). The ultimate envisaged CGCC configuration is two stations, each of 2 x 30$MW_e$ GTs with waste heat boilers; 1 x 25$MW_e$ BP turbine with DH condensers; air coolers for heat dumping: total capacity 2 x (80.5$MW_e$/76$MW_h$). See also 'Sheffield Runs Strongly in CHP Race', Energy Manager 7, May 1984, p.6; 'Sheffield Looks for Cheap Energy', New Scientist

101, 9 Feb 1984, p.24.

216. Atkins, op. cit. (note 210); 'Developing a CHP Scheme ...', op. cit., pp.280 and 283 (note 202).

217. D Lawrence, interview, Jan 1985.

218. 'Developing a CHP Scheme ...', op. cit., pp.280-1 (note 202).

219. ibid., p.281.

220. ibid., p.281.

221. ibid., p.282; D Lawrence, interview, Jan 1985.

222. Utilicom and Tarmac offered a turnkey package for Sheffield. (D Lawrence, interview, Jan 1985.)

223. D Lawrence, interview, Jan 1985.

224. ibid.

225. ibid.

226. ibid.; Sheffield CHP Consortium, 'Application to the Department of Energy for Grant Towards a Prospectus for CHP District Heating of Sheffield' (Jul 1984); 'Ezra Leads Sheffield Bid for CHP Prize', Energy Manager 7, Jul 1984, p.5.

227. Memorandum 9, op. cit. (note 202); C Porter, 'Sheffield Has Something to Gas About in CHP', Surveyor 165, 2 May 1985, p.2. The pattern of events in London, which will not be analysed in depth here, shows similarities. Southwark has been most active of the LBs and encouraged a response from other Boroughs, and the GLC until its abolition helped coordinate these efforts and promote the option politically. With probably half the national HDHL in the capital, early studies outlined large schemes in one or more Inner Boroughs. Southwark anticipated the DEn programme by commissioning a preliminary study from Orchard Partners in 1979. Orchards envisaged a heat load of over $1GW_h$ served eventually from a coal CHP station at Deptford, possibly with supplementary refuse sources. (LB Southwark Housing Dept, Combined Heat and Power in the London Borough of Southwark (undated); WRH Orchard, 'The Southwark Scheme', paper to Energy Costs and Conservation conference, Polytechnic of the South Bank, London, Dec 1981; 'CHP in Southwark', Consulting Engineer 45, Feb 1981, pp.27-9.) The CEGB cooperated in the Southwark study, assessing stations at Deptford and Bankside. (App.3 in JK Wright, 'Alternative Methods of Electricity Generation', Proof of Evidence to the Sizewell B Power Station Public Inquiry, CEGB/P3 (Nov 1982), pp.47-67.) Atkins preliminary study identified a load of some $1200MW_h$ in Camden, Tower Hamlets and Southwark, and suggested a major CHP station at Barking and possibly a small one at Deptford. (Atkins, op. cit. (note 117).) Atkins Stage 1 considered a load of $965MW_h$ in Southwark and Tower Hamlets, and the CEGB recommended two $170MW_e/275MW_h$ BP sets with $335MW_h$ HOBs at the Barking site. (DEn/Atkins, op. cit. (note 112).) Orchards' plan for the GLC, as used in evidence at the Sizewell Inquiry, covered five Inner Boroughs

and parts of three others, with a load of 2895$MW_h$. The scheme was three times the size of that in Atkins Stage 1 and claimed substantially better results. ('London-Wide CHP Proposals', Building Services 6, Apr 1984, p.7. See also 8.6, esp. note 325.) With the exclusion of London from the DEn programme, the GLC continued evaluations for the Southwark and Tower Hamlets areas. In 1985 consultants were commissioned to look at core schemes, based on the rapid connection of existing DH networks but with the addition of suitable institutional buildings and dwellings with high cost or poor heating systems, such as the high proportion of flats in the ILBs using electric heating. Alternative schemes proposed for the northern and central parts of Southwark were of 80$MW_h$ using a 25$MW_e$/51$MW_h$ GT and costing £19m, and of 130$MW_h$ supplied in part from a 30$MW_e$/75$MW_h$ coal CHP set and costing £55m. For the eastern part of Tower Hamlets, the consultant favoured refuse-fired CHP plant of 68$MW_h$ and exporting 6$MW_e$, at a cost of £44m. The cost of heat in each appeared favourable. Independent financial appraisal suggested private sector funding would be available for a joint private-public venture, and returns would at least meet existing public sector criteria. ('Southwark and Tower Hamlets CHP Studies', App. to CHPA Parliamentary and Local Government Committee, Minutes, 23 Apr 1986.)

228. The contrast with the debate over early postwar legislation is interesting; then outside interests sought to prevent municipal undertakings being subsidised in any way from other sources. On the general problems of structuring finance, see e.g. A Lawson, 'CHP Funding Considerations', paper to 4th DHA National Conference, Heating Britain with CHP, Jun 1981.

229. D Lawrence, interview, Jan 1985; A Smith, interview, Feb 1985.

230. D Lawrence, interview, Jan 1985.

231. Newcastle's former Director of Policy Services suggested a liaison committee in each authority which would meet regularly with the company; specific programmes of action devised by each appropriate department and committee to tie in with the phased development of the scheme; and the location of parts of the company's design work in local authority offices. (Elton, op. cit. (note 166).)

