WHO'S IN POWER?

A Comparative Investigation of the Forces shaping British and Danish Energy Policy 1950-1980

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ABSTRACT.

Tine Andersen: Who's in Power? A Comparative Investigation of the Forces shaping British and Danish Energy Policy 1950-1980.

The aim of the thesis is to establish a framework for evaluating current trends in energy policy through an historical analysis of British and Danish energy policy. The focus of the thesis is on changes in the issues, objectives and methods of state energy policy. For each country, these changes are recorded and sub-periods characterized by stability of goals and methods are identified. A comparison between the countries shows similarity both as regard period characteristics and time of transition to another approach. Investigating the development of political activity related to energy it is found that changes in energy policy have reflected the ideas of different political groups in the period. Furthermore it is found, that these ideas reflect the cahnging character of energy-related problems. An investigation into the development of economic and resource conditions indicate that these conditions are themselves influenced by energy policy. The role of technological change is then investigated and again it is concluded that energy technological change reflects state energy policy. Hence, it is concluded that it is not possible to isolate one single set of causes which will allow us to explain why the focus of energy policy has changed across time. Considering the applicability of different theories of social change to this problem, it is concluded that a non-determinist theory is necessary in order to explain the observed changes. Taking as a starting point the trial-and error theory of social change developed by V. C. Petersen, a framework for further analysis is presented.

CONTENTS:

PREFACE

The present thesis is the most recent result of a process, which started back in 1979 when I was completing my cand. scient. degree at the Geographical Institute, University of Aarhus. Until then, my work had mainly been within fields related to planning and planning theory. Consequently I approached energy policy from a planning point of view. I was mainly interested in establishing whether the anti-nuclear movement in Denmark had influenced the outcomes of Danish energy planning since 1960. By comparing the objectives and issues of state energy policy with energy political proposals made by the most important political groups since 1960, I found, that parallel to the campaigns of the anti-nuclear movement, successive governments displayed increasing hesitation to adopt nuclear power in the Danish energy supply. At the same time an increasing number of political groups were seen to engage themselves in attempts to influence the objectives of state energy policy after 1973. Along with this, the objectives and methods of state energy policy changed. During the 1960s the policies addressed each fuel or power industry as a separate entity, and matters today being considered energy political were dealt with under the auspices of a number of different government departments. In contrast, after 1970, 'energy policy' was introduced, and emphasis was on the need for long term planning and coordination. Also the idea that choice of energy technologies ought to be informed by analyses of the external effects of each technology gained growing support from the early 1970s, in particular as regarded possible environmental effects.

All these observations pointed towards a wide-ranging change in the way society conceptualized and solved problems related to energy. The implications of this, however, were only tentatively touched on in the cand.

scient. thesis. But when I was given the chance in 1982 by the University of Aarhus to continue research within this field, it was natural to pursue in more depth and width themes related to change in the energy policy field.

A fellowship from the Faculty of Natural Sciences, Aarhus University enabled me to register for the degree of Ph.D. at the Department of Town Planning, Oxford Polytechnic, where I stayed and worked from 1982 to 1984. A grant from Statens samfundsvidenskabelige Samfundsråd, Danmark, permitted me to make a number of visits to the Geographical Institute which collaborated in the degree.

A large number of people were involved in the work along the way. Glen McDougall, Department of Town Planning, was my supervisor. She contributed her insight into British politics, and through exacting and scrupulous criticism as well as valued linquistic assistance she tried to add consistency and legibility to the argument. Verner C. Petersen, Geographical Institute, was my second supervisor. From his work the main ideas of the thesis as presented in chapter six were derived. His contribution extends far beyond what can be demanded of a supervisor. Apart from the long discussions to which he lent his critical faculties and interest in my work, he kept me on the track, seeing to it that I never relaxed the demands on myself.

The thesis could never have been completed without the collaboration of the institutions and groups whose policies I have described and analyzed. Everywhere I have been met with interest and willingness to provide me with the information I needed. Also the research teams at the Sizewell Inquiry Project at the University of East Anglia and the Power Stations Impact Project at Oxford Polytechnic were most helpful in supplying information.

Along the way various fora presented themselves for discussion of themes related to the thesis. In particular the

Politics, Philosophy and Economics seminar series and the Research Seminars at the Department of Town Planning were sources of inspiration; and at the Geographical Institute, the students participating in my seminar series "Technology: Power or Participation?" endured lengthy discussions which helped in clarifying the argument. While my participation in the activities of the women's group at the institute is not reflected directly in the argument, it helped me to put my problems as a woman researcher into perspective.

Friends and colleagues, often the same thing, cared for me and my work in different ways. In particular my best friend, my husband Kurt Bøje, believed in me, bore with me and kept loving me through it all.

My father offered me a place to work, where disturbances were kept at a minimum, which was indispensable. Lillian Jagd typed it all with great speed.

Thus, although I did not have the access to the services of 'the researcher wife' which, it appears from male researchers' acknowledgements, include typing, proof-reading, childcare and cooking, I have received more support than I had dared wish for.

A few comments on the form of the thesis. The evidence used in the analysis is mainly verbal, e.g. in the form of quotations. This is in part due to the nature of the investigation, which emphasizes changes in attitudes. Also I prefer verbal evidence to tables and figures as I find that it aids fluency of argument. The drawback is that it adds to the length of the thesis. I have therefore, especially in chapter four, supplemented the verbal evidence with tables and diagrams. Whereever possible, quotations are from English and American editions; otherwise I have translated the quotation into English myself, again in order to achieve fluency. Finally, I have chosen to use the

pronoun 'we' throughout as an indication that knowledge and insight are always results of processes involving more than one person. Notes appear at the end of each chapter.

1. INTRODUCTION

1.1 Background.

The present inquiry into changes in the energy policy field may be viewed as a continuation and extension of previous work[1] on the development of the Danish energy policy field since 1960. Out of this work grew a realization that the energy policy field had been transformed through a number of developments which had occurred during a short period of time around 1970. The character of state energy policy had changed in terms of both its expressed objectives, its issues and its methods. This change was accompanied by the emergence of an anti-nuclear movement as the earliest indication of the importance increasingly being attached to energy by political groups. Finally, the role of theory in the energy policy field seemed to have changed. We had observed that theoretical literature on aspects of energy policy had grown explosively.

These observations highlighted an interesting problem: while the energy sector is increasingly subjected to attempts at detailed, long-term state planning, the understanding of the forces which influence changes in the policy field is limited. In spite of the turbulent developments of the past, state energy policies as well as different 'alternative energy strategies' of the 1970s indicated a trust in the ability of society to control all relevant aspects of energy supply and consumption in the future. We felt that in a situation where energy research seemed predominantly concerned with feasibility, there was a need for a more broadly based analysis which would allow us to explain changes in the energy policy field. In order to evaluate the prospects, for instance, for the alternative strategies, we would suggest that knowledge

must be gained about the processes which connect the intentions of political groups, the intentions underlying state energy policies and the tangible results in the energy policy field. Hence the main intention has been that of establishing a theoretical framework for understanding changes in energy policy in terms of a historical process.

1.2. Aim of Thesis.

The aim of the thesis is to describe and compare the historical development from 1950-80 of the energy policy field in Denmark and Britain in order to establish which factors have contributed to changes in the field and to establish, through this analysis, a framework for evaluating the current trends in the energy policy field.

If we want to explain changes in the energy policy field, we shall first have to locate and specify these changes. Hence, a subsidiary aim of the thesis is to identify and describe changes in the energy policy field between 1950-80.

Which factors may influence the energy policy field? If we accept that state energy policy to some extent structures the energy policy field, we may look for factors influencing energy policy. Leaving aside theoretical reflection for a moment, we will observe that a number of political collectives (political parties, fuel and power industries, anti-nuclear groups, other interest groups) all attempt to influence policy. We will also observe that the proposals of these groups as well as the policies themselves are related to a particular section of existing reality, having to do with economic conditions, fuel sources, energy supply, consumption etc.

In short, we may identify two types of factors which must

be assumed to play a role in changing energy policy: 'those who act', i.e. political collectives or groups, and 'that to which they react', the structure of at any given time the energy policy field.

In this context, the collective ideas of these groups about the energy policy field are important. We want to investigate the relationship between ideas in energy policy and the ideas of political groups in order to locate the sources of policy assumption.

These considerations, together with the results of previous work, led to the formulation of a set of hypotheses, which specify causal connections between energy policy, political groups and structural conditions. In addition, hypotheses about the underlying process of change were derived from work done by Petersen (1985) on planning and social change.

1.3. Hypotheses

Following the results of the work on Denmark, we expected to find a similar development in Britain. In Denmark a politicization of the energy policy field was marked by the emergence of new political groups trying to influence state energy policy, widening out of the range of issues in energy policy and a conflict over the objectives of energy policy exemplified in the emergence of large numbers of alternative proposals for policies. This led us to formulate the first hypothesis:

1. Between 1950 and 1980, the energy policy field in both Britain and Denmark became politicized.

On the basis of the discussion above, we want to suggest that political groups, as well as economic and energy-related conditions, influence changes in the energy policy field. Changes in the actual structure, including economic

conditions, access to energy resources, and existing methods of energy production and consumption, are expected to be reflected in energy policy to the extent that they are picked up as problems by political groups. Hence:

2. Changes in the energy policy field are influenced directly by political groups.

If this is the case, any particular state energy policy will reflect attempts by specific political groups at impressing their version of energy policy problems and objectives upon the state's activities in the field. Groups presently attempting to influence energy policy include political parties, industries within and outside energy production, trade unions and different types of interest groups, in particular environmental and anti-nuclear groups. Hence:

3. The objectives, issues and problems of state energy policy reflect objectives, issues and problems identified by specific political groups.

We have indicated that in Denmark the development of the energy policy field was characterized by the emergence of new groups addressing aspects of energy production and consumption which had until then not been included into energy policy formulation. Following the argument above, we want to suggest that the emergence of these groups reflect altered conditions in the provision of energy. We would suggest that problems in the access to energy resources, changes in the relative prices of fuels as well as rises in the price of energy relative to the income level prompt political activity to overcome the economic problems created by such changes. Hence:

4. The emergence of new groups in the energy policy field and changes in the attitudes of existing groups reflect changes in the material conditions in the field.

In addition to this, the Danish experience shows that the new groups in the field to a large extent focused on the negative aspects of particular energy technologies, espe-

cially nuclear power. We would therefore suggest:

5. The emergence of new groups in the energy policy field and changes in the attitudes of existing groups reflect reactions to negative experiences of energy technologies on the environment as well as on social conditions and quality of life.

We suggest that the conditions related to energy prices and the experience of energy technologies are to a large extent common to Western Europe, including Denmark and Great Britain. Hence we would expect a parallel development of the energy policy field in the two countries. We would therefore suggest that

6. The development of state energy policy in terms of objectives, issues and methods is parallel in Denmark and Great Britain.

In addition to these hypotheses which address the relationship between changes within the energy policy field, we want to examine the following hypotheses which are derived from Petersen's (1985) work on change in social systems, in order to evaluate whether they can add to our understanding of change in the energy policy field:

7. The process underlying changes in the energy policy field is assumed to contain elements of trial and error.

This would imply that the changing attitudes of different groups are to be interpreted as reactions to conditions which, on the basis of the expectations of the members of the groups, are experienced as negative.
In addition, we want to suggest that fundamental social and technological conditions like (potential or real) inconsistencies between behaviour at the micro level and perceptible results of the aggregate of such behaviour at the macro level imply that, except in the very short term, the effects of any policy which seeks to universalize a particular pattern of behaviour will lead to results which are in conflict with the original intentions. Hence:

8. Any attempt at purposive, long-term state control of

the energy sector will lead to counterfinal results whose nature is in principle unforeseeable.

If this framework is adopted, it will be of consequence for our evaluation of the practicability of proposals for changing today's energy policies.

1.4 Method.

Examination of the hypotheses stated above demands a translation of some of the rather abstract categories, e.g. 'energy prices', 'environmental groups' into more specific ones. In addition, we need to specify the conditions under which we will consider the statements made in the hypotheses plausible. In short, a method needs to be specified.

As we are putting forward elements of a new theory about change in the energy policy field, we can not employ any one single established theoretical framework for our examination of the hyptheses. In addition, the nature of the hypotheses is such that we cannot expect to establish any of them as a truth in a positive sense. At the most, we can hope to establish a certain plausibility of our hypotheses by showing that they represent a consistent explanatory framework over a long period of time as well as across different countries. By using a comparative and chronological perspective we also eliminate the need for considering key persons or other nationally specific circumstances as important sources of change.

In order to examine the hypotheses, we need a perspective which will allow us to inquire into changes in the relationship between energy policy, activities which influence energy policy and the conditions which make up the object of energy policy.

The first requirement of such a perspective is conceptual

clarity. We need to know what we are talking about, when we write 'energy policy' and ' the energy policy field': we need definitions. We need, however, to be careful in defining too rigidly social and political phenomena which we want to investigate across a long period of time. We shall have to be aware of the historical situation in which the definition is made[2]. If we are not, our definitions may give rise to theoretical myopia, which prevents us from understanding why energy policies of the past were different than those of today. We will end up imposing our interpretation of what energy policy ought to be like on the policies of the past as e.g. Lindberg (1977 II) does here:

> "To speak of "energy policy" in the 1945-75 period is almost a misnomer. Energy considerations have been subordinated to other policy goals - primarily to maintaining economic output and national power. By and large, energy policy has only very recently emerged as a distinct area of concern in its own right. What has passed for energy policy is a collection of decisions and nondecisions that have had their genesis in efforts of public and official actors to cope with other policy concerns that inevitably have energy implications. Decisions have been taken in other spheres on the basis of criteria internal to them, and the energy consequences have toted up afterwards." (Lindberg, 1977, II, p. 333).

Whereas we do not want to cast doubt on the correctness of Lindberg's observation, the narrow definition of energy policy which they imply is insufficient when we want to explain these changes rather than just evaluate their result. We need to make sure that our definitions are sufficently wide to allow us to 'see' the problems to which the policies of the past could be seen as adequate answers, and we need to make sure that our definitions do not prevent us from seeing the whole range of objectives, issues and methods of the energy policies of the past.

We have already indicated that we want to differentiate 'the energy policy field' from 'energy policy'. 'Energy

policy' will be reserved solely for state activities. We need, however, to specify further what we mean by 'energy policy' in order to differentiate from other policy types. Lindberg (1977 I) suggests, on the basis of an observation of the traditional role of energy policy, that it has to do with

> "(...) government and industry activities relative to the several stages (...) of the supply of the various forms of energy (...) needed for individual and collective consumption and for industrial production." (Lindberg, 1977, I, p.4).

Although this definitions is quite broad, it is insufficient for our purpose. Lindberg's inclusion of industry as energy policy makers is probably due to the fact that British energy industry is largely nationalized. We shall, however, maintain a definition of energy policy as official state policy which is subject to parliamentary control. Thus, although the industries may influence or even determine the content of state energy policies, they do not have the official policy making capacity. We may also observe that Lindberg does not include activities towards energy consumption, which represent an important component of today's energy policies. In order to avoid these problems, we shall have to allow in our definition for variations in the energy policy field which is addressed by state energy policy. Upon these considerations, we shall now define energy policy as follows:

Energy policy consists of state activities relative to the stages of supply, distribution and consumption of energy as well as to issues which are at any time defined as relevant in relation hereto.

This indicates that the policy field is not static. This definition does not imply any evaluation of the efficiency of a particular energy policy. Energy policy is simply described as a certain type of state activity towards a

policy field. As the term energy policy is reserved for state activities, the activities of e.g. the anti-nuclear movement or the power plant industry are not included under the heading of energy policy. Instead we shall examine how and to which degree these groups influence state activities.

Having established the main categories of the inquiry, we need to specify the principles of the investigation. Above it has been indicated that a dynamic approach has to be adopted. We shall need to consider the problems that have been dealt with by energy policy over a period of time, look for changes in the range and character of these problems and from this extract implications for our understanding of the processes involved. As noted above, our understanding of the process is important for our interpretation of the attempts to solve today's energy political problems. Therefore, in order to understand the future of energy policy it is necessary to relate the history of energy policy, not in an anecdotal way but with the clear purpose of uncovering the processes which created the conditions facing today's attempts at purposively changing the direction of energy policy.

Only a clear account of the historical succession of events and policies will show whether it is warranted to interpret this process as one of a series of trials and reactions to experienced 'errors' in relation to expectations. Hence, chronology is a main structuring principle of the investigation. The main drawback of chronological accounts is the risk of emphasizing historically specific detail at the expense of the analysis of the nature of the socio-historical processes of which the specific details are only elements. Whenever this is the case, the chronological account ends up as a set of anecdotes or a 'story', the historical account is reified and the reader is left to draw the implications for her own time and the problems at hand. Energy political literature abounds with

stories of failures of the past serving as background for proposals for reform[3].

In order to explain change, however, it is necessary that the clear demarcation between energy policy, those who influence energy policy, and that which they want to change by means of energy policy is upheld within the chronological framework. Taking this into consideration, we have chosen to describe the historical development within each of these categories rather than describing the development of the entire energy policy field simultaneously. This means that a description of the development of energy policy is followed by a description of the development of the activities of political groups in relation to energy policy and so forth. The events of one period will therefore be described several times, as seen from different angles.