232. Advocates of CHP continued criticism in the technical press and elsewhere: e.g. N Jenkins, 'The Unjustified Neglect of Combined Heat and Power', Science and Public Policy 9, Feb 1982, pp.28-34; B Wood, 'Economic District Heating from Existing Turbines', Proc Inst Civ Eng 77, Feb 1985, pp.27-48. For responses, see G England, 'Use of Reject Heat from Power Stations', DHA J (24), Mar 1979, p.16; England, CHP: From Debate to Practical Progress (London: CEGB, Jan 1982); Sizewell B Power Station Public Inquiry Transcripts 64, 12 May 1983.

233. ACEC, EP15, op. cit., p.9 (note 58).

234. DEn, The Structure of the Electricity Supply Industry in England and Wales: Report of the Committee of Inquiry, Cmnd.6388 (London: HMSO, Jan 1976), p.21.

235. ibid., p.51.

236. ibid., p.21.

237. ibid., p.21.

238. ibid., p.51.

239. ibid., p.21.

240. Draft Electricity Bill, Ann.B in DEn, Reorganisation of the Electricity Supply Industry in England and Wales, Cmnd.7134 (London: HMSO, Apr 1978), esp. 3(1)(g), (4)(b) and (c) (App.6); P Betts, interview, Feb 1985; papers, Jul 1977, in CEGB 118.2.

241. Select Committee on the Nationalised Industries, Ninth Report 1977/8, Reorganising the ESI: Pre-Legislative Hearings, HC 636 (London: HMSO, Jul 1978). The clauses did not appear in the subsequent consolidating Bill for the Scottish Boards in 1979. (Electricity (Scotland) Act 1979, ch.11.)

242. GT Shepherd, interview, Feb 1985; Shepherd, 'The Organisation of Electricity Supply in the UK: A Personal View', IEE Proc 130, Pt.C, May 1983, pp.148-9.

243. Commons 2nd Reading: Parl Deb Comm 32, 24 Nov 1982, c.865-943; Commons Committee G: 7 Dec 1982 - 15 Feb 1983; Commons 3rd Reading: Parl Deb Comm 38, 8 Mar 1983, c.715-808; Lords 2nd Reading: Parl Deb Lords 440, 28 Mar 1983, c.1409-28; Lords Committee: 441, 19 Apr 1983, c.477-506; Lords Report: 442, 3 May 1983, c.10-29; Energy Act 1983, ch.25.

244. Parl Deb Comm 32, 24 Nov 1982, c.865-7.

245. e.g. Commons Committee G, 7 Dec 1982, c.47.

246. R Budden, interview, Dec 1984. The ESI had earlier strongly resisted any encroachment on its statutory monopoly: e.g papers, Jan 1973, in CEGB 118.2.1.

247. Parl Deb Comm 32, 24 Nov 1982, c.884.

248. ibid., c.893, 907.

249. Commons Committee G, 7 Dec 1982, c.41.

250. Commons Committee G, 15 Feb 1983, c.475.

251. ibid., c.478. See also Parl Deb Lords 440, 28 Mar 1983, c.1417.

252. Commons Committee G, 15 Feb 1983, c.478; Energy Act 1978, s.19.

253. Parl Deb Comm 38, 8 Mar 1983, c.790.

254. Parl Deb Lords 441, 19 Apr 1983, c.498-500. The proposer had also wanted 'promote'. (Select Committee on Energy, Minutes of Evidence, 25 Jun 1986, HC 488-i, p.53.)

255. Commons Committee G, 10 Feb 1983, c.456, and 15 Feb 1983,

c.475. See also Parl Deb Lords 441, 19 Apr 1983, c.500-2. In addition the provision s.5(4) was inserted during the Bill's passage (App.6).

256. Commons Committee G, 15 Feb 1983, c.472; P Betts, interview, Feb 1985.

257. P Betts, interview, Feb 1985; J Dart, interview, Feb 1985. On the interpretation of s.19, see Select Committee on Energy, op. cit., pp.50-6 (note 254).

258. Parl Deb Lords 440, 28 Mar 1983, c.1412.

259. Parl Deb Lords 442, 3 May 1983, c.28.

260. loc. cit. (note 258).

261. 'Group View of Electricity Supply Industry Policy Relating to Private Generation', Ann.4 in EP35 (note 36). See also papers, Jun 1977, in CEGB 118.2.

262. EP35, pp.xi, xiv (note 36).

263. J Dart, interview, Feb 1985; J Macadam, interview, Nov and Dec 1984; Merz and McLellan, Memorandum, in Select Committee, Minutes of Evidence, 8 Feb 1982, HC 60-iii, pp.50-2.

264. 'Sources of Purchased Electricity', CEGB/S/821(Rev), Jul 1983, Sizewell B Power Station Public Inquiry; Electricity Council, Memorandum to Select Committee on Energy, Feb 1982, in Minutes of Evidence, 8 Mar 1982, HC 60-vii, p.330.

265. Select Committee on Energy, Minutes of Evidence, 22 Feb 1982, HC 60-v, pp.212-14.

266. Select Committee on Energy, Third Report ..., HC 314-1, pp.36-8, 41 (note 158).

267. ACEC, Fifth Report to the Secretary of State for Energy, Energy Paper 52 (London: HMSO, 1983), p.39.

268. GJ Fowler, 'Electricity Tariffs for Private Generation', in Electricity Council, CHP Bureau brochure (1984); C Gronow, 'The Energy Act 1983: The Tariff Structure', paper to CBI Conference Combined Heat and Power: New Opportunities for Industry, Oct 1983.

269. B Wilkins, 'Electricity Tariffs and the 1983 Energy Act', paper to 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985; P Millbank, 'Purchase Tariffs Scuttle Energy Act', Elec Rev 215, 29 Sep 1984, p.4; Editorial, 'Monopoly Reluctance', Elec Rev 215, 2 Nov 1984, p.15; 'Industrial CHP Founders on Restrictive Tariffs', Elec Rev 216, 21 Jun 1985, p.4. The industry stressed the continuity of the principles of calculation of the tariffs before and after the Act (Memorandum 13, loc. cit. (note 150)) but the assessment of avoided costs remained contentious. For the unit charge, marginal costing should ideally give no discontinuity between the buying and selling rates; yet there remains a 20% difference. Given, as Shepherd argues, roughly 10% transmission and distribution

losses in the public system, the private generator is effectively being penalised by some 30%. (GT Shepherd, 'CHP: The UK Situation', HVE 58 (670), 1985, p.19; Shepherd, interview, Feb 1985.) The actual AB tariffs appeared to some critics to be a mixture of marginal costs, average costs, recovery of assets, investment in distribution and other miscellaneous costs. (Macadam, interview, Nov and Dec 1984.) The most contentious element has been the capacity credit, or often lack of it. (e.g. Select Committee, Third Report..., HC 314-1, p.37 (note 158).) Generally the excess capacity on the supply system has suppressed capacity credits. The exact effect in capacity terms of introducing a CHP station depends on the present and projected state of the system. There can be a credit or debit attributable to the station accordingly. (For schemes operated by the ESI, it also depends on a view of whether the projects compete for capital; the ESI maintains there is no such competition.) The marginal cost to the system is thus a NEC formed of two elements: the avoided costs from the early retirement of old plant, which predominate in the short term; and in later years the effective cost of deferred investment in new plant when such would be required. The capacity credit should be related to one or other element of the BST capacity charge. The industry maintains it should be the basic capacity charge; critics argue it should be the peaking charge since it is effectively the NAC over a year, allowing the early retirement of an equivalent capacity of old plant. The capacity charge has declined considerably over the past few years, with the basic charge falling from £45/$kW_e$ in 1981 to £31/$kW_e$ in 1984. A capacity credit is incorporated in the AB Energy Act tariffs by an additional variation in the unit charge with time of day; thus 'payment for capacity is automatically credited at a level commensurate with the pattern of the generator's output.' The capacity credit thus incorporated in the unit rate is equivalent to £28/$kW_e$. The EC maintains that the real value to the ESI is only about £5/$kW_e$. (J Macadam, interview, Nov and Dec 1984; R Budden, interview, Dec 1984; Fowler, op. cit. (note 268); Gronow, op. cit. (note 268); CEGB, op. cit. (note 133); P Millbank, 'The Thinking Behind Private Power Tariffs', Elec Rev 213, 4 Nov 1983, pp.16-17.)

270. J Macadam, interview, Nov and Dec 1984; Electricity Council, Memorandum 13, loc. cit., p.34 (note 150).

271. D Lawrence, interview, Jan 1985; J Dart, interview, Feb 1985; J Macadam, interview, Nov and Dec 1984. See also note 299.

272. App.3 in Wright, op. cit. (note 227).

273. See section 8.4. CEGB, 'Unit Size (Rating) for Lead City CHP Plant', May 1982, App.6 in Select Committee on Energy, Third Report ..., HC 314-2, op. cit. (note 158).

274. ibid.; App.3 in Wright, op. cit. (note 227); JF Dart and JRW Talbot, 'The CEGB's Role in CHP Development', Atom (342), Apr 1985, pp.9-14.

275. DEn/Atkins, EP53, p.10 (note 112).

276. ibid., pp.15-18 and Ann.A; CEGB, op. cit. (note 133).

277. CEGB, op. cit. (note 273); Postlethwaite and Waterton, op. cit.

(note 189). The Board later appeared quite enthusiastic about the possibilities of long distance heat transmission, as against new CHP plant. (CEGB, Annual Report and Accounts, 1984/5, p.31.). On another method of long distance heat transport, see an earlier suggestion of hot water barging from Hunterston to Glasgow: JS Oakes and AF Rogers, paper to 2nd DHA National Conference, Better Energy Investment: the Role of District Heating, Mar 1977, extracts in 'Combined District Heating and Power Generation: Can This Be Viable in the UK?', HVE 51, May 1977, pp.10-15. The Hartlepool suggestion and the associated shift in the CEGB's thinking on conversion of large stations thus raised as a practical proposition the possibility of nuclear CHP. The idea was raised in the early postwar years as soon as a civil nuclear programme was proposed. The technics of nuclear CHP or HO/DH has been discussed frequently, often drawing on foreign experience (e.g. RME Diamant and D Kut, District Heating and Cooling for Energy Conservation (London: Architectural Press, 1981), ch.7; S Wrigley, 'Nuclear Reactors for District Heating', paper to IEE conference Energy Options, Apr 1984.) The MPBW assessed long distance heat transmission from Sizewell (AE Haseler, interview, Jun 1982) and the CEGB at least considered ITOC sets for nuclear stations in the 60s though finding the capital costs prohibitive. (CM Johnston and VG Newman, 'Combined Heat and Electricity Generation for Disrict Heating', in EM Ackery (ed.), Electricity and Space Heating (London: Blackie, 1965), pp.344-5.) So long as heat supply from remote stations was considered uneconomic, however, the idea remained somewhat academic. Proponents of CHP/DH could be expected, of course, to be strongly divided on the idea.