The analysis aims to cover the period from 1950-1980. The work on Danish energy policy had suggested that political conflicts related to nuclear power were an important component of the observed politicization of energy. This implied that we looked back to the origin of civil nuclear power and investigated the policies which favoured an introduction of nuclear power. In addition, a preliminary literature review[4] pointed to the 1950s and early 1960s as the end of an era of market control of energy. The investigation might have been brought further back. However, the World Wars are considered in this context to represent periods of abnormal social and economic conditions[5] as are the immediate post-World War II years when energy shortages were still prevailing in most nations (Chesshire et.al. 1977). It must be emphasized, however, that the choice of period is fundamentally pragmatic. It may be necessary to follow certain trends further back than 1950 in order to understand their origins. Generally, however, 1950 is taken as the starting point for our discussion. Similarly, 1980 is chosen as the end point in order to be

able to distance ourselves from the issues. The discussions of the day are often not accessible in a form which allows a broad analysis of actors and issues, and keeping abreast of energy political developments in Denmark and Britain in order to be up to date would demand more resources than are at the disposal of the present project. Finally the preceding argument should have made it clear that being up to date is not crucial to the argument which we want to advance.

The analysis must allow us to evaluate the relations between the development of energy policy and the different factors which may have caused this development. A comparison between at least two nations allows for an assessment of the importance of local events and single centrally placed or otherwise influential persons as opposed to the influence of e.g. world market trends or wider-ranging ideological shifts, as observed by Lindberg (1977):

> "To the extent that particular factors appear systematically as causes or consequences in nations as different as these (the anthology contains studies of energy policy in Britain, Canada, France, Hungary, India, Sweden and the United States. T.A.) we will be more confident of their explanatory (and predictive) powers". (Lindberg, 1977, I, p.2).

We have limited the comparison to two nations: Britain and Denmark. The differences between these countries mean that the above argument can still be considered valid, yet the limitation has made it possible to analyse the development of energy policy in each country in some detail.

Considerable amounts of material on Danish energy policy were readily available, and it seemed obvious to seek to extend the scope of the project by extending the investigation to another country and a wider time-span. For comparison, Britain was chosen. The country which was to be compared to Denmark should be different in respect to energy resource access, as similarities across countries

different in this respect would rule out an automatic relationship between the material basis and the form of energy policy. On the other hand a certain similarity in respect to basic political and economic structures was desirable, as this would ease the task of analysing the policy system itself. This does not imply, that the theses are only expected to hold for parliamentary-type democracies within a capitalist economy[6]. It was, however, stipulated that the additional gains in theoretical insight which might be offered by choosing a country exhibiting a completely different political context, would be outweighed by the extra burden on analysis which the demand for a thorough understanding of this context would represent.

In order to investigate the assumption that changes in the energy policy field are influenced by political groups and that new groups have appeared in this field in the 1950-1980 period, a further specification of the meaning of 'political groups' is needed. We deliberately use the term 'political groups' to avoid terms like 'decisionmakers' or 'pressure groups'[7]. Such terms focus on the relationship of a group to the procedures of formal political decisionmaking. But making decisions or exerting pressure on the institutions who make these decisions is not the same thing as changing energy supply and consumption in the real world. Dividing the population into decisionmakers, pressure groups and the general public obscures the difference between political institutions and the political interests and ideas that are expressed through these institutions; and by focusing narrowly on institutionalized politics, they may prevent us from perceiving the implications of political activities outside the institutions.

Hence, 'political groups' or just 'groups' is used to denote groups of individuals who act purposively to influence the development of the energy field through in-

fluencing the political system. It is important to remember that in addition these individuals influence the energy system directly through their activities as consumers and producers. When we discuss, the groups, however, we are predominantly interested in their purposive attempts to change energy policies at the national level.

A further systematization of possible types of groups was desirable in order to provide for a structured search. The preliminary literature review gave rise to identification of the following wide classes of groups:

1) Political parties have traditionally provided for individuals wanting to impress a particular version of 'the national interest' onto policies.

2) Industrial interests, including energy industries, which in both countries have been deeply involved in energy decisionmaking (see e.g. Gowing, 1978; Ince, 1981; Rasmussen, 1983), and industries outside the energy sector itself, which could be expected to seek to influence energy policies at least insofar as these concerned the price of energy.

3) Trade union interests, including trade unions with members in energy industries, which could be expected to seek to protect the interests of those members; and other trade unions, which could be expected to seek to influence those aspects of energy policy, e.g. employment, of direct interest to their members.

4) Other interest groups, including environmental groups, which could be expected to seek to influence the aspects of energy policy related to the environmental impact of energy production, and other interest groups who could be expected to seek to influence energy policy insofar as it touched on the main issue of the group.

Upon identifying these groups, a method was needed to enable an evaluation of their role in relation to state energy policy beyond that determined by their formal position in relation to state energy decisionmaking.

After having recorded the development of issues, problems and methods in state energy policy, we want to establish the origin of new problems and new ways of interpreting them and trying to solve them. 'Political influence' as such can never be established with certainty[8], but we can establish whether particular problems are identified by particular groups before they turn up as problems for energy policy, and whether the objectives and methods employed by energy policy are parallel to objectives and methods proposed by particular groups. To do so, we need to record for each of the classes of political groups mentioned above its 'energy political history'. For each class this history will include an account of the range of groups within the class involved in energy policy. This will allow us to estimate the degree of politicization of energy. It will also include an account of the groups' approach to energy policy in terms of problems, issues and solutions to problems related to energy, which will then be compared to the development of energy policy in order to establish parallels.

The emergence of new problems will also be compared to the actual development of the energy policy field. If new issues can be shown to arise from identification by particular groups of actual problems related to the actual conditions in the energy policy field, this will provide important support for the suggestion that the process underlying changes in the field contains elements of trial-and-error.

The method of recording for each group those problems, issues and methods seen by the group itself as relevant to energy policy cannot be stringently applied, as it raises

the question of the group's own definition of the policy field. This becomes clear when it is remembered that it is assumed that coherent state energy policies were not attempted at a large scale before the late 1960s. Hence it is not to be expected that before this time any group would have formulated issues in terms of 'energy policy'. Therefore, we have had to employ our definition of energy policy as mentioned above for this period.

The next step is relating the political expression to the material conditions. In order to assess the importance of these conditions as well as the impact of state energy policy on the material conditions, we need to specify how these conditions have developed through the period. 'Material conditions' are here understood as conditions related to energy as well as more general economic conditions. As it is assumed that energy prices have been an important factor in influencing the development of energy policy, the development of the price structure in the energy sector has to be recorded for both nations. Similarly the development of the resource base needs to be described in terms of access to indigenous sources and dependence on energy imports, in order to assess whether this element had significantly affected energy policy. Finally, the structure of consumption should be described in order to assess the implications of changes here.

We have suggested that an important class of problems in energy policy is related to effects of energy technologies on the physical environment as well as on social structures. Hence, an investigation into different ideas about state control of technology as well as actual attempts at establishing institutional frameworks for controlling technology was considered important. A comparison between this debate and the issues raised in energy policy by the political groups would then show if an extraction of specific themes and issues was possible, and again the chronology should help us to establish the origin of the for-

mulation of these themes.

The elements described above together make up the energy arena. This arena we define as follows:

The energy arena is a social space in which political groups define the issues they see to be relevant to state energy policy. These issues are assumed to contain as one element identification of problems and as another formulation of solutions to these problems.

Thus the energy arena represents at any time the range of attempts of groups in society at purposively influencing the aspects of energy that are considered to be of national importance.

Descriptions of the development of state energy policy, changes in the energy arena and material changes in the energy field together make up the components for an inquiry into the process underlying changes in the energy field as well as changes in attempts at social regulation in this field.

The amount of recent research on political, economic and institutional constraints on the free scope of state energy policy is considerable[9]. In contrast, research is scant when it comes to investigating the development of the energy policy field in terms of the changing relationship between that which is regulated - society's production and consumption of energy - and the regulatory mechanisms employed. This observation will be examined in chapter six - for now it will have to stand as a postulate. It implies, however, that we shall concentrate first on establishing the nature of the changes in the energy policy field as far as possible independently of later evaluations of these changes. We simply want to record chronologically the development of the objectives, issues and methods of state energy policy, what it is and what it should be like, again in terms of objectives, issues and methods.

The sources for an investigation of this type have yet to be discussed. In order to gain knowledge about the energy policy field and identify major changes in the field in both countries, historical analyses[10] of the development of energy policy were consulted. This led to identification of further sources of the changing objectives and issues of state energy policy, including state energy policy documents. These were then consulted in order to identify issues and locate them within a chronological framework. From the resulting description of the historical development of state energy policy in the two countries, a periodisation could be derived, which could then serve as the basis for examining whether changes between periods in energy policy reflected changes in the energy political activities of the political groups.

As for the groups, it follows from the aim and hypotheses of the present investigation, that our main focus should be on the group's attempts to influence the objectives and methods of state energy policy, again posited within a chronological framework. While more traditional sociological analyses, analysing political actors in terms of socio-economic background variables such as class, income, education, sex or age[11], have been of some help in identifying at different times the range of groups involved in activities to do with energy, our concern with the historical process means that we have had to look for sources to the issues advanced by the groups in relation to energy. Evidence of these issues, including the group's interpretation of the process, of energy policy and its own role in relation hereto, is to be found in the records of the groups themselves. Important sources of the attitudes and activities of political groups has thus included: policy documents on energy; proposals for alternative energy strategies; annual reports; public relations or information documents on energy and finally informal interviews with members of different groups. Sources of the material conditions include mainly sta-

tistical data on energy production and consumption as well as on the economic aspects of energy.

Sources of information on the question of the social control of technology include policy documents from Denmark and Britain as well as from other nations and organisations.

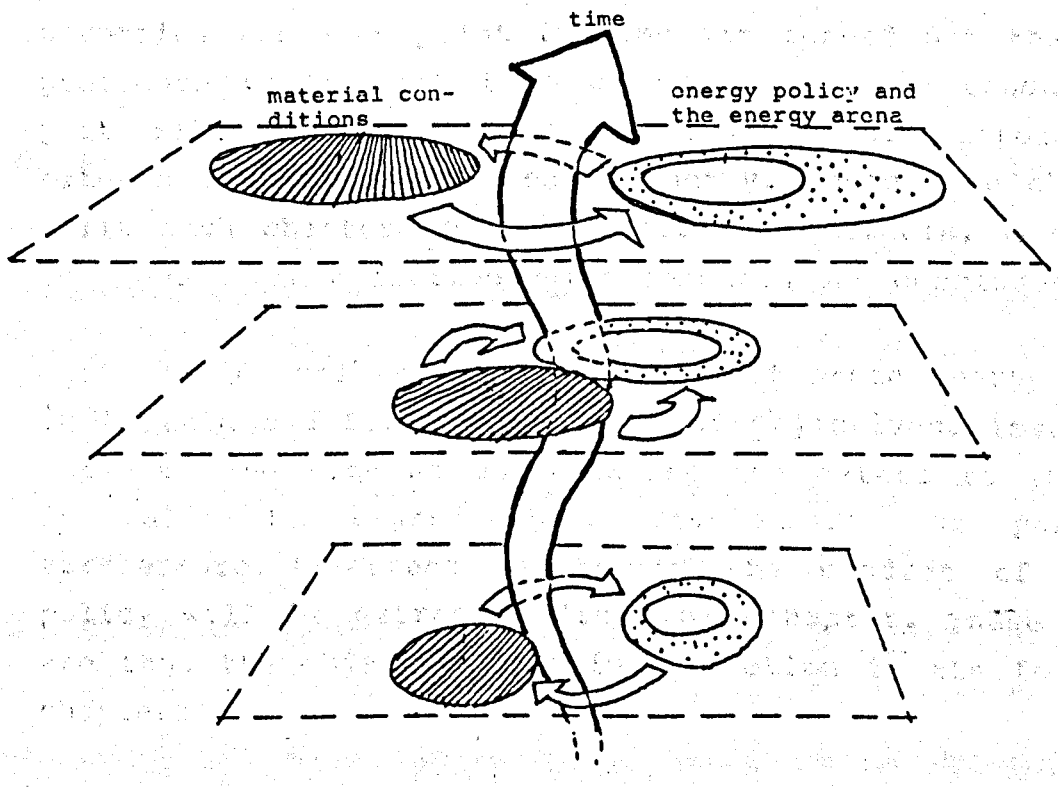
These sources are supplemented with academic analyses of the different phenomena: of groups in energy policy, of the politics of technology and of the relation between energy policy and economy. Such analyses are assumed to reflect, at any time, a contemporary interpretation of the issues, problems and relevant actors. The academic literature is thus understood as a generation's reflection, at a given point in time, of its own problems and solutions. Hence, we expect to find in the academic literature a range of issues parallel to those identified by the political groups; but in addition we would expect to find here the role of the political groups reflected. Generally speaking, theoretical elements which address any specific part of the analysis will be considered in the course of the investigation. Particularly the analysis of political groups give rise to consideration of different theories of political decisionmaking as well as to suggestions that the emergence of new types of political actors signify a paradigm shift from a set of values and world views oriented towards economic growth to a growing emphasis on environmental and non-material values[12].

1.5 Structure of the thesis.

It has been the intention, that the structure of the thesis should itself reflect the aim and suggestions made above. Fig.1 sums up in a graphical form these suggestions. Here, energy policy and the energy arena are depicted in a chronological structure. The vertically

oriented line represents time; its slightly winding course indicates the suggested non-linearity of historical processes. The intersecting horizontal planes represent 'snap-shots' of, on the one hand (hatched circles) material conditions related to energy, on the other (dotted circles) attempts at political control of these conditions. Here, the large circle represents the energy arena, whereas the smaller circles within these represent state energy policy. The increase towards the present in size of these circles illustrate the hypothesis that energy has been politicized during the period. The dots represent the political groups, and the increase in the number of dots reflect the hypothesized increase in the number of groups engaged in energy political activities.

Fig. 1.1 Energy Politics in a Chronological Framework



In the language of this graphic representation, the thesis aims at investigating the nature of the invisible lines connecting one set of planes to the succeeding set as well as the connections between the planes within the specific period in order to add to our understanding of what these relationships may look like in the future.

The succession of chapters within the thesis reflects the main structuring principles described above. Four chapters each deal with one aspect of the development of the energy policy field: the development of state energy policy; the development of the energy arena; changes in conditions related to the economy, resources, energy production and consumption; and the emergence of problems related to the effects of technology. Within each of these chapters, the chronological principle is employed, so that the chapter describes the development within the particular aspect during the 1950-1980 period. Ideally, this principle should have overruled the comparative principle, so that parallels could be drawn between the countries for each point in time. It turned out that this procedure would mean that we would have to renounce in part illustrating clearly the relationship across time between the policies of each country. Instead we chose to split each chapter up in a section on Britain, a section on Denmark and a section which compares and concludes.

Chapter 2 describes the development of state energy policy in Britain and Denmark in terms of objectives, issues and methods and aims at establishing the extent to which it is valid to regard these developments as parallel. Furthermore important breaks in the conduct of energy policy will be extracted from this chapter. These breaks are thus the object of the investigation in the following chapters.

Chapter 3 describes the development of the energy arena in terms of the political groups. The issues brought forward

by political parties, energy industries, industry outside the energy sector, trade unions and other environmental and energy groups are recorded and compared to the issues we have found to be important in chapter 2.

Chapter 4 describes the material conditions in the energy field as they have presented themselves to the political groups as well as to the single energy consumer or producer. Again the emphasis is on establishing correspondence with the problems and issues identified by the political groups and with the attempts at state control.

Chapter 5 is devoted to a discussion of political reactions to effects of technology. The development of problems stemming from the unintended effects of technology is illustrated by recording technology-related problems as these are identified by policies addressing energy technology in general. We shall also discuss different proposals which have been made for solving these problems and compare the ideas inherent in these proposals to the ideas and objectives of energy policy.

Chapter 6 which pulls together the threads in an inquiry into the process of change in a policy field. Changes in energy policy, as found in chapter 2, are evaluated on the background of the development of the arena, the material conditions and the effects of technology. In this context, the questions of the relationship between intentions and effects/results and between the micro and macro levels of society are important and will be discussed at some lenght.

Finally, Chapter 7 is devoted to drawing up the conclusions and evaluating the extent to which we have succeeded in rendering plausible the hypotheses.

NOTES TO CHAPTER 1

1. Andersen (1982).

2. For an elaboration of this observation, see Petersen (1985), pp. XXI-XXII.

3. Pearson (1981) and Ince (1982) are examples of the approach which aims at developing proposals for 'better'energy policies by identifying the failures of past policies.

4. Chesshire et.al. (1977); Poulsen (1978); Solomos (1980).

5. This should not be taken to indicate that the general interpretation of the basic processes shaping energy policy would not apply to such a situation. For the sake of clarity, however, we have chosen a period of relative social stability so as to limit the number of possibly significant factors.

6. Indeed the analysis presented in Lindberg (ed) (1977) seems to suggest similarities across a variety of political and economic conditions.

7. See e.g. Pearson (1981) who lists pressure groups under the heading of "The electricity industry"; Ince (1982) distinguishes between "policy makers" and "work-forces, pressure groups and politicians" but fails to evaluate the significance of the different groups in actually altering the system of energy production and consumption.

8. If I tell politician A to work for the closure of a polluting industry, and he does, and it is closed, we can observe a harmony between my intent and the outcome. But did I influence the decision? This could only be established with certainty if we could show, that in the absence of my proposal, the factory wouldn't have been closed. But being counterfactual, this procedure is of little interest.

9. See e.g. Tietenberg (1976); Lindberg (ed) (1977); Lawrence (ed) (1979); Pearson (1981).

10. On Danish energy policy, see e.g.: Andersen (1981, 1982); Poulsen (1978); Rasmussen (1982). On British energy policy, see e.g. Chesshire et.al. (1977); Ince (1981); Reid and Allen (1970).

11. Examples of such an approach are Gundelach (1980); Lowe and Gayder (1983).

12. Whereas this discussion is taken up later, it can be noted here that this there has been explored by Colgrave (19

2. STATE ENERGY POLICY IN DENMARK AND BRITAIN 1950 - 1980.

2.1 Introduction.

The following chapter is devoted to an investigation of the historical development of state energy policy in Britain and Denmark. Through a description of this development, we want to arrive at an identification of sub-periods within the 1950-1980 period according to the character and intensity of state energy political activity within these periods. We want to investigate whether it is possible to identify periods of relative absence of conflict in energy policy against periods dominated by conflicts, and we want to describe these periods and the shifts from one period to the next. In this way we hope to arrive at a periodisation within the 1950-1980 period.

Before proceeding to describing the development, a further specification of its object is needed. In Chapter one we defined state energy policies as state activities relative to the different stages of energy supply, distribution and consumption as well as to issues which are at any time defined as relevant in relation hereto. By 'state activities' we understand explicit intentions, plans and policies formulated or endorsed by parliament, ministries formally responsible for energy, relevant branches of the civil service and such advisory bodies which may be set up specifically to deal with energy. This implies that we do not regard the activities of nationalized industries as part of state energy policy. Although the activities of e.g. the National Coal Board undoubtedly have profound implications for state energy policy[1], they represent only one input into policy considerations. Therefore the activities of the nationalised industries will be dealt with in the next chapter along with those of other groups attempting to influence state energy policy.

To assess the development of these activities, we are going to investigate the development of three indicators of the range and intensity of state involvement in energy policymaking. The first indicator is the issues dealt with in energy political terms: which issues have been important at different times? Has the range of issues changed? These questions will be answered through an analysis of official policy documents. The second indicator is the range of methods employed as policy aids at different times. It is assumed that particular methods reflect particular assumptions about the policy field: which factors are important? How are they seen to interrelate? Are they regarded as exogenous or manipulable? The third indicator is the institutional setting, its extent and complexity.

In addition to recording the chronological development of state energy policy, we want to examine whether this development has been parallel in Britain and Denmark, i.e. if specific periods have been dominated by the same types of issues, methods and institutions during the 1950-1980 period. In order to achieve clarity for each country, we have divided the chapter into two sections, one for each nation.

Let us briefly look at some alternative interpretations of 'energy policy'. It will be noted that our definition of energy policy is quite broad. On purpose we have used the word 'energy' without specifying what it includes. The reason for this orginates in the considerations of the historical specificity of socio-political concepts mentioned in Chapter one. More specific definitions are more often than not saturated by ideas of what energy policy ought to be like, as when Nigel Forman (British Conservative member of Parliament) defines energy policy as:

> "(...) an honest attempt to set a framework of political decisions within which the various sources of energy supply are encouraged to make their most appropriate contributions towards satisfying the likely levels and categories of future energy demand. (...) the meaning of energy policy must also comprehend a fair minded attempted by government to influence future levels and categories of energy demand (...). (Forman, 1977, p. 8).

At the other end of the political spectrum we find the following conceptualization:

> "Energy policy is <u>not</u> a purely technical issue; the politics of energy is about the interplay between resources and technology on one hand, and class interest on the other." (Spence, n.d., p.4).

The first of these definitions is overtly normative. Using this definition, Forman could deny the existence of energy policy during periods of Labour government. Furthermore Forman assumes that energy policy should influence future energy demand. As we shall see, however, this has not until recently been an accepted task for state energy policy. Hence, a definition like this can be of little use for an investigation of the development of state energy policy, including the energy policy concept itself. The second definition may seem more promising, as it specifies some (presumed) invariant components of energy policy. For our purpose, however, it is far too imprecise. Substitute the word 'energy' with 'food' or 'health' and see what happens -the definition remains meaningful. Thus, whereas it offers a description of some crucial factors of energy policy (resources, technology and class interest), it does not say anything about the way they inter-relate.

Our definition as stated above, while open, intends to avoid these pitfalls so as to allow an investigation on the basis of the historical development of aspects of energy dealt with by the state as well as changes regarding interpretations of what energy policy ought

to include and which means should be employed.

2.2 British Energy Policy

Some authors, e.g. Lindberg (1977, II) and Chesshire et.al. (1977) proposes that a prominent feature of British energy policy since World War II has been its stability:

> "(...) since the Second World War, Britain has had an identifiable framework of energy policy that has permitted a variety of national interests to be taken into account in addition to purely commercial considerations. (...) there has been a degree of consistency in the approach to policy formulation in the institutional structure over a period of three decades." (Chesshire et.al., 1977, p.33).

This emphasis on the stability of energy policy may be explained by two factors. Firstly, Chesshire et.al. use 'energy policy' to mean fuel policy. Therefore, the emergence of new issues like energy conservation is not recorded as an indication of change. Secondly, and more importantly, 'change', 'stability' or 'consistency' are not absolute concepts. Chesshire et.al. actually do observe change. Within the 1945-1976 period they propose a periodisation into four sub-periods characterized by different supply and demand conditions. They argue that successive governments have responded to these conditions in a consistent manner. In contrast, Ince (1981) considers that change has been a prominent factor in the development of British energy policy:

> "Until the last decade (the 1970s, T.A.), there was no government department dealing solely with energy - although one had existed under various guises before - and whatever energy policy Britain and other countries had was scarcely of interest to any but afficionados of coal output, North Sea gas, power station construction or whatever else was the fuel policy issue of the year. Now there is a Deparment of Energy and a large number of other bodies, more or less official, which worry about energy policy." (Ince, 1981, p.2).

We shall now examine the development in state involvement more systematically in order to assess the relative importance of change and stability in the 1950 - 1980 period.

Beginning from the 1950s, the responsibility for oil, coal and gas was located with the Ministry of Fuel and Power[2], whereas the nuclear energy project before the creation of the United Kingdom Atomic Energy Authority in 1954[3] was located with the Ministry of Supply. The Authority was established as an independent body under the responsibility of the Lord President of the Council. A few years previously, nationalisation of the major fuel and power industries had taken place: the gas and electricity industries were nationalised in 1947 followed by the coal industry in 1948 (the oil industry, then occupied with processing imported oil, stayed wholly in private hands until the setting up in 1974 of the British National Oil Corporation). However, in spite of the evident potentials for a coordinated energy policy offered by public ownership, policies towards energy in general and the nationalised industries in particular remained fragmented throughout the 1950s. Reid and Allen (1975) identify the following characteristics of the policies of this period.

1) Industries were given no real guidance on the type of pricing policies they ought to follow. Prices were based on vague notions of 'social desirability' rather than on actual costs.

2) Control and appraisal of capital investment was inadequate.

3) Nationalised industries tended to be regarded as independent entities.

We may take this absence of attempts at co-ordinating the activities of the industries as an indication that competition between fuels was not seen to present a problem.

This is confirmed by a report from the Committee on National Policy for the Use of Fuel and Power Resources[4]. The Committee concluded that the best pattern of fuel and power use would be promoted by the consumer's exercise of free choice between competing services, provided the competition was based on prices which reflected relevant costs. The existence of nationalised industries meant that the market would not ensure that costs were reflected in prices. Therefore, pricing policies were necessary within each industry to ensure correspondence between costs and prices.

Alongside these attempts at recreating market circumstances in the energy sector we find arguments for long term fuel supply planning based on an assumption of a positive correlation between energy consumption and economic growth. Energy demand was observed to increase and the future growth in the demand for energy was thought to provide room for growth in all fuel industries. This was, for instance, an important argument for the initial introduction of nuclear power as well as for later expansions of the nuclear programmes:

> "The principal objective of the United Kingdom's nuclear power programme is to provide an additional source of energy to meet the country's ever-expanding needs." (Central Office of Information, 1957, p.17).

The fear of the 'fuel gap'[5] was strengthened by the realization in 1956 that the future supply of foreign oil could not be guaranteed[6].

Observing the present situation in the energy sector, one may ask how it was possible to envisage ever-expanding increase in energy demand. The actual experience, however, supported such expectations. Economic growth was almost synonymous with growth in the industrial sector, especially in energy intensive branches of industry such as iron and steel. Therefore, if economic growth was to

continue energy demand would grow. Towards the end of the 1950s, actual developments like e.g. substitution of diesel for steam on the railways, increase in car transport and the (albeit marginal[7]) use of nuclear power and oil for electricity generation had made it clear that the demand for coal had not increased as rapidly as had been expected ten years ago. But this seemed to be outweighed by increasing demand for electricity, whose share of energy supply had been rapidly increasing. The Central Office of Information (1957) observed, matter-of-factly:

> "An increasing proportion of energy is required in the form of electricity, consumption of which, in Britain, has doubled every ten years over the past three decades." (Central Office of Information, 1957, p.17).

Today, the idea that electricity consumption could continue growing exponentially seems naive. But again we must remember the historical context within which such prognoses were conceived. Along these lines, Chesshire et.al. (1977) make the following observations on the general mood of the period:

> "As a generalisation, the mood (of the period 1946-57, T.A.) was one of expansion following two decades of depression and wartime austerity. The election of Conservative governments in 1951, 1955 and 1959 reflected a popular concern for rising material standards. In 1955, a senior minister was able to predict that the material standard of living would double over the next twenty-five years". (Chesshire et.al., 1977, p.42).

Following this argument, the primary objective of energy policies during the 1950s was to ensure that future fuel supplies would not fall short of the predicted demand. This was to be achieved through increased efficiency in the fuel and power industries and state-financed development of nuclear power, which would solve the threat of a 'fuel-gap' once and for all[8].

One of the means of achieving improved efficiency was reorganisation. By concentrating management of energy in large hierarchical organisations like the United Kingdom Atomic Energy Authority and the Central Electricity Generating Board, it was hoped that greater efficiency would ensue.[9]

The role of the state in the development of nuclear power[9] is characteristic of this approach to energy. Before the setting up of the United Kingdom Atomic Energy Authority (from now: the Authority) in 1954, nuclear technology had been developed under the auspices of the military establishment in extreme secrecy. The argument for setting up the authority contained elements of the rationales we have already identified as characteristic of state energy policy in this period:

> "The reason for the change is because of the growing importance of the possibilities of adapting atomic energy to industrial and other civil uses. The Government thinks that this makes necessary a form of control more akin to that of a big industrial organisation than to that of a Government department." (The Times, 13 February 1954, p.6).

The expectations of the potential of nuclear power for closing the hypothesized energy gap forever was coupled with confidence in capability of the nuclear industry to achieve results in a very short time[11]. Also it should not be forgotten that in addition to economic considerations, a strong pioneer spirit saturated the early nuclear energy development. This is evident from contemporary statements about nuclear power like that of the Minister of Works (who was responsible for nuclear power) wishing the first chairman of the Authority success in:

> "(...) what must be one of the most responsible and romantic posts open to a British subject." (The Times, 2 March 1954, p.4).

A statement for a similar occasion could hardly have been formulated along these lines 20 years later, as we shall see. This indicates that public acceptance of nuclear power was to a large extent taken for granted. In favour of nuclear power was also the potential for national scientific and engineering prestige[12]. At the time, the origin of the civil nuclear project in the military uses of nuclear fission and the link between the two was openly

recognized. One of the prime proponents of the creation of an independent atomic energy authority, Lord Cherwell, who was closely involved with the nuclear project, expressed the need for such an authority as a solution to the main problem, which was defined as the:

> "(...) slow progress (...) in developing atomic energy for peaceful and warlike purposes". (Motion for the House of Lords by Lord Cherwell, 1951. Quoted from United Kingdom Atomic Energy Authority, 1979, II p.6).

The development of nuclear power was thus seen to serve a number of purposes: it would obviate the fear of a future energy gap; it was expected to produce electricity at a lower kW-cost; the project itself would be beneficial for the scientific prestige of Britain; and the civil project would help in gaining experience which might aid the military uses. Nuclear power was expected, on balance, to solve more problems than it would create, and this expectation served as the rationale for state support for the project.

This is confirmed by the presentation of nuclear programmes[13] subsequent to the setting up of the Authority. These were presented as government's programmes (rather than as the industry's). There is, however, reason to believe that important decisions regarding the development of nuclear power was in reality not in the hands of government or Parliament. The Authority was not accountable to Parliament but to a Minister of High

Cabinet rank. The fact that it was not made responsible to the Minister for Fuel and Power again indicates that the fuel industries were not regarded as different aspects of an energy policy area, but as separate undertakings. The Minister was empowered to give directions to the Authority, but was not normally to intervene in its affairs[14]. Thus government intervention was limited when it came to detailed control of the operations. Instead, the state was to create the institutional structures which were seen best to enhance the growth within the industry and to fund the project[15]. All this leads us to conclude, that the state support for nuclear power during the 1950s were based on a belief in the capacity of the nuclear industry, given sufficient financial support and educational resources, to develop nuclear power to the benefit of society.

These assumptions, however, were partly given up towards the end of the decade. The Nuclear Installations (Licensing and Insurance) Act, which was passed in 1959, and the initiation of public information campaigns about nuclear power from the early 1960s indicated that science and the industry alone were no longer relied upon to create a publically acceptable and problem-free system of nuclear electricity production. The Nuclear Installations Act provided for a system of social control of siting, design, construction and operation of nuclear installations and set up a 'watch-dog' body, the Inspectorate of Nuclear Installations, which was to secure public accountability in the conduct of nuclear power operations. This indicates that it was now thought necessary to establish an independent body to control an industry which was formally accountable to government. Also dissemination to the public of information about nuclear power appeared as a novelty in 1960. In the 1950s, apparently, there had been no need for such campaigns.

It would not be true to say that this absence of state

awareness of public opinion about nuclear power was the result of an orchestrated attempted to suppress the facts about nuclear power. Public awareness about nuclear power seems simply to have been small. This is difficult to demonstrate, but the events surrounding the Windscale fire in 1957 may be taken as an indication. After the fire during which a number of radioactive substances were released into the environment[16], an inquiry into the accident was staged; but there is no evidence of any sizeable public concern about the wider implications of this accident until almost twenty years later, when a public inquiry was to look into plans for a new plant at the site.

From 1962, however, a series of pamphlets was issued by the Central Information Office under the title of "Nuclear Power in Britain". The pamphlets described the technology and presented arguments for further nuclear developments. The project was presented as a scientific venture with a growth-enhancing potential:

> "With technical development, it is also likely to become increasingly competitive with conventional sources of electricity. (...) nuclear energy will, from about 1970 onwards, tend, in suitable circumstances to be as cheap or cheaper than conventional fuel." (Central Office of Information, 1962,p.17).

We observe that profitability was only expected to arise under 'suitable circumstances'. But this did not represent an argument against the investments; on the contrary, reliable predictions of future costs were conditional on further operating experience[17].

Even though the public was addressed, it was not given an active role in decisionmaking procedures. The consultative procedures of the nuclear project made for a closed decisionmaking. No independent technical staff was available to the responsible minister[18]. When consultation

was available, it was limited to technically oriented fora, for example the Radiological Substances Advisory Committee was under a duty to consult "scientific, professional and technical organisations and persons such as Ministers think appropriate" prior to giving Ministers advice[19].

Parallel with the information campaigns, the state from the late 1950s took over direct control of an increasing number of regulatory functions in relation to nuclear power. In this period it was increasingly realized that the utilization of nuclear power was accompanied by a need for auxiliary services in relation to the various aspects of the nuclear fuel cycle[20], e.g. transport of spent fuels, reprocessing and waste disposal. Towards the mid 1960s the health and safety problems accompanying nuclear power were increasingly recognized. Thus it was acknowledged[21] that the responsibility of the state nuclear power included the following areas:

1) Health and safety.
   (discharge of waste: monitoring, measuring, setting standards;
   regulation of contamination of water;
   regulation of contamination of food;
   transport of radioactive materials;
   regulation of hazards arising from medical uses of radio-activity;
   research into biological effects and protection against such effects;
   setting standards for human exposure to radiation;
   monitoring nuclear fall-out;
   protecting the general public).
2) Liability regarding nuclear hazards.
3) Licensing and insurances.
4) Radiological protection.
5) Disposal of waste.
6) Transport of materials.
7) Training of manpower.

In practice the implementation of these areas was left to

the Authority, subject to the licensing procedures of the Inspector on Nuclear Installations, later the Nuclear Installations Inspectorate. Thus, the problems raised by the nuclear project were predominantly to be solved by the industry under a number of obligations to the state. Again the promise of future economic growth aided by access to cheap nuclear electricity served as a justification for having to accept these side-effects[22]. In addition, it was expected that technological change would contribute to the solution of these problems. It was also expected that the problems of low load factory which had been experienced during the first years of operating could be solved by further technological refinements[23].