278. Postlethwaite and Waterton, op. cit. (note 189); SSEB and Kennedy and Donkin Associates, 'Combined Heat and Power Associated with District Heating: A Study of Alternative Schemes for Edinburgh and Glasgow' (May 1983).

279. G Roberts, interview, Jan 1985. See also C Caufield, 'New Jobs for Old Power Stations', New Scientist 94, 17 Jun 1982, p.778; Parl Deb Comm 32, 15 Nov 1982, c.44; CEGB, Memorandum, in Select Committee, Minutes of Evidence, 8 Mar 1982, HC 60-vii, p.306.

280. Electricity Council, 'The Electricity Supply Industry's Role in Combined Heat and Power' (Mar 1984); Electricity Council, CHP Bureau brochure (1984); RJR Budden and DL Tolley, 'The Role of the Electricity Supply Industry in CHP', in ibid.; R Budden, interview, Dec 1984; Memorandum 13, loc. cit., pp.26-46 (note 150) and Minutes of Evidence, loc. cit., pp.46-56 (note 150); DGC Gronow, 'The Impact of the Electricity Act for CHP Users', paper to Energy Week, Polytechnic of the South Bank, London, Jun 1984; 'EC Opens CHP Bureau', Energy Manager 7, Mar 1984, p.6; J Cogle, 'Electricity Boards Gear Up to Push Industrial CHP', Elec Rev 214, 10 Feb 1984, p.5.

281. Dart and Talbot, op. cit. (note 274); JK Wright, CEGB/P3, op. cit. (note 227). Other statements continued to imply a more passive role - that the CEGB's duty was the 'promotion of individual schemes, as and where they arise ...' (Transcripts, loc. cit. (note 232).)

282. J Dart, interview, Feb 1985; Dart and Talbot, op. cit. (note 274).

cf. its earlier stance: Transcripts, op. cit. (note 232); England, CHP ..., op. cit. (note 232).

283. J Dart, interview, Feb 1985. The CEGB Midlands Region and the EMEB are now involved with the Leicester consortium. (App.5, loc. cit. (note 150).

284. See 8.5.

285. See 8.5.

286. D Lawrence, interview, Jan 1985; A Smith, interview, Feb 1985; Memorandum 8, loc. cit., p.27 (note 166); Memorandum 12, loc. cit. pp.20-1 (note 158).

287. Sheffield City Council, Memorandum 9, op. cit. (note 202); D Lawrence, interview, Jan 1985. The EC claimed the CEGB suggested joint operation of the CGCC station with BGC. The CEGB and Yorkshire Electricity Board produced an assessment of the alternative Sheffield schemes in May 1986. (Memorandum 13, loc. cit. (note 150).)

288. CHPA Parliamentary and Local Government Committee, Minutes, 23 Apr 1986. See also note 257.

289. On the CEGB's involvement in aquaculture and horticulture projects using waste heat from power stations, see App.3, loc. cit., pp.48-9 (note 227).

290. Notes of meeting, 3 Apr 1981.

291. J Alton, 'Brighton CHP Conversion "Could Save £27m"', Elec Rev 216, 10 May 1985, p.9.

292. App.5 in Memorandum 13, loc. cit. (note 150); P Millbank, 'Corby Power Scheme Looks Good on Paper', Elec Rev 213, 4 Nov 1983, p.9; J Alton, 'First Large Private CHP for Corby', Elec Rev 216 22 Feb 1985, p.6; D Coleman, 'Area Board Joins CHP Syndicate', Power News, Nov 1984, p.20.

293. App.5 in Memorandum 13, loc. cit. (note 150); P Millbank, 'Eastern Board Supports Industrial CHP Venture', Elec Rev 215, 19 Oct 1984, p.5; 'CHP Group Asks Customers to Sharpen Pencils', Elec Rev 217, 20 Sep 1985, p.9.

294. J Dart, interview, Feb 1985.

295. DEn, 'Industrial CHP Schemes by Area Electricity Boards', App.1 in Select Committee on Energy, Third Report ..., op. cit., HC 314-2 (note 158); 'Well Advanced at Fort Dunlop', DHA J (39), Jun 1983, p.12; Electricity Council, App.5 in Memorandum 13, loc. cit., pp.32-3, 44-5 (note 150). Capital costs for the Dunlop scheme were estimated at £14m in 1981, and a return of 18% was expected. As with Hereford, the DEn asked the MEB to consider complete coal firing, but higher capital costs and technical problems ruled it out. The scheme replaced a gas-fired heating system. Note the comparisons of unit capital costs for Hereford and Fort Dunlop: £450/$kW_e$ and £650/$kW_e$, compared to £700/$kW_e$ for conventional

coal stations and £1000/$kW_e$ for nuclear stations. (JD Lycett, 'Combined Heat and Power', 2nd Congress of Civil Engineers, Proc Inst Civ Eng I 78, Jun 1985, p.566.)

296. Electricity Council, Memorandum 13, loc. cit., p.32 (note 150). On problems of economic assessment, see Select Committee on Energy, Minutes of Evidence, 24 Nov 1982, HC 60-i, p.27.

297. The Boards identified a potential load of some 180$MW_h$/1800$TJ_h$/y out of 800$MW_h$ within 1km of possible canal routes for mains. Attempts to sell the station were abandoned in Apr 1984 and the station was dismantled. (Postlethwaite and Waterton, op. cit. (note 189).