This technological optimism also included the prospects for renewable energy. In the 1950s, a national committee was to co-ordinate a wind R&D programme and three prototype wind machines were erected[24], but this development was stifled in the 1960s. Flood (1983) explains this development by referring to the falling oil prices coupled with the expectation that nuclear power in the near future would provide cheap and abundant electricity. This expectation, as we have seen, was related to the understanding of nuclear power as part of scientific and technical progress.

Symbolic values aside, we have seen that policies towards nuclear power were characteristic of fuel policies of the 1950s and early 1960s, which were predominantly geared towards regulating the supply of energy. The emphasis on the supply side of energy has remained strong ever since the 1950s, and in this sense it is justifiable to claim that British energy policy has been consistent. The 1965 White Paper on Fuel Policy (Cmnd 2798) emphasized the importance of the consumer's freedom to choose between fuels and set out consequences of changing relationships between the prices of main fuels; and the 1967 Fuel Policy (Cmnd 3438), which was published in reaction to the 2nd

nuclear programme of 1965 and the finds of natural gas in the North Sea, had as its main aim a cheap supply of energy. This aim warranted a plan for a run-down of the coal industry in the face of cheap oil-supplies from the middle East in addition to the above mentioned developments.

The emphasis on supply was still evident, though in a different way, as late as by the end of the 70s, when central documents on energy policy were organised around forecasts for each fuel sector. But supply orientation is only one dimension of energy policy, and on other scores considerable changes occurred in the issues and methods of state energy policy. Towards the end of the 1950s the interplay between the development within the fuel industries had begun to create problems viz. the plans for a run-down of the coal industry. This indicates a dawning recognition that simultaneous growth in all fuel sectors, as had been expected only ten years previously, had now shown impossible. Now the state was being called upon to ensure not only sufficient energy but also the cheapest possible energy for industry. In addition to these problems of coordinating the activities of fuel industries and adapting to changes from the external world came problems related to the energy political process itself.

The New Problems in Energy Policy.

The creation of the Inspectorate of Nuclear Installations in 1959 is one indication that the nuclear industry in particular was not able to handle externalities arising from the production of nuclear electricity. But also at the more general level attempts were made to ensure, by means of planning, that unwanted effects would not arise from energy production and consumption. The attempts at planning started by the end of the 1950's and accelerated until the mid-1970's. Three tendencies within state intervention can be identified as characteristic of these

planning attempts:

1) From about 1960, intensified efforts to secure trade union and industrial approval of energy policy through formal hearing procedures.

2) From the late 1960s, introduction of mathematical and statistical tools in state energy planning;

3) From the late 1970s, increasing emphasis on the cost of energy production and consumption in a national economic perspective coupled with increasing concern about public acceptance of state energy policy.

1) The first important attempt to ensure interest group consensus with regard to energy policy was the creation of the Energy Advisory Council in 1965 by a Labour government. The Council, which was to advise government in energy matters, drew its membership from the top levels of the fuel industries, trade unions and a number of government departments[25]. Hence the Council represented an attempt to incorporate the interests related to energy production into the energy decision-making process. The Energy Commission which was set up in 1977 served a similar political role. The Commission was to provide background material for energy decision-making. Its membership consisted of representatives from energy industries and from the TUC Fuel and Power Industries Committee as well as persons representing consumer and 'other interest'[26] and ministers in charge of energy, the environment, industry, prices, and the Treasury.

2) From the late 1960s, the use of statistical and mathematical modelling became increasingly prominent in energy forecasting. As we saw, the dominant assumption of energy policy in the 1950s was that the economy would keep expanding. This led to forecasts based on extrapolation of consumption trends of the last ten to twenty years. Whereas such 'rudimentary' forecasting methods were still used by the late 1970's[27], more refined models were increasingly introduced. In 1977, for example, the

forecasting procedures employed by the Working Group on Energy Strategy assumed as key variables estimates of the average annual rate of GDP growth[28] and future oil prices; however, the estimates were modified by taking into consideration trend forecasts of final energy demand by sector. Finally the forecast total energy demand was adjusted in accordance with conjectures about possible effects of technological change, changes in prices and conservation efforts. The result was a single set of target for total future energy supply, distribution between fuels and technological change in the fuel and power industries; but the step towards drawing up scenarios, i.e. descriptions of possible future states of energy supply and consumption given different sets of assumptions about the future, was not far off.

Only a year later, the 1978 Green Paper on energy policy[29] considered the possibility of constructing a number of different scenarios. Only one such scenario was presented, however, although it was acknowledged that large uncertainties were involved in this procedure. The same year Energy Paper No. 29 on 'Energy forecasting Methodology' indicated that the future was becoming an important issue. The paper presented an over-all energy forecast arrived at by manipulating a set of models. Each model described one aspect of energy supply or demand by a number of mathematical equations derived from empirical observation of impacts of different types of events on energy supply or consumption. In contrast to the forecasts of the 1950s and 1960s which extrapolated fuel supply and demand sectorally, the new forecasting procedure extrapolated past relationships between different types of events.

Energy forecasting as an element of state energy policy represents a different approach to energy problems than the creation of new institutions and attempts at involving interest groups in decisionmaking. Forecasting was presented as a neutral tool for assessing the future implica-

tions of developments of energy demand and supply. It would enable politicians to establish which policies would be needed in the future. The policy documents of this period never entered into discussions of the whole range of problems raised by forecasting: is it desirable to construct the future on the basis of the past? Is a surprise free future conceivable on the basis of past experience? And from whom do we get the data? British energy forecasts rely on data supplied by the energy producing industries. This may lead to an adoption of overly optimistic demand forecasts, as Ince (1981) has pointed out:

> "The electricity industry thinks, as industries will, that it is the thing of the future. The people who make the electricity demand forecasts are members of the industry that generates the electricity. It would be foolish to expect them to be cynical about their own prospects."

It is possible to interpret the function of forecasts as tools which illustrate, in terms of a limited number of parameters, the consequences of 'business as usual' provided nothing unexpected happens. But in the real world spectacular unexpected events like the oil crisis happened, and unexpected costs of 'business as usual' were increasingly identified.

3) Towards the end of the 1970s, the subject of costs, and in particular external costs, became increasingly prominent in policy formulation, and procedures and methods were developed to allow assessments of costs of particular projects as well as alternative options. The increasing use of tools like cost-benefit analysis[30] and environmental impact analysis is indicative of this development. This new emphasis on cost first appeared in the 1977 Energy Policy Review:

> "In principle the cost of reducing the impact (of any conceivable system of energy supply, T.A.) can be

balanced against the benefits and an optimal solution sought." (Energy Paper No.22).

Also the 1977 Working Document on Energy Policy[31] and the 1978 Green Paper[32] were concerned with the possibility of balancing costs against benefits, especially as regarded the environment, employment and public safety. On this subject, the Green Paper concluded:

"We therefore need to make decisionmaking in this area as objective as possible by establishing the facts on as firm basis as practicable." (Department of Energy, 1978, p. 64).

The external effects of energy production and consumption were now regarded as so important as to necessitate their inclusion in the decisionmaking process, albeit only insofar as they could be translated into economic terms[33] But the main emphasis was on the direct economic costs to the nation and this emphasis was stable regardless of which party held government. Thus, in 1977 (when Labour was in government) the Energy Commission argued that energy policy could not and should not deal with the social effects of retail prices of energy[34]. Also environmental protection was a secondary concern for energy policy: environmental standards, e.g. limits to discharges of radioactivity, air pollutants or cooling water, should only be adopted insofar as it could be shown "on a reasonable balance of probability" that they were justified by the resulting benefits[35].

Not only was the toolbox of energy planning being newly equipped, the increasing state interest in energy policy was also marked by attempts to introduce new and more efficient frameworks for policy and planning in order to allow better coordination between the energy industries as well as between the energy sector and other sectors of the economy. We have already mentioned the Energy Advisory Council; the subsequent Labour government in 1975 set up a

Working Group on Energy Strategy drawing its membership from the fuel industries and different divisions within the Department of Energy to explore

> "(...) a coordinated approach between Government and the industries to the formulation of energy strategies and energy policies" (Working Group on Energy Strategy, 1977, foreword).

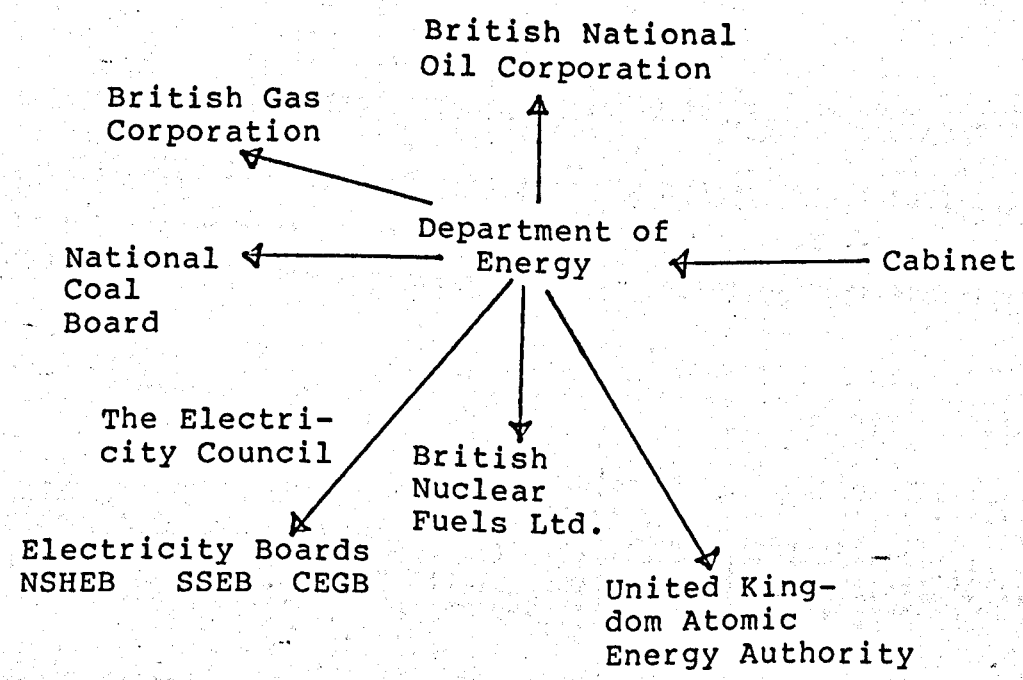
The remit[36] of the Energy Commission on its creation in 1977 was a major policy document. Here, it was acknowledged that energy policy cannot be conducted in separation from the rest of society. Instead of planning within the single industry, energy policy should aim at arriving at one single but coherent and robust strategy, an idea which was supported by the Working Group on Energy Strategy, although this group emphasized the necessity of maintaining a flexible approach[37]. In view of this aim, general adoption of a long-term planning horizon of 20 years for corporate planning was recommended. This would ensure that state energy planners were provided with sufficient input for the preparation of at least one over-all long-term energy plan. Up till this time, planning had been related to single industries,one at a time. The idea of one over-all energy plan was new.

Also during the 1970s the framework for energy policy decisionmaking had been altered and new state institutions created within the energy sector. For example, in 1971 a number of processes involved in the production of fuels for nuclear reactors, which had earlier been undertaken by the UKAEA, were gathered together within a new state owned company, British Nuclear Fuels Ltd. (BNFL). BNFL was to undertake enrichment, production, reprocessing and disposal of nuclear fuels. It was to operate on "similar lines to any other private industry"[38].

Up to 1973, the responsibility for the fuel industries was

divided between different Ministries[39]. With the creation over Christmas 1973-74 of the Department of Energy by a Conservative government, all fuel industries, including the nuclear industry, were for the first time brought together in one institutional setting (see fig. 2.1.). Even though the staff remained largely unchanged, as observed by Ince (1981), the creation of a separate energy department must be regarded as a significant event. Both Chesshire et.al. (1977), Ince (1981) and Pearson (1981) interpret the creation of the Department of Energy as a direct government response to the 1973 oil crisis coupled with the fear of coal shortage following a national miners' strike. Whereas this may explain the date of formation of the Department, it does not explain why the fuel and power industries and the nuclear project had come to be seen as parts of one identifiable area of policy: energy policy. The change of label from 'Fuel' to 'Energy'

Fig.2.1 The Department of Energy and its resort areas.



(After Chesshire et.al., 1977).

indicates more than just that the national economic implications of a coal strike or an oil embargo had become very important. It indicates a recognition, that these problems, and the civil nuclear project, and electricity, were now conceptualized as different aspects of one complex of problems. This conclusion is supported by the emergence of new institutions like the Advisory Council on Energy Conservation which was established in 1974 to advise and assist the Secretary of State for Energy in promoting economy and efficiency in energy use by identifying methods for improvement and methods of conservation. A 'Save-it' campaign was launched by the Department in early 1975 to inform the public about the need to save energy; and the U.K. signed the International Energy Agency agreement on an International Energy Program[40].

Parallel to the emergence of energy policy as an identifiable area of state intervention, with a responsible department, with investigation into policy models, and with tools for evaluating concrete energy developments, a new concern for this branch of policy had appeared: formal integration of different interests into the decisionmaking procedures. Different interest groups (especially trade unions, industrial interest organisations and consumer organisations) were given the opportunity to participate in commissions and conferences. The Energy Commission was presented[41] as an example of public participation in energy policy for different 'interests' to be taken into account. Bearing in mind the composition of the Commission, it is tempting to conclude that 'interests' were interpreted as synonymous with 'established interest groups', and that interest in energy policy was interpreted as economic interests relating to fuel production.

It was an explicit objective of involving interest groups in energy decisionmaking to ensure consensus among these

groups, but also wider public acceptance was hoped for. Parallel to the introduction of new participatory structures, the Minister of Energy observed that there was a need to ensure

> "(...) the democratic accountability of energy planning to the taxpayer, consumer and workers in supply industries." (Energy Paper No.22).

We observe that the idea that public ownership per se was a sufficient guarantee of public accountability had been discarded. New safeguards would have to be established to ensure accountability, and we saw that interest group involvement was one solution to this problem. Another was an increased effort to inform the general public about energy problems and energy policy, for example the Department of Energy's Energy Paper series which was started in 1975 was

> "(...) primarily intended to create a wider public understanding and discussion of energy matters, though some technical papers may appear from time to time." (Energy Paper No.9, p. ii).

Going through the issues dealt with in the Energy Papers from No.1 (1975) to No.45 (1981), we see that almost one half of the papers (17) dealt with aspects of energy conservation, while 12 papers were devoted to one particular source of energy. Of these, one dealt with nuclear energy and six with renewable sources. This distribution indicates a weighting of issues which is crucially at odds with the amount of government funding allocated to the respective areas of energy policy during the same period[42]. The apparent over-emphasis on issues related to energy conservation can possibly - at least in part - be ascribed to the Advisory Council on Energy Conservation choosing the Energy paper series as an outlet for its reports. In addition, it may be argued that the fuel industries, and in particular the nuclear industries, were already publishing

sufficient informative and public relations oriented material as to make any further coverage redundant[43]. The series was presented as a 'database' available to the general public. It was to serve as a input into a public debate about the means and ends of energy policy; therefore the bias towards issues that do not involve discussions about the energy industries is conspicuous, and suggests that not all energy issues were thought suitable for public debate.

Towards the late 1970s the focus on the role of the general public had become stronger, while on the other hand the earlier attempts to ensure concensus between the energy production interests were to some extent given up. Both the Energy Advisory Council and the Energy Commission were disbanded in 1979. The reason given was that the Secretary of State for Energy considered that there were better forms of consultation for energy policy[44]. From the mid-1970, procedures involving economic interest groups directly in decisionmaking were gradually replaced by efforts aimed at ensuring the approval of the general public, mainly by information. Also the use of planning inquiries for energy projects is an element in this trend. This seems to indicate that the workers in the energy industry were no longer thought to present as large a problem as the attitudes of the general public.

New Objectives of Energy Policy.

The emergence of an explicit energy policy by the late 1960s was also marked by the emergence of stated aims for this policy area. In the 1950s partial objectives for single industries and projects were derived from the overall objective of economic growth and technical progress. Growth in the energy supply industry was necessary to ensure ongoing economic growth. This is sharply contrasted by the remarkable set of stated aims of a national energy

policy which appeared originally in the 1977 Energy Policy Review:

> "(i) Everyone can afford adequate heat and light at home
>
> (ii) Industry's needs for energy are fulfilled at a price which reflects fully resource cost and has regard to long-term availablity of the various fuels.
>
> (iii) These objectives are met on a long-term basis, taking account of risks; the depletion of our reserves of oil and gas is regulated; research and development in energy supply and use is adequately funded; and investment in energy industries to meet these objectives is properly planned.
>
> (iv) Freedom of the consumer to choose between fuels provided a minimum price which reflect economic cost, should, where possible, be maintained and increased." (Energy Paper No.22).

These objectives were repeated in consecutive government energy policy documents[45]. They marked interest in new issues in energy policy: consumer protection, resource depletion, investment planning. Alongside these new objectives, a number of 'traditional' objectives of energy policy were cited: achieving the lowest possible cost in energy production, aiming at a secure and continuous energy supply and achieving efficiency in use.

The interpretation of these goals however, has changed considerably. Interpreting this set of goals demands a specification of the cost concept and of the time-horizon within which costs should be minimized. There has been a tendency to widen out the cost-concept from including only direct costs of producing and transmitting energy to including external costs stemming from e.g. environmental pollution. Likewise, there has been increasing emphasis on long-term cost and hence on the need for sensitivity of analysis in cost calculations. For example, whereas the original long-term aim of the nuclear project was achieving a stable, low-cost electricity supply, competitiveness

was only expected in the very long term. From the mid-1970, mere expectations of low cost in a far away future could no longer be afforded. Proof of the competitiveness of energy technologies was now demanded, witness e.g. the Sizewell Inquiry debates on the costs of the American Pressurized Water Reactor[46].

In this context, energy conservation and renewable energy have increasingly been considered as possible ways to cut the social costs of energy production.

In order to illustrate this in more detail, the role in state energy policy of nuclear power on the one hand and renewable energy on the other will be looked into in greater detail.

As far back as 1965, nuclear power had been established as a component of a national energy policy[47]. This did not, however, result in attempts by government to direct the development of the technology. On the contrary, the governments between 1965 and 1973 were lying low on nuclear power: no nuclear programmes were issued, no policy statements on nuclear power or the nuclear industry were produced, no initiatives taken towards the nuclear industry. In 1973, however, the Nuclear Power Advisory Board (NPAB) was established as a top-level body with the aim of advising government on all aspects of nuclear generating policy[48]. This indicated a renewed interest in nuclear power (probably prompted by the increasing tension between the OPEC countries and Israel); and immediately upon the oil crisis in 1973/74, a third nuclear programme was presented. It consisted of 4000MW of Steam Generating Heavy Water Reactors, a new design. The programme was rejected only two years later[49], and in 1978 it was replaced by a less ambitious programme of two Advanced Gas Cooled Reactors, to start in the 1980s. These policy changes were explained in policy documents, which has not been the case with earlier changes in nuclear programmes.

In 1976, the official principal objective of the nuclear project was

> "(...) to develop an alternative source of power to supplement, in particular, exhaustible supplies of fossil fuel - coal, oil and natural gas." (Central Office of Information, 1976, p.1).

The rationale for developing nuclear power was no longer ever-expanding needs as in the 1950s and 1960s - instead the fuel gap would result from fossil fuels being exhausted. Hence, the project was justified by referring to new problems leading to the same result: fuel shortage.

The increasing importance of public opinion was evident in the third nuclear programme, which referred to the need to maintain public confidence[50], and in 1977 government encouraged public debate on nuclear power[51]. Nuclear power was still regarded an important component of a national energy strategy, but not unconditionally so:

> "The amount of nuclear power that could be made available in 1980s will depend critically on the nature and timing of current decisions about the reactor programme, and these in turn will depend on the relative costs and acceptability of nuclear power." (Energy Paper No.20) (Emphasis added).

This somewhat half-hearted commitment to nuclear power was replaced by a strong commitment when the Conservative Party took over government in 1979. The new government announced a new nuclear programme. One new station was to be buitd each year in ten years starting in 1982, and altogether 15,000 MW of nuclear capacity was to be added to the grid. Later, this commitment waned somewhat. The reasons given were the increasing cost of nuclear power and the increasing excess capacity in electricity production leading the government to state, in 1981, that each order of a new power station should be justified in terms of cost efficiency and need[52]. Again it is evident, that the

costs of energy production had become prominent amongst policy criteria.

Also the public acceptance of energy decisions was thought to rely on an assessment of costs. The information about nuclear power which was to be given to the public should serve the objective of making clear the economic advantages of nuclear power. Implicity it was assumed, that the public, given insight into project economics were able to arrive at a rational assessment of nuclear power:

> "(...) as much information as possible about the economics of the proposed future power stations should be made available to the public." (Department of Energy, 1981, p.14).

In this way, economics was established as the appropriate language in which to discuss energy.

Just like nuclear power received a renewed attention when it became clear that future oil and coal supplies could no longer be guaranteed, so renewable energy technologies were drawn into the focus of energy policy in the mid-1970s. But whereas the nuclear industry was 'standing-by' as was the power plant industry, neither organisation nor capital were present to ensure that the emerging political demand for 'alternative' sources of energy (alternative to coal and oil) was readily transformed into commercially viable technologies. Development of the renewable energy technologies was defined as a field for state initiatives, but without any economic or organisational rationales to ensure its implementation.

State involvement in renewable energy has mainly consisted in informing the public of the existence of the technologies and contributing to R&D. R&D funding has relied on assessments of the potential contribution to total energy supply from renewable sources, and as a rule this contribution has been expected to be minute. In 1977,

sun, wind, tides, waves and biomass were expected to contribute 0.9 - 2.4 per cent of primary fuel demand by the year 2000[53]. In 1979, these sources were not included in the energy projections of the Department of Energy. It was argued, that they seemed

> "(...) unlikely to be able to contribute to supply or to be economically preferable to other fuels over the period to 2000." (Department of Energy, 1979):

Again we notice the increased emphasis on economic criteria. The role of state funding for future competitiveness was not discussed. In contrast to the large state expenditure for nuclear R&D, funding for renewable R&D was minute[54]. Around 1980, the Conservative government argued a return to market principles. The difference between nuclear power and renewable energy technologies in this situation was that renewable energy technologies were now in approximately the same phase of technological development as nuclear technology had been in the early 1950s: it was not developed into a commercially viable or cost efficient technology, only further research and development would show if it ever could be cost-efficient, and the R&D would demand sizeable funding. R&D into renewable sources was both costly and risky, and therefore private industry was reluctant to invest. But whereas funding in the 1950s for nuclear energy could be justified by referring to expectations for future performance, renewable energy technologies were now being subjected to policy criteria which emphasized short-term cost efficiency.

British state energy policy has tended to emphasize the capacity of any energy source for producing energy 'in bulk'. Hence, renewable energy technologies have been seen to be relevant to state energy policy only insofar as they were thought capable of feeding electricity into the national grid. Policy statements on renewable energy have

shown a clear preference for technologies compatible with the existing infrastructure, first and foremost the national grid[54]. This implies a bias toward large-scale technologies like tidal barriers, wave power and large-scale wind machines. The renewable sources have been divided into two categories[56]:

1) sources mainly suited for electricity generation;

2) sources mainly suited for local production of heat.

Of these, the first group has received the bulk of attention:

> "Wave power offers a greater potential for the United Kingdom than any other natural renewable source. It is a concentrated source of power that can be harnessed into volume to the grid and there is a good chance of solving the technical problems." (The Department of Energy, 1978, p. 59).

Summary of British Energy Policy.

Table 2.1 sums up the developments in British state energy policy described above. For the sake of clarity we have divided the 1950-1980 period into five-year intervals.

The first period was dominated by initiatives on nuclear energy. We have seen that the main aim of fuel policies in this period was maximising output. The 1956-1960 period gives evidence of attempts by the state to advance efficiency in the fuel industries through restructuring of the industries. By the end of that decade, we saw the creation of the Inspectorate of nuclear installations as a sign that the nuclear industry was no longer relied upon to handle the externalities arising from nuclear electricity generation.

The first five years of the 1960s witnessed new practises

in relation to energy: establishment of formal procedures for interest group participation in decisionmaking as well as the first proposal for a coordinated fuel policy. Between 1966 and 1970 the fuel industries including the nuclear industry were gathered within the Ministry of Technology, and yet another fuel policy was issued. The state increasingly intervened in industrial affairs. The national coal industry was protected by means of subsidies in order to prevent imported oil from displacing coal. Between 1971 and 1975 the institutional setting of energy decisionmaking was restructured so as to define energy policy as a central concern of the state. An increasing number of state bodies were set up to handle different aspects of energy and to ensure the influence of interest groups. Attempts at coordination between the policies of the fuel industries were intensified. A nuclear programme was presented in an attempt to cope with the oil price rises and the political volatility making coal a risky option to the electricity industry.

From the mid-70s, state energy bureaucracy stopped multiplying, and by the end of the 1970s, state bodies were even disbanded. Interest group participation in energy policy was no longer regarded important. Instead, efforts were made at securing public acceptance through participatory structures like the public inquiries and through information campaigns. Towards the end of the 1970s, cost became a dominant issue in energy policy. Hence, emphasis was on enhancing efficiency in consumption. At the level of planning, attempts were being made to assess future costs of alternative projects and scenarios through a number of econometric techniques.

We shall now return to our objective of identifying within the 1950-1980 years possible periods of political quiescense in energy policy as against possible periods of conflicts. Looking at the events described in this section

Table 2.1 Events in British Energy Policy 1950-1980.

Time (5 year intervals)	Institutional changes	Legislation and important policy documents	Methods and practices (changes)
1950			
	Formation of UKAEA (1954)..	Atomic Energy Act (1954).	
1955			
1956			
	Ministry of Fuel becomes Ministry of Power (1957). Central Electricity Authority replaced by The Electricity-Council plus the electricity boards (1957). Inspectorate of Nuclear Installations (1959).	Electricity Act (1957). Clean Air Act Nuclear Installations Act (1959).	
1961			
	Energy Advisory Council (1965).	'Fuel Policy' (Cmnd 2798) (1964).	Public Information on nuclear energy (1962-).
1965			
1966			
	Ministry of Power + the UKAEA absorbed in the Ministry of Technology (1969-1970).	'Fuel Policy' (Cmnd 3438) (1967). Coal Industry Act. (1967).	Subsidies for power station coal purchases. Forecasting adopted in 'Fuel Policy'.
1970			

(table contnd. next page)

1971	1 BNFL formed (1971). 2 British Gas Corpooration replaces Gas Council (1972). 3 Department of Energy formed (1973). 4 Nuclear Power Advisory Board (1973). 5 Advisory Council for Energy Conservation. (1974). 6 Working Group on Energy Strategy (1975).	'Nuclear Reactor systems for Electricity Generation' (Cmnd 5695).	Adoption of national energy forecasts. Publication of Energy Papers. 'Save-it' campaign.
1975			
1976	Energy Commission (1977) - disbanded (1979). Energy Advisory Council disbanded (1979).	'Energy Conservation' (Cmnd 6575). (1976). Energy Policy' (Cmnd Re-organisation of the Electricity Industry' (Cmnd 7134) (1978).	Mathematical modelling adopted. Introduction of non-economic cost. First allocations for R&D into renewable energy. First public inquiry into energy-related project. Public participation policy issue.
1980			

and the chronological order of these events as they are represented in table 2.1 we find it warranted to identify four periods characterized by distinctly different patterns of energy political approaches.

1) **1942-1959.** This period began before the starting point of our analysis, and ended about 1959. It was characterized by limited state intervention in the energy sector compared to the later periods. Energy policy aimed at securing energy output so as to ensure that economic growth could continue. In this strategy, besides aiming at increased efficiency in the traditional fuel industries, the development of nuclear power played a major role. This technology was expected to increase productivity in energy immensely, thus ensuring an increasing energy output even beyond full employment. It was characteristic that these expectation, on a background of rapid economic growth, were sufficient to justify a major state investments in developing this new technology. The optimism with regard to the future role of technology was also reflected in state involvement in other technological projects related to renewable energy and technologies for increasing efficiency in other fuel sectors.

2) **1960-1973.** This period was characterized by intensified state involvement in all aspects of energy supply. The supply of fuel was influenced by the prices on the World Market, and the state reacted by subsidizing the national coal industry. The development of nuclear power was not happening as rapidly as had been expected, and it was realized that the environmental problems in utilizing radioactive processes had not been solved as easily as had been expected. As a reaction, new state institutions were formed for handling these problems. Increasingly the state during this period took over energy planning as well, and towards the end of the period we saw an increased interest in methods for diminishing future uncertainties in energy supply. The main characteristic of this period were in-

tensified state attempts to cope with the increasing number of uncertainties related to energy. But that also meant that a growing number of decisions which had earlier been taken within the single industries were now taken in the political sphere.

3) **1973-1977** (approx.). This period was characterized by a dramatic increase in energy supply problems. In Britain, two events contributed hereto: the 1973/74 oil crisis and the national coal miners' strike in 1973. These events presented the energy political system with problems which it was not designed to cope with. We interpret both the attempts to coordinate energy decision-making and the multiplication of committees, advisory councils etc. as a reaction to these problems. Also the renewed interest in nuclear power and in energy conservation were presented as solutions to the problems stemming from dependence on oil and coal. This accelerated state intervention in the energy sector.

4) **1977-.** The immediate problem was no longer securing physically the energy supply. The national economic implications of energy supply became an increasingly important issue. Energy policy increasingly became a means to economic ends. Whereas this was also the case in the 1950s, when the objective was economic growth, the objective is now efficiency of state investment in order to straighten out the ailing economy. But at the same time, the problems of the 1960s and early 1970s still persisted. The environmental effects of energy production were answered by state intervention insofar as they were expected to give rise to future costs for society. Added to this came an increased interest in methods which allowed for estimating and comparing future costs of different projects and energy futures. Hence, this period was characterized by a political emphasis on the national economic cost of energy.

Before we discuss the significance of these changes, let us examine Danish energy policies of the same period in order to assess whether the changes are particular to Britain or whether a parallel development can be identified in Denmark.

2.3 Danish Energy Policy.

In Denmark, state intervention in the energy sector during the 1950s and early 1960s was even more modest than in Britain. Taking into account the level of available technology and the price of importing coal and oil, Denmark did not have access to any fuels of interest for a national energy supply (we shall look into this in greater detail in chapter four). The accessible indigenous resources, like peat or firewood, were used directly for space heating in the homes. The organisation of energy production and distribution differed considerably from that of Britain. The energy industries were privately or collectively owned. Some undertakings were limited companies while others were owned by local authorities. The industry was only to a very limited extent subject to state control. In particular, the state did not control directly the prices of the most important fuels, which were imported coal and oil. State organisation in the energy field was scant. The most important body until 1976 was The Electricity Council (Elektricitetsrådet) who was to advise the Minister of Public Works on issues related to electricity supply and whose membership was drawn from the electricity industry, universities and the Ministry[57]. The 1935 Electricity Act had given the Electricity Council the responsibility of licensing installations and drawing up limits between the supply areas of different electricity companies. However, during World War II, as an aspect of economic planning, the first high voltage lines were constructed by means of state funding. The physical basis for a centralised energy supply was

thus present by the beginning of the 1950s. The development of the industry through the 1950s happened in the private sector without much interference from the state.

The interest in a publically supported civil nuclear project was evident in Denmark, as in Britain. In 1955 an Atomic Energy Act was passed which set up the Atomic Energy Commision (Atomenergikommissionen). This institution was akin to UKAEA and had as its main purpose the peaceful utilization of atomic energy. Contrary to the British situation, no established organisations existed in the nuclear field nor did an established nuclear industry. Hence the Atomic Enérgy Commission had to draw its membership from the scientific community, from the electricity industries and from other important industries. The Commission was not the responsiblity of any ministry.

During the 50s and early 60s, nuclear power was expected to be introduced in Denmark by the end of the 60s, and in 1962 an Atomic Installations Act (Atomanlægsloven) was passed in Parliament, which gave the National Health Inspectorate (Sundhedsstyrelsen), the Atomic Energy Commission and the Minister for Education[58] the right to initiate the introduction of nuclear power in Denmark without further consultation. As it turned out, nuclear power was never introduced, as the go-ahead collided with falling oil prices making the electricity industries' interest in nuclear power wane[59]. But the nuclear research establishment Risø which had been set up in 1955, continued its activities funded by the state.

The Ministry of Commerce[60] was responsible for policies concerning fuels other than nuclear, but no attempts were made to coordinate these policies[61]. The fragmentation of policies was reflected in the lack of interest in the Danish reserves of North Sea oil and gas. The existence of

this resource had been known as far back as in the 1940s when Gulf and Esso (Exxon) prospected for oil in the Danish part of the North Sea. Concession to prospect and exploit North Sea oil was in 1962 given by government to a consortium consisting of Gulf Oil, Shell Oil and a Danish shipping company. Later, this decision was heavily criticized, but as Wilhjelm (1979) notes:

> "It is probably redundant to note, that the steps of government in relation to the 1962-license were definitely not underpinned by energy policy considerations. Possibly that was asking too much as far back as 1962. Indeed this happened towards the end of the fantastic process of switching from coal to oil which was never decided upon or even discussed by any political authority, but was nevertheless implemented in record time, making Denmark the country more than any other in the pocket of 'the seven sisters', the multinational oil companies." (p.55).

Developments in energy supply were left to private industry except for the nuclear power project which was funded by the state. The conduct of the project was, however, largely left to the scientific community, and no political procedures or institutions existed to check the development of the project. As Poulsen (1978) observes:

> "Only in the area of scientific research into energy was the influence of the state pronounced as a result of its financial control of the activities of the Atomic Energy Commission, i.e.the control of grants within the framework of the budget." (Poulsen, 1978, p. 52).

This situation lasted until the early 70s, when a growing interest in coordination and planning of the energy area became visible. The Danish state was not faced with the problems of coordinating nationalised fuel-industries. Still, in 1971, the Ministry of Commerce set up an Advisory Committee consisting of representatives of government departments and branches of industry to assist government in investigating the possibility of establishing a natural gas supply from the North Sea. The

Committee negotiated a possible pipeline for North Sea gas with a multinational corporation, but the negotiations ended without any result. This led to the setting up of the state-owned limited company Dansk Naturgas A/S which was to ensure state influence in future natural gas activities. But intially the company was given only a very small operating capital indicating that the immediate interest in natural gas was limited.[62] The Advisory Committee had only been concerned with a single fuel, but in early 1973 it was replaced by a civil service Energy Policy Committee (Energipolitisk Udvalg) which was to coordinate energy administration across departments as well as advise government in energy policy matters.