298. J Dart, interview, Feb 1985. As for use of the transmission system by private generators, there were several enquiries but no significant use by the end of 1984, reinforcing the view of sections of the industry that the provision was unnecessary. (P Millbank, 'Energy Act Proves a Slow Starter', Elec Rev 213, 2 Sep 1983, pp.14-15; Cogle, op. cit. (note 280); Millbank, 'Purchase Tariffs ...', loc. cit. (note 269); T Sacks, 'Energy Act Fails to Attract Private Generators', Elec Rev 214, 13/20 Apr 1984, p.7.)

299. Balfour-Beatty and Taylor Woodrow. With the tariffs offered by the ESI, including what was regarded as a low capacity credit, the Carmarthen scheme failed to show a 5% rate of return, let alone the 15% deemed necessary for private sector backing. The proposers considered the scheme had been thwarted by the offer. (P Millbank, 'Plymouth Power Station to Go Private', Elec Rev 213, 21 Oct 1983, p.9; 'CEGB Tackles First Case of Privatisation', Technology 7, 24 Oct 1983, p.25; Editorial, op. cit. (note 269); CHPA Parliamentary and Local Government Committee, Minutes, 16 Jan 1985.)

300. R Budden, interview, Dec 1984.

301. ACEC, EP52, op. cit., pp.33-4, 36-9 (note 267); T Sacks, 'Private Heat and Power Utilities Advocated', Elec Rev 214, 6/13 Jan 1984, p.8.

302. ACEC, EP52, p.33.

303. ibid., p.39.

304. ibid., p.39.

305. A Tweedale, 'A Private Utility's View of Industrial Combined Heat and Power', paper to CBI conference Combined Heat and Power: New Opportunities for Industry, Oct 1983; Tweedale, paper to Energy Week, Polytechnic of the South Bank, London, Jun 1984.

306. 'Power Station Helped Make "The Dump" Prosperous', Elec Rev 187, 25 Sep 1970, p.447; D Clifford, 'The Slough Estates Scheme', Consulting Engineer 43, Aug 1979, pp.39-43; D Clifford, R Coates and A Park, 'Repowering of Slough Estates for Optimum Energy Conversion', Proc Inst Mech Eng 194, 1980, pp.279-89; FTF Wiggin, 'The Effect of the Energy Act on a Private Utility Operating in the Public Sector', paper to CBI conference, loc. cit. (note 305);

FTF Wiggin, 'Utility Services for Industry at Slough: CHP at Work', paper to conference Local Power and Heat Generation: A New Opportunity for British Industry, Open University, Apr 1982; Select Committee on Energy, Minutes of Evidence, 11 May 1982, HC 60-ix, (London: HMSO, May 1982).

307. Select Committee, Minutes of Evidence, loc. cit., pp.410-12 (note 306).

308. G Rufford, 'Small Scale Combined Heat and Power Systems', HVE 59, 1986, (675) pp.10-13, (676) pp.20-4; P Millbank, 'Small Scale CHP Moves into Britain?', Elec Rev 209, 6 Nov 1981, pp.30-1; Millbank, 'Market Blossoms for Micro CHP', Elec Rev 213, 23 Sep 1983, pp.16-17; C Linnell, 'Combined Heat and Power Can Slash Fuel Bills', New Natural Gas, Sep/Oct 1984, pp.22-3.

309. D Andrews, 'Micro Cheap Power', Energy Manager 9, Jan 1986, pp.48-50; Andrews, letter, and other letters, Energy Manager 9, Jun 1986, pp.17-19.

310. 'Energy Efficiency Put to the Test', Housing 21, Mar 1985, p.26; P Millbank, 'Energy Department Seeks Multiple CHP Projects', Elec Rev 214, 6 Apr 1984, p.4.

311. Millbank, op. cit. (note 308).

312. Andrews, 'Micro ...', op. cit. (note 309).

313. G Johnston, letter, Energy Manager 9, Apr 1986, p.17.

314. P Millbank, 'Best Year Yet for Micro CHP', Elec Rev 214, 3 Feb 1984, p.3; Linnell, op. cit. (note 308). The introduction of a system of spot-pricing of electricity could make a significant difference for small generators. See e.g. J Cogle, 'Spot Pricing of Electricity', Elec Rev 208, 26 Jun 1981, pp.16-17; Electricity Council, '"Spot Pricing" for Electricity', Memorandum 26 in Select Committee, Third Report ..., op. cit. (note 158).

315. 'Energy Act Has Little Impact CEGB Says', Elec Rev 216, 22 Feb 1985, p.7.

316. EM Hammond, DR Helm and DJ Thompson, Competition in Electricity Supply: Has the Energy Act Failed? (London: Institute of Fiscal Studies, 1986); T Dawn, 'Has the Energy Act Failed?', Elec Rev 218, 14 Mar 1986, pp.12-13.

317. DEn, op. cit., p.A28 (note 24); FP Jenkin, 'The Need for Sizewell B', Proof of Evidence to Sizewell B Power Station Public Inquiry, CEGB/P4, pp.29-31 and tables.

318. D Hutchinson, 'GLC Interest in Energy Supply', Proof of Evidence GLC/P1, p.2, citing GLC, 'Energy Policy', Report PR144 to Policy and Resources Committee, Feb 1979.

319. Hutchinson, op. cit., p.12 (note 318); GLC, 'Electricity Generation in London', Report PC748 to Planning and Communications Policy Committee, Feb 1981.

320. On safety issues, the GLC had 'lost "confidence in nuclear technology" ... as suitable for siting in any part of its region.' Its earlier 'confidence in the CEGB's interpretation of accident risks ... was undermined by overseas experience of the PWR and, indeed, by increased understanding of the risks of nuclear power generation generally.' (Hutchinson, op. cit., p.9 (note 318).)