Beyond doubt, state involvement in energy matters was accelerated by the 'energy crisis' in 1973/74, but it is important to bear in mind, that when the rise in oil prices hit the national economy, the organization of a coordinated state energy policy had already begun.

The oil price rises sparked new initiatives. Immediately upon the price rises, a new centre-right government (Venstre; det Konservative Folkeparti; det Radikale Venstre) voiced its intention to achieve control and coordination of the energy area and to coordinate the different policies within this area. The Minister of Commerce was to be responsible for implementing coordination. He was to be responsible for all aspects of policies and plans for energy supply and consumption, whereas aspects related to public safety or the environment was not regarded as parts of the Minister's responsibilities[63]. In 1974 the Minister issued the first energy policy review outlining energy problems and the achievements in reorganizing energy policy organisations so far.

After the oil crisis in 1973/74, attempts at creating an energy planning framework were intensified. A Heating

Methods Committee was set up by the Ministry of Housing in 1975 to be in charge of an investigation of the appropriateness of different heating methods in a wider energy-political perspective. In the remit of the committee it was observed that

> "Substantial changes have occurred in the market conditions for energy, and the present development of technology supports an assumption that heat supply in the years to come will be characterized by a shift between heating methods and possibly introduction of new methods." (Boligministeriets Opvarmningsmetodeudvalg, 1975, app. 11 (remit to the Committee from the Minister of Housing)).

These observations were used to motivate state involvement in energy. It was noted that the cost of heating had become an important element in the balance of payments, and that achieving the aim of a secure fuel supply was to a large degree dependent on the methods of heating used. The national economic argument for energy planning was prominent, and indeed the twin aim of achieving fuel supply security and diminishing the effects of fuel imports on the balance of payments was the foundation of Danish energy policy throughout the 1970s.

In Britain, we identified three dominant tendencies in energy policy since the 1960s: attempts, especially in the early part of the period, to secure consensus around energy policy; introduction of planning techniques, such as forecasting and mathematical modelling, into energy policy; an increasing emphasis on national economic aspects of energy projects towards the end of the 1970s coupled with an increasing concern about public acceptability of energy policy from the mid 70s. Furthermore we saw that new issues were introduced in energy policy: the nuclear project was redefined and nuclear power was clearly defined as a power-producing technology which would have to be assessed in the context of energy policy and energy economy; technologies for utilizing renewable energy were debated;

energy conservation was introduced as an important issue.

The same tendencies can be identified in the Danish energy policy of the period, albeit with differences in emphasis. Early attempts to secure consensus are not as evident in Denmark as in Britain. The Advisory Committees of the early 1970s drew their memberships from government and industry. Unlike in Britain, trade unions were not formally represented in energy decisionmaking until 1976 when the Energy Political Implements Act[64] set up the Energy Board to advise government in the preparation of energy policy reviews. The Energy Board drew its membership from trade unions as well as from industry and the scientific community.

In Denmark as well as in Britain, an increased emphasis on the use of planning techniques in energy policy during these years can be observed. Looking ahead became increasingly important, as indicated by the creation in 1974 of an Analysis and Prognoses Committee under the Ministry of Commerce. The forecasts prepared by the Committee were based on in mathematical-statistical models describing for each sector energy supply and demand. Hence the forecasts included

> "(...) the development of energy demand and the consumption of resources available for satisfaction of this demand, disaggregated into sectors of consumption and different fuels and including a statistical-economic analysis of the impact which would result from e.g. the relation between prices and tariffs, efficiency in energy consumption and from the development of production, transport and consumption." (Handelsministeriets analyse- og prognoseudvalg, 1975, p.5.).

The need for using mathematical models in energy policy was explained to the public in a book on energy economics and planning which is one of a series published as part of a major energy information exercise conducted by the state during these years:

"Energy transformations are influenced by a multitude of social factors, and for an energy policy to be efficient and balanced, all these factors need to be taken into account in its preparation. In order to implement energy policy, a long term, coordinative energy planning is a necessity.
The content of this planning has to be founded on a detailed analysis of the character and background of present circumstances and a description of alternative future trends and their requirements." (Energi Oplysnings Udvalget, 1975, I, p.7) (emphasis added).

Recognition of the vulnerability of sectoral forecasts led to the development of increasingly sophisticated forecasting procedures. The adoption of scenario techniques around 1980 seems to reflect growing uncertainties about the future. For example, the 1981 energy plan examined the implication of three sets of basic assumptions about future levels of economic growth and future types of social control[65]:

1) GDP growth: 2% p.a. until 1984, 3.5% from 1985-2000. Unchanged social control.

2) GDP growth as above. Strong social control ("(...) a more radical effort to reduce energy consumption" (Energiministeriet, 1981, p. 76)).

3) GDP growth: 1.5% to the year 2000. Unchanged social control.

Generally, the policy statements of the late 1970s displayed an increasing awareness of the social costs generated by energy production and consumption. In 1978 and 1979 the Ministry of Finance published long-term economic projections[66] which included for each major future energy investment programme (nuclear power, establishment of a gas distribution network) calculations of long term costs and benefits of the programme.

At the same time as methods were being developed for comprehensive ex ante evaluation of energy investments, increasingly attempts were being made to subject the

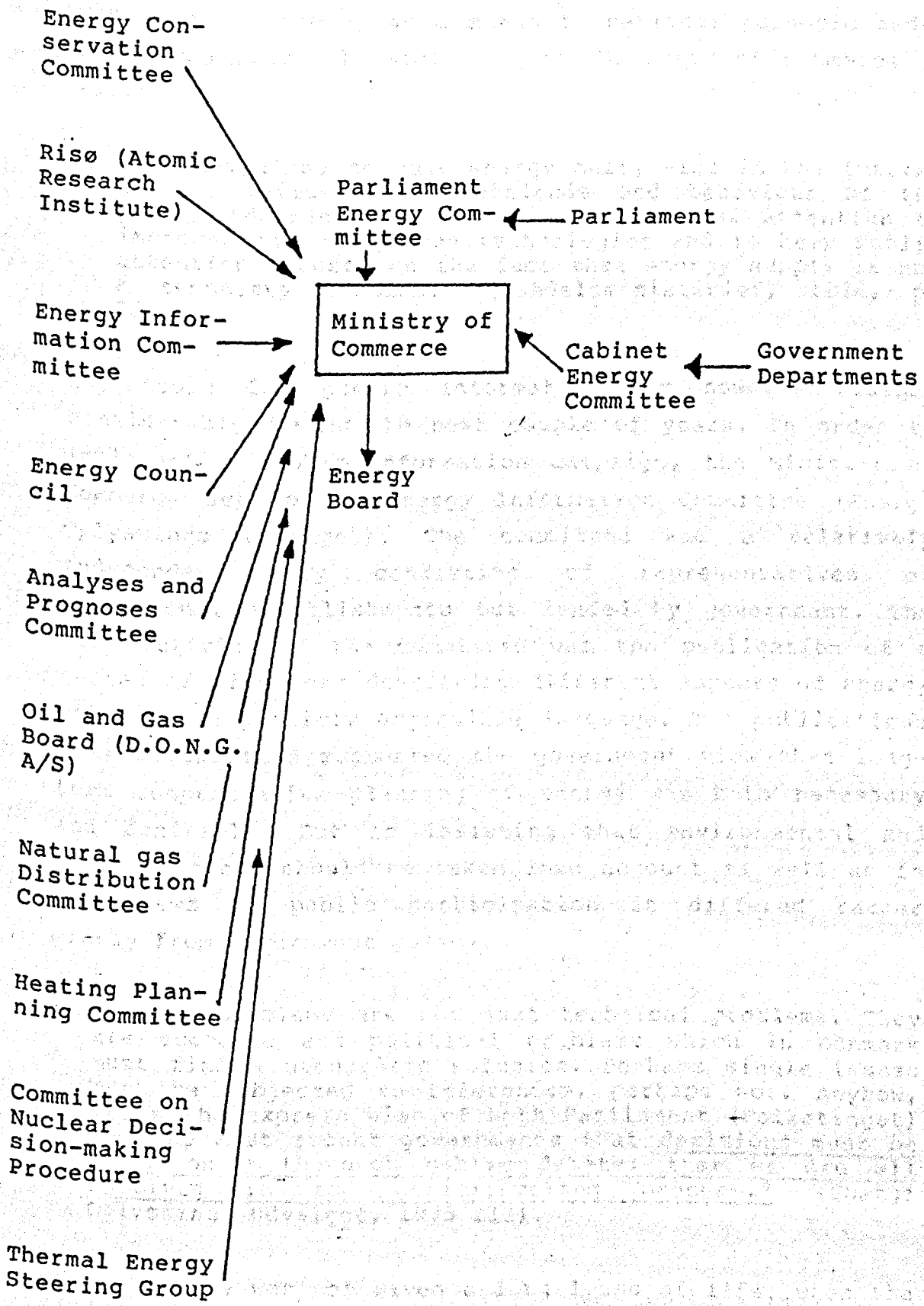
energy sector to economic control in terms of budget constraints. The abovementioned long-term projections from the Ministry of Finance were tools for coordinating public expenditure within firmly set budget limits. In the context of economic planning, energy was seen to be a particularly important component of the national budget for two reasons: 1) energy imports was a major factor in Denmark's increasing trade deficits, and 2) the export potential of Danish industry relied on a sufficient and reasonably priced energy supply[67]. In addition, the energy sector was seen to offer large potentials for increasing efficiency of public investments, partly by enhancing energy conservation, partly by controlling investment directly. This is evident from the the Budget reviews of the Budget Department within the Ministry of Public Finances which represent attempts to subject energy investments to evaluation on the basis of national economic efficiency criteria.

New institutions

The years after 1973 also witnessed a rapid expansion of the institutional framework for state energy policy[68]. Until 1976 various government departments had been responsible for different aspects of energy production. In 1976, energy was formally incorporated as a responsibility of the Ministry of Commerce and an Energy Agency (Energistyrelsen) was set up to be in charge of this area. Hence, energy was formally defined as a policy area. Whereas the importance of this area was finally acknowledged by the creation in 1979 of the Ministry of Energy, the number of state bodies involved in energy decisionmaking had been increasing from 1974. Fig. 2.2 shows the organization of the energy area which developed during the 1970s.

Public participation in energy decisionmaking was another

Fig.2.2 Organisation of Danish Energy Policy 1973-78



(After Poulsen, 1978, p.63).

concern of the Danish as well as the British state from the mid-70's. Originally, the objective was informing the public about energy as a means to national economic ends, as it was succintly stated by the Ministry of Commerce in 1976:

> "The campaigns to save energy must, also in the future, aim to influence the attitude and behaviour of the public towards waste and energy, to draw attention to improved uses of proven technologies and to keep public attention focused on the fact that energy supply is not a temporary problem." (Handelsministeriet, 1976, p. 85).

The scope for public information was however widened considerably during the next couple of years. In order to implement a public information campaign, the Minister of Commerce set up the Energy Information Committee (Energi Oplysnings Udvalget). The committee was a relatively independent body consisting of representatives of educational establishments but funded by government. The main activity of the committee was the publication of a series of six books describing different aspects of energy politics in publicly accessible language. The publications of the committee supported the government view that long-term comprehensive planning of energy was both necessary and desirable. But in insisting that environmental and social factors should be taken into account as well as in its views on public participation it differed rather widely from government policy:

> "Energy problems are not just technical problems. They are economic and political problems which in Denmark must find a democratic solution. Perhaps single issues must be subjected to referendum, perhaps not. Anyhow, it is the express wish of both Parliament (Folketinget) and the most recent governments that decisions must be based on a thorough public debate: that we are all involved in the decisionmaking process." (Energi Oplysnings Udvalget, 1975 III).

The committee was not given a long lease of life: when the

original grant ran out, no additional funding was allocated for the activities of the committee, and it was disbanded in 1976. No official reason was given for this. Procedures allowing for public participation in energy decision-making were never introduced, but there was a growing awareness of the importance of public opinion. Thus, the 1979 Energy Report from the Minister of Commerce[69] stressed the need for positive cooperation of the general public in implementing the plan, but did not specify how this cooperation was to be achieved. The 1981 Energy Plan[70], however, was more specific on this issue, mentioning information campaigns as an instrument for achieving public consent and cooperation. Such campaigns would include

> "(...) information activities focusing on rational use of energy and energy efficient technologies." (Energiministeriet, 1981, p.35).

We may say that the growing recognition that public opinion was vital to the success in implementing energy objectives was not transformed into procedures for ensuring that the attitudes and ideas of the public was incorporated in energy policy. In contrast, procedures for involving traditional interest groups were established as soon as state energy policy had been defined as a separate concern. For example, the Energy Board, which was to advise the Minister of Commerce on energy matters drew, its membership from the energy industries, the employers' organization, and the trade union council (the LO).

New Objectives

In Denmark as in Britain the objectives of national energy policy changed during the 1950-1980 period. Before 1973 there had been no formulated over-all objectives for state policies towards energy. The 1975 discussion document on a

national heating plan[71] cited the long-term aim as diminishing energy consumption and dependence on (imported) oil in space heating. The reaction to the economic repercussions of the oil price rises were evident also in the objectives cited in the 1976 Energy Plan[72]:

1) Reduction of Denmark's dependence on oil by means of

   a) Implementation of a diversified system of energy supply;

   b) Accumulation of emergency stocks.

2) Deceleration of growth in energy consumption.

3) Coordination and intensification of energy R&D.

In 1979, these remained fundamental objectives, but they were supplemented with an objective relating to energy consumption:

> "(It is an objective) to cut growth in energy consumption, with special emphasis on measures which can be implemented relatively quickly, in conjunction with the efforts to co-ordinate and intensify research and development in the energy sector." (Ministry of Commerce, 1979, p.3).

The emphasis on cutting growth in energy consumption is parallel to the increasing emphasis on the role of energy in the national budget. Where the main concern of the 1976 Energy Plan was a reduction of oil imports by replacing imported oil with other sources of energy, towards the end of the 1970s reduction in oil imports was to be achieved by reducing consumption. The emphasis shifted from supply security in the long term to effects, immediate as well as long-term, on the national budget.

New Issues

The concrete issues of Danish energy policy differed somewhat from those of British energy policy. While the

potentials of North Sea oil and gas supply, nuclear power and renewable energy commanded interest in both countries, the concern for heat occurred only in Denmark. This was due to the fact, that energy consumption in the form of heat in 1972 amounted to 43% of gross consumption, and that this heat was obtained largely by burning imported oil[73].

Shifting fuel consumption in this sector away from oil became a prime concern of energy policy. A Heat Supply Act passed in 1979 aimed at regulation of energy consumption for space heating[74]. The Act gave the Minister the power to divide the country into heating regions. Each region was in principle to be supplied with either one of two types of collective heating: district heating from combined heat and power station or natural gas. In the case of rural areas with low density of buildings, other heating methods like electrical were drawn up with due regard to the natural gas project, the existing and projected combined heat and power stations as well as projections of heat demand density.

Energy conservation was another important area for state intervention. 'Car-free Sundays' and 'Save-'it' campaigns of the immediate post-oil crisis years were replaced by more direct state intervention when the building regulations were tightened considerably in 1977. The new regulations set standards for insulation, heating and ventilation installations etc. Also in 1977 the Process Energy Act (Lov om statstilskud til energibesparende foranstaltninger i forbindelse med industrielle processer) was passed in Parliament which provided for state subsidies of up to 40% of costs of investment of private trade and industry in energy conservation and efficiency.

The partial nationalisation of Danish reserves of oil and gas in the North Sea also fits in this context. In 1973 the gas company was extended to deal with oil and became

the Danish Gas and Oil Company (Dansk Olie og Naturgas, A/S), a limited company in which the state owned all shares. It was to operate like a private firm on the oil market, for example by setting up direct trade agreements with Middle East oil producers. The first task of the company was to renegotiate the licensing conditions of the private consortium prospecting in the North Sea. A contract for gas sales from the consortium to the nationalised company was set up in 1979. This contract is generally considered very unfavourable to the Danish state, which is contractually bound to purchase 55.000 millions m^3 of gas before 1994. The gas is to be purchased evenly over the period, and the price of gas is to follow the price of oil in the world market[75]. In 1981 a contract was signed which gave the Danish national oil and gas company option to purchase 40% of oil recovered after 1982. In addition the contract defined the terms for a gradual handing over of sectors of the North Sea to the Danish state. According to the contract, sectors in which oil recovery had been or were to be initiated shortly after 1981 were to be handed back to the state. The North Sea negotiations give evidence to increased state activity in relation to energy supply and can be seen as one side of the efforts to replace the imported Middle East oil with other fuels. Parallel to these efforts, increased attention were given to technologies which seemed to offer other ways of getting rid of the dependence on oil imports.

The prospect of fuel shortage also led to renewed consideration of nuclear power. In 1975, the Social Democratic government put forward a Nuclear Installations Bill to supersede the 1962 Act, which had never been implemented. According to this bill, the decision to introduce nuclear power was to be taken in Parliament. Siting was also to be a question for the state, which would issue planning directives to local authorities reserving areas for future nuclear power plants. The Act

was only passed, however, after an escape clause had been added. According to this clause, the Act would only become operational if and when Parliament passed an additional bill putting it into force. This bill reached the 1st committee stage. The bill was presented thus:

> "I think that nuclear power is necessary for our supply situation. It cannot be replaced by natural gas. We will have to use it to rid us of two thirds of our reliance on oil and coal. That is essential." (Speech by Erling Jensen, Minister for Commerce, in Parliament 21 May 1975. Quoted here from Hertz and Nielsen, 1979, p.8).

This bill, however, never went beyond the committee stage and in 1976 it was removed from the agenda. This did not imply, however, that nuclear power was taken out of energy planning. Both the 1976 Energy Plan, the economic prognoses of the late 70s, the 1979 Energy Report and the 1981 Energy Plan included a nuclear component, which was maintained even after the Social Democratic government in 1979 declared a moratorium on nuclear power until a full inquiry into questions of reactor safety, waste disposal and economics of nuclear power generation had been conducted. The moratorium indicated growing uncertainties about the future costs of nuclear power. In addition it was decided that any decision to introduce nuclear power in Denmark would be subjected to a referendum. This reflects growing government concern about the public acceptance of nuclear power, a concern which was also present in the 1981 Energy Plan. The plan stated, that although large economic benefits would be expected to arise from the introduction of nuclear power, just as this would mean a further decrease in the import of oil, there was no need for a quick decision on nuclear power, as the present generating capacity was sufficient (Energiministeriet, 1981).

Hence, nuclear power has not as yet been introduced in Denmark although successive governments have regarded it

as a favourable option. The development in the arguments for opting for nuclear power has been parallel to what we have seen to be the case in Britain: In the 50s nuclear power was portrayed as a major scientific and technical achievement. Later, the emphasis was on the ability of nuclear power to displace imported oil, and by the end of the 70s focus was on the relationhip between costs and benefits of nuclear electricity generation.

In Denmark, as in Britain, renewable energy received more political attention in the 70s than in the 50s. Although renewable energy was mentioned along with other sources in the policy documents of the 1970s, the expectations for the future supply potential of the renewable sources were minute. Thus the 1979 Energy Report noted:

> "The possibilities of switching to renewable energy sources in 1985 and 1995 are just as hypothetical as they were at the time of preparing the 1976-Report. Considerable research and developmental work is going into this fields, bu there are as yet no thorough appraisals that enable a realistic quantification of the contributions that renewable energy sources are likely to make to our energy supply". (The Ministry of Commerce, 1979, p. 11).

In the 1981 Energy Plan it was observed that increases in fuel prices had improved the competitiveness of renewable energy technologies. The supply scenarios assumed a contribution from renewable sources at 3.3 to 7%. The 'high' case of 7% assumed a large percentage of renewable sources in heating whereas no contribution from these sources to electricity production was expected. Taking into account the present interest in wind machines from Danish industry, this assumption seems somewhat odd.

The policy instruments used by the state in relation to renewable energy have mainly fallen in two categories: funding for technological R&D in places like Risø and the universities, and subsidies for local experiments with

renewable energy systems. R&D funding for renewable energy was increased dramatically from 1977. Before then, renewable energy had received 2-3% of R&D expenditure (for comparison 62-65% were allocated for fission and fusion). After 1977, this percentage was increased so that by 1980, 22% of energy R&D went into renewables as compared to 24% for nuclear power[76]. The stakes were being placed more evenly, reflecting that nuclear power had become a risky proposition. The sizeable R&D figure for nuclear power shows, however, that it was still expected to play a role in future energy supply. The bulk of renewable energy R&D went into technologies expected to be compatible with the existing infrastructure, for example about 42% of the total renewable energy R&D expenditure went into wind power (at odds with the assumptions mentioned above of the role of renewable energy in the future energy supply).

Summary of Danish Energy Policy

Table 2.2 sums up the most important developments in Danish energy policy from 1950-80. The period is divided into five-year intervals.

From 1950 to 1955, the most important concern of the state in relation to energy was the development of nuclear power. State initiatives were taken to support the development of the promising technology. In Denmark, no nuclear establishment existed at the time, so the Atomic Energy Commission was to start up the nuclear project from scratch.

From 1956-1960, the state did not intervene in energy affairs at all. From 1961-1965, we notice an attempt to strenghten nuclear research by setting up Risø, the nuclear research station, as well as renewed efforts to ensure introduction of nuclear power by passing the Atomic Installations Act. The government's handing over the li-

cence to exploit North Sea resources to a private consortium indicates that the possible access to indigenous oil and gas was not regarded important to the Danish fuel supply or the national economy in the long term. Again from 1966-1970 a quiet period indicates that energy supply was left to fuel and power industries.

From 1971, however, we notice a sudden activity in energy policy. A number of state bodies were set up to look into different aspects of energy supply and consumption. The problem of ensuring sufficient supplies of fuels in the future were addressed by attempts to analyse, forecast and control vital factors determining the need for fuels in the future. Such vital factors were the size of future energy consumption and the composition of fuels in the national energy supply.

The interest in fuel diversification was reflected in renewed interest in the North Sea and in nuclear power. In addition, the period was characterized by attempts to involve interest groups in decisionmaking, the attempts to control consumption through proposals for heating plans as well as directly through information campaigns, and finally, energy was now being regarded as an integrated and important policy area located within one Ministry, the Ministry of Trade.

From 1976, the state energy policy establishment did not develop as rapidly as in the previous period, but the establishment of an energy department and more formalized administration procedures signals that the energy area was now regarded a stable concern of the state. This is also indicated by the increase in the number of Acts on energy being passed in this period and the institutionalisation of Energy Policy Reviews. Towards the end of the decade, national economic costs of energy production and consumption became an important issue in state energy policy, and emphasis was increasingly on efficiency in consumption as

Table 2.2 Events in Danish Energy Policy 1950-1980.

5 year period	Institutional changes	Legislation and important policy documents	Methods and practices - changes
1950	Creation of the Atomic Energy Commission (1955) Risø set up (1955)	Atomic Energy Act (1955)	
1955			
1956			
1960			
1966		Licence to exploit North Sea to DUC (1962) Atomic Installations Act (1962)	
1965			
1966			
1970			
1971	Advisory Committee on North Sea Resources. (1971) Dansk Naturgas A/S set up (1972) Energy Policy Committee. Analyses and Prognoses Committee (1974) Heating Methods Committee (1975) D.O.N.G. A/S set up	1st energy policy review (1974) Discussion document on a national heating plan (1975) Nuclear Installations Bill (1975)	Information campaign 'Save-it' campaign
1975			
1976	Ministry of Commerce given responsibility for Energy (1976) Energy Board (1976) Energy Agency (1976) Ministry of Energy (1979)	"Danish Energy Policy" (1976) "Energy Report" Electricity supply Act (1976) Energy Political Implements Act (1976) Building regulations (1977) Investment surveys (1978-) Budget reviews. Moratorium on nuclear power (1979) "Heating Supply Act" (1979)	Scenario technique. Cost-benefit analysis. Funding of renewable energy R&D. Budget-oriented energy planning.
1980			

well as (long and short term) efficiency in energy investments. Finally, the public acceptance of energy political aspects, especially nuclear power, had become important.

Looking across the five-year periods in order to identify periods of stable concerns, periods of conflicts and phases of transition, we note that state activity towards energy was limited until 1971, whereas the picture after 1970 is more complex. Looking at the character of events leads us to identify the following periods:

1) **1950 to 1970.** In this period the state did not interfere with the already established system of energy supply and consumption. Only on the fuel side did the state become involved. The nuclear project was a state venture which was to increase efficiency in electricity production which would mean that full employment would not be an obstacle to continued growth. Besides, energy supply was left to private and local industry and to individual citizens.

2) **1970 to 1973:** growing uncertainties in relation to fuel supply expressed in attempts to coordinate policies towards fuel and power and establish future state influence in fuel supply.

3) **1973 to approx 1978.** The years immediately after the oil crisis were marked by attempts to change the structure of Danish energy supply in order to ensure that Denmnark would not in the future again depend on only one fuel. State energy policy institutions were created. As a novelty, it was attempted to control energy consumption. Energy had become a problem on its own.

4) **After 1978.** Towards the end of the 1970s, state intervention in the energy sector had been firmly established. But new problems had replaced the concern for

a stable fuel supply. The cost of energy was set against the context of a contracting national economy. In addition, the costs to society of the negative higher-order effects of energy production had also been recognized, and attempts were being made to develop planning methods which would ensure that such costs were diminished. Project evaluation had come into focus. Likewise, energy conservation was seen as an instrument to cut down energy imports and thus help trade deficits. At the same time, public acceptance of energy policy was important. Thus, energy policy no longer reacted to a one-dimensional problem like in the 1950s or 1960s when the problem was ensuring economic growth, or immediately after the oil crisis. A multitude of objectives have increasingly been imposed on state energy policy since the mid-1970s.

2.4 Conclusion

This chapter set out to analyse the historical development of British and Danish energy policy in order a) to assess whether our assumption of a parallel development of energy policy in the two nations is sustainable, b) to investigate whether a politicisation has occurred in this area in the specified period and c) to establish the content as well as the chronology of this politicization.

Table 2.3, which in its lay-out resembles tables 2.1 and 2.2, shows developments in terms of institutional changes, policy issues and changes in practises and methods which are common to the two nations.

Looking at table 2.3, we observe that only as regards nuclear policy was the development of energy policy parallel to Denmark and Britain before 1970. The development of political institutions to do with nuclear power as well as of legislation in the field was almost

Table 2.3 British and Danish energy policy 1950-1980. Common trends.

Time (5 year periods)	Institutional changes	Legislation tendencies	Changes in practices
1950	Institutions for preparing civil nuclear projects	Legislation establishing civil nuclear energy	
1955			
1956			
1960			
1961			
1965			
1966			
1970			
1971	Energy remit of one ministry. Advisory councils established. Bodies to look into methods for energy planning. Strengthened control of indigenous sources	Legislation and policies for ensuring future fuel supplies. Plans for new nuclear programmes.	Adoption of national energy forecasting Efforts to make general public aware of energy problems.
1975			
1976	Attempts to involve interest groups in decisionmaking (given up towards end of period).	Comprehensive energy policy reviews. Legislation on energy conservation Legislation on electricity.	Intensified planning. Attempts to include non-economic costs Considerations of new aspects of energy supply: Environment; employment; public participation.

synchronized in the countries in contrast to the development of other fuel policies. As we shall see in chapter 4, this may be explained in part by differences in the fuel base and energy supply systems of the two countries, coupled with the character of nucelar power as a non-geographically specific, highly specialized source of energy, which was widely thought to represent a long-term solution to the shared problem of prospective energy shortage.

After 1971 energy policy tendencies converged in the two nations. In both nations (and especially in Britain), state involvement in the energy sector was increasing up to 1973. In 1973 and 1974 both countries experienced large problems related to fuel supply and fuel prices. Both the Danish and the British state reacted by trying to extend the capacity for planning and controlling energy supply. In both countries, new fuels and technologies were considered as a means towards fuel diversification. In addition, the states sought to control energy consumption by attempts to clarify the national (-economic) effects of individual energy consumption ('waste of energy') to the consumer. The idea that growth in energy consumption was a necessary prerequisite of economic growth had been temporarily suspended in the light of the consequences of depending on very few fuels for energy supply. State energy planning became firmly established as a necessity in order to avoid future similar situations. Immediately after the oil crisis and the British coal strike, the state attempted to avert the immediate consequences of the threatening breakdown in fuel supply and develop strategies which would insure against similar events in the future.

The problems of the 1960s and 1970s, however, had not been solved. The environmental effects of energy production still presented a problem, which came further into prominence when nuclear power programmes were presented as

part of fuel diversification strategies in both countries. Likewise, the political conflicts between political groups, specifically trade unions and industrial interests, were still latent.

These problems were now integrated into a growing state energy policy complex in both countries. The comprehensive energy policy reviews of 1974-1977 included considerations of a very large number of aspects related to energy production and consumption in order to arrive at strategies which were robust against economic as well as political problems.

Towards the end of the 1970s, in both countries, energy was to a still larger extent subjected to national budget considerations. While state policy institutions were consolidated, the proliferation of state bodies had come to a halt. Still, however, new planning methods were being developed, partly in order to ensure future cost-minimization, partly in attempts to accomodate the increasing number of uncertainties in relation to energy.

In table 2.4 we have attempted to draw these observations together with the periods we derived from our surveys of national energy policy in the two nations to arrive at a common periodization. The table is divided into four columns, showing the basic problems for energy policy, the focal points of state policies, the solutions to energy problems in terms of state involvement and finally important divergences between the two nations.

We have seen, that energy policy in the two nations in the 1950s were similar with respect to nuclear power. The fact that British fuel industries were nationalised made for state involvement in fuel production, but this involvement was not subjected to political discussion in terms of the overall energy supply. As in Denmark, energy planning was the task of the energy industry. The basic problem of the

Table 2.4 Problems, issues and solutions in energy policy 1950-1980. Denmark and Britain.

Period	Problems facing the state in relation to energy	Focal points	Policy solutions	Divergences DK/UK
1950s	Future fuel gap Energy infrastructure insufficient to cope with growth	Economic growth Technological progress	Closing fuel gap: State financed development power; centralisation of electricity industry; state support for technological change in fuel production; extension of grid.	Nationalized industries specific problem of the UK. Danish infrastructure and fuel production concern of private sector.
1960s 1973	Growth in energy consumption not limitless control of energy supply conflicting interests in energy production Environmental problems	Inability of industries to control externalities and to coordinate production Environmental effects of nuclear power	State energy planning Energy forecasting; state financed energy R&D; state bodies for control of external effects; involvement of trade unions and industrial interests in state energy policy.	British coal not competitive with oil: Subsidies for coal; proposals to wind up coal production; problems with mineworkers' union.

1973 and the next couple of	'Energy crisis' Future energy supply threatened dependence on few fuels	Supply security Fuel diversification Energy consumption	Intensifed state activities energy area new institutions support for development of new sources: North Sea, nuclear Power.	British coal miners' instrike adds to fuel uncertainties. Danish dependence on oil implies that oil crisis was more important in DK.
late 1970s	Economic stagnation Costs of energy in national economic perspective: Profitability; Costs of external effects; Cost of excess capacity; Public accept of energy policy	Indigenous energy supply Efficiency of investments New energy technologies	State support for development of indigenous sources Energy conservation Public participation.	Nuclear power problems lead to moratorium in DK and public inquiries in the UK.

state was ensuring sufficient energy output to support economic growth.

The 1960s in Britain stands out as a period where state management of energy production led to an increasing number of problems concerning the labour force, competitiveness of coal in the world market and the environment. These problems prompted state attempts to develop new procedures for planning energy production. This development was also marked in Denmark, where the problems were not the concern of the state but of the energy industries and the consumers. Only by the early 1970s did state involvement in energy occur here. Throughout the 1960s, the availability and cheapness of oil had meant that energy did not constitute a problem. The only indication that the energy situation were different from that of the 1950s was the quiet which fell upon nuclear power after the enthusiasm of the 1950s. Thus, whereas state involvement in energy policy increased up to 1973 in both countries, this happened considerably later in Denmark than in Britain. Hence, the period which we have termed 'the 1960s to 1973' only to a limited extent covers a parallel development of energy policy. This indicates that ownership of energy production was an important factor determining state energy policy in this period.

The shift around 1973 is very marked in both Denmark and Britain, and the development of state energy policy after 1974 strikingly similar. In both countries the hectic state activities in these years marked a distinct departure from the paradigms or frameworks of state intervention in energy up to 1973. State energy planning was intensified with the strategic aim of ensuring future fuel supply. We have marked 1973 with a bold line in the table to indicate that this year represents a significant break which is common to both countries.

The fourth period starts about 1977, although no clear date separates this period from the 'period of panic' immediately upon the oil crisis. During this period the emphasis on expanding state capacity to deal with all aspects of energy, first and foremost the problem of ensuring future energy supply, was gradually replaced by emphasis on the role of energy investments in adding to national economic problems. Thus on the one hand energy policy was increasingly regarded as an instrument of economic policy while on the other the need to ensure public accountability led to the adoption of new procedures for public participation. In both countries the number of alternative objectives and concerns for national energy policy accumulates in this period, and so the problems related to state control of energy becomes increasingly evident. This period is thus characterized by a clash of different concerns within state energy policy and between state energy policy and other concerns of which the concern for the national economy appears to be most important. This period is therefore characterized by moves away from the strong state efforts at politically controlling energy supply in the national interest and increasing recognition that a unifying national interest beyond cannot at present be identified.

We have now identified within the 1950 - 1980 period four sub-periods characterized by different approaches to state intervention in energy policy, both as regards its form and content. In both Denmark and Britain, the emphasis on economic growth was strong in the 1950s leading to market-oriented policies. This was followed in both countries by a phase, most marked in Britain, of increasing emergence of problems in energy supply, leading to increasing state involvement. The events of 1973/74 marked a significant shift in both countries and was followed by the definition of energy policy as a national concern. Towards the end of the 1970s, problems of accommodating different possible objectives as well as possible future developments in

state energy policy became increasingly visible. At the same time, the cost of energy production was increasingly important.