321. Hutchinson, op. cit. (note 318); J Macadam, 'The Development of Combined Heat and Power with District Heating in London', GLC/P2; C Moorcraft with S Hodgkinson, 'Public Sector Investment in Domestic Conservation versus Investment in Sizewell B', GLC/P3; F Nectoux, 'Electricity Use in London and the Potential for Electricity Conservation', GLC/P4; N Mason, 'The Macro-Economic and Employment Effects of Different Energy Investment Options', GLC/P5.

322. ibid., pp.15-16; Select Committee on Energy, Minutes of Evidence, 22 Feb 1982, HC 60-v, pp.179-81.

323. See note 227.

324. Hutchinson, op. cit., p.19 (note 318).

325. Orchard Partners, The Development of Combined Heat and Power with District Heating in London, 11 reports 268/1/R0-10 (Oct 1983); Macadam, op. cit. (note 321).

326. ibid., pp.41-2.

327. ibid., p.1.

328. Sizewell B Power Station Public Inquiry Transcripts 64, 12 May 1983, pp.11-12.

329. Addenda to Macadam, op. cit. (note 320), esp.GLC/P2/Add.3; J Macadam, interview, Nov and Dec 1984.

330. ibid.

331. Macadam, op. cit., pp.12-18 (note 320); Macadam, interview, Nov and Dec 1984; JW Baker, 'CEGB Policy', Proof of Evidence CEGB/P1, pp.32-3; Transcripts 64, 12 May 1983, 116, 7 Oct 1983, 139, 17 Nov 1983, and 140, 18 Nov 1983 ; App.3 in Wright, op. cit. (note 227).

332. Macadam, op. cit., pp.15-17 (note 320); CEGB, 'Capital Cost of the Bloom Street Scheme', CEGB/S/810, Jul 1983; Transcripts 64, 12 May 1983. Paradoxically, the SoS for Energy subsequently denied that there were any constraints on investment in CHP by nationalised industries. (Select Committee on Energy, Minutes of Evidence, 4 Dec 1984, HC 87-i, pp.10-11.)

333. Transcripts 139, 17 Nov 1983, and 140, 18 Nov 1983.

334. J Macadam, interview, Nov and Dec 1984; Macadam, op. cit., pp.19-43 (note 320); addenda to GLC/P2.

335. Transcripts, loc. cit. (note 333).

336. Transcripts 64, 12 May 1983, and 116, 7 Oct 1983.

337. J Macadam, interview, Nov and Dec 1984.

338. Transcripts, 116, 7 Oct 1983; Macadam, op. cit., esp. pp.52-8 (note 320).

339. ibid., pp.50-1; J Macadam, interview, Nov and Dec 1984.

340. Dart and Talbot, op. cit. (note 274).

341. DEn, EP35, op. cit., p.xii (note 36). See Levermore's comparison of 1970 with 1983 costs, using the DHA's hypothetical 'Thermville' exercise: GJ Levermore, 'Group Heating Schemes', Building Services Engineering Research and Technology 6 (1), 1985, pp.7-12; DHA, Thermville: An Exercise in District Heating (1976). See also GLC, Industry and Employment Committee, 'Report and Recommendations on Developing an Alternative Energy Strategy for London', 7/IEC663, 24 Jan 1983. On consumer acceptance in general, see A Rew, 'Consumer Acceptance of Community Heating Schemes', paper to 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985. On improvements, see e.g. P Heslop, 'Lower Bills for Brent', Public Service and Local Government 15, Feb 1985, p.20.

342. AB Birtles and RD Fisk, 'R & D Requirements for CHP', paper to 4th DHA National Conference, Heating Britain with CHP, Jun 1981; 'Further Work, Including R & D Requirements', Ann.11 in DEn, EP35, op. cit. (note 36).

343. JA Macadam and PS Woods, 'Developments in the Metering and Control of Heat Distribution Systems', paper to 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985.

344. GC Towler, 'Developments in Metering' (Mainmet, 1986); 'Big Order Boost for Mainmet', DHA J (36), Aug 1982, p.12; 'Mainmet Launch New Token Meter', DHA J (38), Mar 1983, p.7.

345. J Macadam, interview, Nov and Dec 1984.

346. E Clatworthy, 'The Future Uses of Gas', paper to 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985. In late 1984, BG was making supplies available at prices based on HFO, some 40% cheaper than its earlier prices based on light oil. (P Millbank, 'Purchase Tariffs ...', op. cit. (note 269).)

347. J Macadam, interview, Nov and Dec 1984.

348. From 1982 the govenment instructed the industry to increase its prices by 10% above the rate of inflation. It still anticipated increased demand. (Clatworthy, op. cit. (note 346).) See Apps. 10 and 11.

349. L Penzer, 'A Coal Industry View', CHPA J, Jun 1984, pp.3-6; DEn/Atkins, op. cit. (note 112).

350. See also D Merrick, 'Future Coal Utilisation Technologies', paper to 6th CHPA National Conference, CHP: Developments and Decisions,

Jun 1985.

351. CHPA Parliamentary and Local Government Committee, Minutes, 23 Apr 1986.

352. 'Fuel from Waste: Byker Heat Plant Breakthrough', DHA J (27), Jan 1980, p.13; 'Cheap Joules for the Byker Heating Scheme', Heating and Air Conditioning Journal 49, Dec 1979, pp.38-9; 'How Britain's Muck Can Save Fuel and Make Money', Financial Times, 15 Mar 1984.

353. N Barnes, 'Energy From Rubbish: The Mass Incineration Plant at Edmonton', paper to Energy Costs and Conservation conference, Polytechnic of the South Bank, London, Dec 1981 ; CA Belcher and BHH Fordham, 'Electricity Generation and Refuse Disposal: The GLC Edmonton Plant', IEE Conference Publication 73, 1970, pp.61-6; N Barnes, 'Edmonton Settles Down to Reliable Power Generation', Elec Rev 209, 2 Oct 1981, pp.29-31. Early problems at Edmonton persuaded the GLC to postpone further such systems ('GLC One-Day Conference "Talking Rubbish"', DHA J (29), Sep 1980, pp.12-14) but it later considered buying the Belvedere power station and converting it to refuse firing. ('Powering London on its Rubbish', Technology 8, 6 Aug 1984, p.14.)

354. WA Clennell and DT Lowe, 'The Contribution to Energy Conservation of a National Refuse Disposal Policy', paper to 5th DHA National Conference, Planning for CHP Heat, Jun 1983. A 1979 report from the Waste Management Advisory Council was discouraging, however: Working Party on Waste as Fuel, Energy from Waste (1979). In England and Wales in the early 80s, of a total of around 27Mt of refuse of which 17Mt was collected by local authorities, some 9% was incinerated, and less than 1% separated before incineration. (CIPFA, Waste Disposal Statistics: 1984-5 Actuals (London: CIPFA, 1985 and previous years.) See also Thring, op. cit. on a refuse-fired scheme for East London (note 149).

355. WRH Orchard, 'Time for a Change of Name?', DHA J (39), Jun 1983, p.2; P Millbank, 'New Name for Old Campaigner', Elec Rev 213, 2 Dec 1983, p.8.

356. G Bevan, interview, Jun 1984; G Roberts, interview, Jan 1985; J Macadam, interview, Nov and Dec 1984; LR Pincott, talk to DHA Open Meeting Feb 1977, 'Is There a Future for District Heating in the UK?', HVE 51, Mar 1977, pp.13-14.

357. Select Committee on Energy, Minutes of Evidence, 1 Mar 1982, HC 60-vi, pp.276-7, 282.

358. e.g. WRH Orchard, 'CHP: The Nine Star Energy Option', Chartered Mechanical Engineer 32, Jan 1985, pp.34-7.

359. A Smith, interview, Feb 1985; D Lawrence, interview, Jan 1985.

360. The list of groups supporting the Charter for Energy Efficiency launched in 1986 is indicative. (Charter for Energy Efficiency pamphlet.) See also R Edwards, Still Out in the Cold: Combined Heat and Power in Britain (Energy Inform / Charter for Energy Efficiency, Mar 1986)

361. N Jenkins, Electricity: The Alternative to Nationalisation (London: Aims of Industry, 1970).

362. e.g. P Rost, 'The Case for CHP', Coal and Energy Quarterly (36), 1983, pp.17-22; Rost, 'CHP: What Role for Government?', paper to Energy Costs and Conservation conference, Polytechnic of the South Bank, London, Dec 1981; Rost, paper to 4th DHA National Conference, Heating Britain with CHP, Jun 1981; Rost, 'A Parliamentary View', paper to conference Local Heat and Power Generation: A New Opportunity for British Industry, Open University, Apr 1982; 'District Heating Plan', Elec Rev 194, 19 Apr 1974, p.398; Select Committee on Energy, Minutes of Evidence for sessions on CHP, 1982/3 and 1986.

363. Calls for a more comprehensive and interventionist government energy policy continued to come from certain parts of the private sector: e.g. MB Page, opening address, 6th CHPA National Conference, CHP: Developments and Decisions, Jun 1985; M Smith, 'Government Slammed on Energy Policy', Elec Rev 216, 21 Jun 1985, p.4. cf. the FBI in period II, 6.8 esp. note 417.

364. The DHA/CHPA and local authorities have sought and in many cases obtained the support in Parliament of local MPs.

365. Select Committee on Energy, Third Report, 1982/3, Combined Heat and Power, 2 vols, HC 314-1 and -2 (London: HMSO, Apr 1983). See also 'Government's Attitude to CHP Seen as Irresponsible', Elec Rev 212, 29 Apr 1983, p.18; Editorial, op. cit. (note 158); 'CHP Could Take Risk Out of Heating', Elec Rev 212, 22 Apr 1983, p.6.

366. Select Committee, Third Report ..., HC 314-1, p.1.

367. ibid., p.41.

368. ibid., p.41.

369. ibid., p.41.

370. 'The Government's Reply to the Select Committee on Energy's Report on Combined Heat and Power (CHP)', App. in Select Committee, Sixth Report, 1983/4, The Government's Response to the Committee's Third Report (Session 1982/3) on Combined Heat and Power (London: HMSO, May 1984).

371. Sixth Report ..., ibid.

372. TUSIU, Jobs from Warmth: the Campaign for Combined Heat and Power (Jun 1981); Jobs from Warmth: Brighton CHP/DH Study (1982). On CHP/DH in Ipswich, see Orchard and Macadam, op. cit. (note 137).

373. 'Labour Party Pledges Support', DHA J (27), Jan 1980, p.4.

374. Ince, op. cit., pp.41-6 (note 3); D Elliott, Trade Union Policy and Nuclear Power, Open University Technology Policy Group Occasional Paper 3 (1981); TUC Review of Energy Policy (London: Trades Union Congress, Aug 1981); C Sweet and A Coote, 'Frank Chapple's

Fantasy', New Statesman, 20 Nov 1981, pp.6-8; Porter et al., op. cit., pp.71-8 (note 9); 'NUM Support for Marshall', DHA J (30), Dec 1980, pp.14-15.

375. e.g. Friends of the Earth, 'Combined Heat and Power in the UK', App.19 in Select Committee on Energy, Third Report ..., op. cit., HC 314-2 (note 365); SERA, Combined Heat and Power (undated pamphlet). CHP/DH has continued to figure centrally in alternative energy scenarios as they have been more fully developed in the late 70s and early 80s. See esp. D Olivier et al., Energy Efficient Futures: Opening the Solar Option (London: Earth Resources Research, 1983). See also Porter et al., op. cit., ch.6 (note 9), comparing the ERR report and earlier alternative scenarios.

376. e.g. National Right to Fuel Campaign and others, 'The Social Benfits of Combined Heat and Power', App.22 in Select Committee, op. cit. (note 365).

377. On employment implications of energy options, see D Elliott, Energy Options and Employment (London: NELP/CAITS, 1979), esp. pp.23-30 on CHP/DH; Mason, op. cit. (note 321); City of Newcastle upon Tyne, op. cit. (note 120); SERA, 'The Employment Implications of Combined Heat and Power', App.23, loc. cit. (note 365).

378. e.g A Atkinson, op. cit. (note 146); Atkinson, 'Changing the Institutions', Energy Manager 6, Apr 1983, p.22. Since the formation of consortia and the acceptance of that particular form for present activity, such broader discussion has been marginalised and attention concentrated on allowing some development within existing structures or with minimal reforms.

Chapter 9

1. For other useful discussions on CHP and DH in Britain in institutional and political terms, see W Rüdig, 'Energy Conservation and Public Utilities: A Comparative Analysis of Organizational Obstacles to CHP/DH', Energy Policy 14, Apr 1986, pp.104-16; Rüdig, 'Combined Heat and Power for District Heating: An Anglo-German Comparison of Structural Obstacles to the Adoption of a Technology', Physics in Technology 17, 1986, pp.125-31; Rüdig, 'The Comparative Politics of Energy Conservation: Actors and Influence in Britain and West Germany', paper to Annual Meeting of American Political Science Association, Washington, 30 Aug - 2 Sep 1984; NJD Lucas, 'CHP and the Fuel Industries', in WRH Orchard and AFC Sherratt, Combined Heat and Power: Whole City Heating (London: Godwin, 1980), pp.59-78; Lucas, 'Combined Heat and Power', in RIPA, Facing the Energy Future: Does Britain Need New Energy Institutions? (London: RIPA, 1981), pp.27-32.

2. P Dunleavy, Urban Political Analysis: The Politics of Collective Consumption (London: Macmillan, 1980), pp.50-3. Dunleavy's classification of gas and electricity as 'services' is questionable. See chapter 4, note 264, on collective consumption.

3. This is not to say that advocacy of CHP and DH has necessarily been associated with progressive political demands. See 8.7 on the spectrum of political support. The options have often been associated with paternalistic and technocratic forms of planning.

4. In particular, in times of high awareness of energy matters, it has been argued that projects should be evaluated in energy terms; that is, if the efficient use of energy is uneconomic then the fault lies with the economics. The idea has seldom been taken up outside academic and environmentalist circles, and in opposition the primacy of conventional economics has been successfully reasserted by government and industry. See e.g. 7.2, notes 206-9.

5. See note 1.

6. In turn, it has been assumed that all critics infer malice and subscribe to conspiracy theory to explain the exclusion of the option. (e.g. PC Warner, 'The Whole City CHP Assessments', Energy World (137), Jun 1986, p.3.) The argument in this thesis is, of course, that first, while conscious opposition cannot be ruled out, it is not necessary to impute such to hold that institutional factors are responsible, nor, second, is that adequate as explanation.

7. NJD Lucas, 'The National Case for Local Production of Heat and Power in Parallel with the Public Supply of Electricity', Applied Energy 2, Jul 1976, pp.225-36; Lucas, 'The Case for Combined Heat and Power in the UK', Energy Research 2, 1978, pp.29-42.

8. J Macadam, interview, Nov and Dec 1984. See also J Ross, 'CEGB "Running Scared" of CHP', Elec Rev 217, 25 Oct 1985, p.9.

9. e.g. RA Peddie, 'CHP: A Utility's View', in NJD Lucas, Local Energy Centres (London: Applied Science, 1978), p.70; JE Platt and MN Eggleton, 'Merit Order Influence', DHA J (11), Dec 1974, pp.18, 26, 42.

10. CP Swain, paper to Construction Industry Conference, London, Nov 1975, cited in N Jenkins, 'Europe Shows a Way as Britain Reviews Electricity Act', Energy International 13, Apr 1976, p.25.

11. Papers, Mar 1949, in POWE 14/264.

## Chapter 10

1. JK Benson, 'A Framework for Policy Analysis', in D Rogers and D Whetten (eds.), Interorganizational Coordination (Iowa State UP, 1983), p.148. See 3.4.

2. NJD Lucas, 'The National Case for Local Production of Heat and Power in Parallel with the Public Supply of Electricity', Applied Energy 2, Jul 1976, pp.225-36; Lucas, 'The Case for Combined Heat and Power in the UK', Energy Research 2, 1978, pp.29-42.

3. See chapter 3, note 124.

4. See chapter 8, note 378.