We are now left with explaining these shifts in approach. This means that we will now have to investigate our assumptions about the influence of different factors on energy policy. The following chapter is devoted to an investigation of the impact of political groups on energy policy.

NOTES TO CHAPTER 2

1. See e.g. Ince (1981), who includes as policy-makers nationalised and private industries in energy production as well as government departments and their divisions.

2. The name of the department was changed from the Ministry of Fuel and Power to the Ministry of Power in 1957. The responsibilities, however, remained unchanged.

3. For an account of the formation of the UKAEA, see Gowing (1974); UKAEA Authority Historian's Office (1979); Connell and Chudleigh (1983) pp. 30-32.

4. The Committee was set up by government to look into whether, in view of growing demands for energy arising from full employment and the rearmament programme, any further steps could be taken to increase efficiency in fuel production and consumption.

5. 'The fuel gap' denoted a possible excess of demand for energy over supply. Hence, when in 1955 the Conservative Minister of Fuel and Power, Geoffrey Lloyd, presented government measures for reducing coal export and support for an expansion of the nuclear power programme, these were motivated by the need for "bridging the fuel gap" (The Times, 21 July 1955).

6. See Chesshire et.al. (1977), pp. 40-41.

7. Reid and Allen (1975), p. 33.

8. Chesshire et.al. (1977), p.40.

9. This is exemplified by the brief of the committee which preceded the Electricity Act of 1957: "to enquire into the organisation and efficiency of the electricity industry in England and Wales in the light of its working under the electricity Act 1947." (The Electricity Council, 1982).

10. A full account of the development of the nuclear project is beyond the scope of this thesis; for detailed accounts, see e.g. Patterson (1976) pp. 189-233; Gowing (1974); Stott and Taylor (1980); Canell and Chudleigh (1983) pp. 27-63.

11. Government expected 10,000-15,000 MW of nuclear plant to be installed by 1957 (The Times, 8 August 1954). For comparison, the total capacity of all British nuclear plant in 1975 was 12,256 MW (UKAEA, 1979, II, appendix 7).

12. The Times of 13 February 1954 cites as one of the objectives of the creation of the Authority the need to keep Britain in the lead of development of the "sane uses of atomic energy".

13. The nuclear power programmes were presented and revised as follows:

year	official number of programme	size, MW	time horizon of programme
1955	1	1,500-2,000	10 years
1957	revision	5,000-6,000	by end 1965
1957	revision	5,000-6,000	by end 1966
1960	revision	5,000	by end 1968
1964	2	5,000	by end 1975
1965	revision	8,000	by end 1975
1974	3	4,000	by end 1978
1978	revision	2 Advanced gas cooled reactors possibly pressurized water reactor	immediately 1980
1979	4	15,000	1982-1991

(from Cannell and Chudleigh (1983)).

14. United Kingdom Atomic Energy Authority (1979 II), p.7.

15. To give an idea of the economic implications of the project, the expenditure in 1954 for the UKAEA come to $53,675,000 £36 mill. (Camilleri, 1984).

16. For an account of these events, see Stott and Taylor (1977).

17. Central Office of Information (1962) p.17.

18. Camilleri (1984), p.40.

19. Central Office of Information (1962), p.62.

20. 'The Nuclear fuel cycle' denotes the processes involved in mining, enrichment, fuel fabrication, fuel use in reactor, reprocessing and storage (see e.g. Patterson, 1976, p.88).

21. Central Office of Information (1962, 1965, 1967).

22. The assumption of a correlation between GDP-growth and growth in electricity demand is repeated in Central Office of Information (1965). The costs of the first nuclear power stations had turned out to be considerably higher than had been forecast. This did not, however, affect the presentation of cost forecast for the future stations.

23. For instance it was assumed that load factors of 75% would be feasible (Central office of Information, 1965). The load factor is the ratio of units actually generated over a period to those which could have been generated if the plant had worked continuously at full power for the period. Data on actual load factors are difficult to find. The second generation of British

reactors, however, have load factors at about 25% (Pattersen, 1976).

24. Energy Paper No.21.

25. Pearson (1981), p. 171.

26. Central Office of Information (1975, 1977).

27. Although increasingly sophisticated forecasting procedures were developed, more primitive models based on linear extrapolation or assuming simple relationships between energy demand and a very small number of other parameters remained at the foundation of British State energy policy. For example, a model presented in Energy Paper No.12 assumes that = GDP, where = growth in energy demand and e (the energy coefficient) is constant. In addition it was assumed that no radical price changes would happen: "(...) the UK is assumed to develop in a world unconstrained by energy scarcity and with only moderate changes in energy prices." (p.25). Likewise, Department of Energy (1979) projections of energy supply and demand to the end of the century used expected trends in GDP growth and oil prices as key indicators of energy demand growth.

28. Energy Commission (1977,II). For critiques of the use of GDP as an indicator in energy forecasting, see Chapman (1975); Hvelplund (1980); Ince (1982).

29. Department of Energy (1978).

30. For a discussion of the use of cost-benefit analysis in public policy see e.g. Flyvbjerg (1979).

31. The Energy Commission (1977 I).

32. Department of Energy (1978).

33. For different angles on the political and ethical problems in quantitative measures of social variables, see Schrader-Frechette (1983) and Zimmerli (1983).

34. The Energy Commission (1977 I) stated that it should be of no concern to national energy policy whether the poorer members of society were in a position to buy adequate warmth and light.

35. The Energy Commission (1977), p.32.

36. Ibid.

37. Working Group on Energy Strategy (1977).

38. 'At the Heart of Nuclear Power', pamphlet, BNFL, 1982.

39. UKAEA had been accountable in turn to the Ministry of Science and the Ministry of Technology (from 1966). The Ministry responsible for coal, oil and gas had its name changed a couple of times,

from the Ministry of Power to the Ministry of Fuel and Power (1957-59). It was absorbed into the Ministry of Technology as was responsibility for the UKAEA.

40. The Electricity Council (1982).

41. Ibid, pp.1-2.

42. The allocation of government expenditure on R & D in energy in 1980/81 was distributed thus: nuclear, electricity, gas, coal oil (in order of importance) 95%; renewable sources 2,5%; conservation 0.5% (Energy Paper No.11).

43. The bibliographies of e.g. the UKAEA are impressive. See: United Kingdom Atomic Energy Authority: Nuclear Power Publications. London: UKAEA, 1982; Nuclear Energy: A Select Bibliography. London: UKAEA, 1983.

44. The Electricity Council (1982).

45. The Energy Commission (1977); Department of Energy (1978).

46. See e.g. Cannell and Chudleigh (1983); Kemp et. al. (19849.

47. The White Paper "Fuel Policy" (mnd. 2798) had established nuclear power as fuel.

48. The Membership of the NPAB consisted of: The chairman of the United Kingdom Atomic Energy Authority; a full time member of the Authority; the Chairman of the Electricity Council; representatives from the electricity boards; plus 'independent nuclear experts' (United Kingdom Atomic Energy Authority Report and Accounts 1973/74).

49. Cannell and Chudleigh (1983), p. 50.

50. Department of Energy (1974).

51. See The Energy Commission (1977).

52. Department of Energy (1981).

53. The Energy Commission (1977); Energy Paper No.21.

54. See note 39. For a detailed account for government R & D expenditure on renewable sources, see Flood (1983) p. 181 ff.

55. See the Energy Commission (1977); Energy Paper no.22. Also the R & D Funding reflects these preferences. Hence, between 1978 and 1980, 73% of total government expenditure on renewable energy sources went into R & D in tidal power, wave power and geothermal energy (FLood, 1983, p. 182).

56. The Energy Commission (1977).

57. Rasmussen (1982), p. 144.

58. The involvement of the Minister of Education was probably due to the absence of nuclear industry as well as science being a remit of that Minister.

59. Mouritzen et.al. (1978).

60. Equivalent to the British Ministry of Trade

61. Poulsen (1978).

62. Ibid., p. 53.

63. Statsministeriets svar til det energipolitiske udvalg 26/5/1975 pp. 1-2. Statsministeriet 26/5/1975 j.no.12-90-34.

64. Lov om Energipolitiske Foranstaltninger.

65. Energiministeriet (1981).

66. Finansministeriet 1978, 1979).

67. Finansministeriet, Budgetdepartementet (1979-)

68. For a detailed account, see Poulsen (1978), pp. 52-63.

69. Handelsministeriet (1979).

70. Energiministeriet (1981).

71. Boligministeriets opvarmningsmetodeudvalg (1975).

72. Handelsministeriet (1976).

73. Op.cit. note 67, p. 4.1 ff.

74. Lov om varmeforsyning af 8/6/1979.

75. This contract has been heavily criticized (see e.g. varmeplan-gruppen, 1981) for placing severe constraints on the manouvering capability of local authorities in heat planning. Furthermore the price at which the gas is purchased at platform and world market oil price index is seen as unfavourable considering the actual cost of extracting the gas.

76. See: Ministry of Commerce (1979) p.101; Energiministeriet (1981) p. 104 ff. supplement 1.

3. POLITICAL GROUPS AND ENERGY POLICY

3.1 Introduction.

The analysis in the preceding chapter of the development of energy policy in Britain and Denmark led to the identification of four periods each showing different characteristics of state energy policy. In this chapter we shall look into the possible influence of political groups on this development. In particular we shall examine our assumption that changes in energy policy are subject to direct influence by political groups, while economic and resource conditions as well as the effects of the existing systems of energy provision influence the attitudes of these groups.

We have seen that in both Denmark and Britain energy became politicized in the course of the 1950-1980 period, in the sense that the state administration concerned with energy multiplied, the number of issues defined as energy policy grew and an increasing number of new methods were adopted in state energy planning. These tendencies were closely related to the imposition of multiple objectives on state energy policy. The most important of the secondary objectives present in the energy policies of both countries were related to the impact of energy technologies on the environment and on employment. At a more specific national level, the process of politicization itself as well as the specific issues taken up in energy policy was seen to exhibit characteristics peculiar to the nation. Thus we found that the increase in state involvement in energy planning started earlier in Britain than in Denmark, and that different weight were attached to different issues in the two nations: nuclear power and renewable energy being extreme examples of the different importance attached to different energy technologies.

In the following we shall investigate political groups as a possible source of the changes in energy policy. We shall do this by chronological accounts of the energy political statements of different classes of political groups during the 1950-1980 period. We shall seek to locate in the chronology the groups' perception of the energy policy context, the range of issues considered important and the specific proposal for solutions to problems identified in relation to energy. We shall then be able to relate this to the development of state energy policy and trace whether there are parallels between the energy political ideas of particular groups and state energy policy. This will give us an indication of the direction of the possible influence of particular groups. It must be noted that the method does not allow us to achieve any proof of causality. If, however, a specific issue appears in the policy statement of a group prior to it showing up in state energy policy we are satisfied that the group is a possible source of influence.

In addition we want to investigate whether the increase in the range of energy political issues and secondary objectives is paralleled at the level of political groups. We have suggested that new groups have emerged in the energy field and that existing groups have taken up energy questions during this period. We want to locate these changes within the chronology and again establish possible parallel developments.

To establish these parallels it is necessary to look at British and Danish groups separately, as we have found differences in the energy policies of the two nations. Hence, for each class of groups, the account is divided into a British and Danish part. Furthermore it is necessary to identify more precisely the political groups for investigation. Also we need to specify what we mean political groups. Let us therefore look at some proposals for the identification and analysis of political

groups in relation to energy policy.

Pearson (1981) as well as Ince (1982) include in their analyses of British energy policy 'policymakers', and groups and workforces not directly involved in state energy decisionmaking. Ince operates with a category called 'the energy establishment' which includes diverse groups such as trade unions, the environmental movement, the House of Commons Select Committee on Energy, political parties and extra-parliamentary institutions like the Monopolies and Mergers Commission and the Electricity Consumers' Council. The inclusion of these groups in the description of British energy politics is not argued beyond the observation that

> "Any account of Britain's energy affairs must recognize that much power lies with bodies outside the mainstream of official decisionmaking." (Ince, 1982, p.41).

The questions raised by this apparently common sensical observation is not addressed in any depth by Ince. What are we to understand by 'power'? How are we to identify those groups in power? Ince's actor analysis does not provide us with an answer since it merely describes the activities of a number of groups on whose agendas energy-related topics appear. But to say that an issue occurs on the agenda of a group obviously does not establish whether or not the group commands any power in changing 'energy affairs', whether we understand by this the physical supply structure or the policies of the state towards this structure. Likewise, the politicization of energy is reduced to a fact, as when Ince observes that:

> "(...) trade unions have become increasingly aware of the importance of energy problems and the nuclear programme in particular. Even unions whose members are not employed in the energy industries now take an interest in energy policy." (Ince, 1982, p. 41.)

This observation, however, is not used for any further

discussion of why these unions have become interested in energy or the influence they command in relation to state energy policy. The claim that much power lies with these groups is not substantiated and what remains is a documentation of the extent of the occurence of energy-related issues on the agendas of a number of political groups and state agencies in the years from about 1979.

Pearson (1981) in a similar fashion identifies a number of groups which have taken interest in energy issues. Under the heading 'The energy industry' (which is contrasted to groups involved in policymaking) she lists, beside the industrial undertaking in energy production, a number of 'cause groups' (which are "formed for specific purposes to campaign or act as a pressure group for particular causes or ideas" (p.135)), 'interest groups' (which "may be defined as those people who come together out of a given common interest" (p.135)), groups with 'fairly direct interest in energy', academic institutions and 'fringe involvement'. Under each of these headings she lists a number of groups and describes in short their energy political objectives. This approach gives rise to a number of peculiarities beside that of including e.g. environmental groups under the heading of 'The energy industry'. For example, the trade unions are excluded from this category because they have a "basic political stance" (p.135), while the Socialist Environment and Resources Association, SERA, which is closely connected to sections within the trade union movement as well as within the Labour Party, is included here as is the socialist British Society for Social Responsibility in Science. More important, however, is that again the detail in account seems to have been achieved at the expense of a discussion of the significance of what is described. In this case the range of groups which address themselves to energy questions.

This problem is addressed briefly by Lindberg (1977, II),

who comments on the lack of organisation and resources at the disposal of environmentalist and conservationist groups compared to e.g. the energy industry. He concludes, that the apparently growing impact of alternative energy propositions are unlikely to amount to more than incremental modifications of present policies. Although the multiplication of actors at the level of pluralist debate may create a certain amount of stalemate and immobilism in public energy policy, this is a superficial phenomenon:

> "I reach this conclusion because the energy consumption patterns and govermental politics that have supported them seem to me to conform closely to the long-term interest perceptions and survival imperatives of some of the most decisive social groupings in advanced industrial societies. And these are not readily subject to change because they are imbedded in deeply seated organisational, cultural and political/ideological factors that interact with and reinforce the pluralist and elitist constraints on policy adaptation (...)." (Lindberg 1977, II, p. 338).

This conclusion is implicitly supported by Ince (1981) in his assessment of the future of the British electricty industry. In his evaluation of the future options and constraints, the activities of e.g. environmental groups are not brought into consideration in contrast to the activities of the energy industry and of state energy policy bodies. Hence, whereas Ince's actor analysis implied that the emergence of new groups outside the mainstream of energy decisionmaking must be regarded as significant, this suggestion is implicitly contradicted the conclusions. The question of the significance of the arrival of new groups in energy policy thus remains unresolved.

In order to achieve a more systematic understanding of the influence of political groups upon energy policy we have chosen not to make any preliminary inferences about the relative power of different groups. Instead, we want to establish whether the aims, issues and attitudes of particular groups correspond to those expressed in energy poli-

cy at different times.

Leaving out assumptions about the distribution of power implies that the term 'political groups' is, and is intended to be, very open from the outset. The necessary operational classification was established by initially identifying[1] groups (widely understood as groups of individuals) which are at present involved in activities which at some level are intended to influence national energy policy and planning. This includes energy industries as well as trade unions and environmental groups. These groups were roughly divided into the following categories:

Political parties;
Industrial interests;
Trade unions;
Other interest groups.

Within these categories, those groups were identified who are today most prominent in energy policy and in public debates about energy issues. These included for both countries typically the following groups: political parties having been in government during the period; energy industries and industrial interest groups; trade unions in the energy sector; and anti-nuclear or environmental groups. Starting from these groups, the whole spectrum of groups involved in national energy politics was identified. The involvement of the groups was then traced back to 1950 where possible, and the following questions were examined for each category: how many and which type of groups within the category were at the particular time interested in energy? What attitude did they take to state energy policy? And how did they perceive the role of different energy technologies?

Although the research process involved one of tracing backwards, the account as it is reproduced here follows a forward chronology starting from 1950. This makes possible

a direct comparison between the political groups' attitudes to energy policy and the actual content of state energy policy as recorded in the preceding chapter.

3.2 Political Parties.

If, as we have assumed, changes in energy policy are subject to direct influence by political groups, what springs to mind first as a possible source of influence is the political parties, which in both the Danish and the British political system are the main fora for political action. More specifically, we would expect that the energy policy of a country in a specific period would reflect the political ideology of the party in government during that period. We would also expect that the politicization of energy is recognizable at the level of the political parties; more specifically we would expect a growth in the number of parties addressing energy problems and an increase in the issues taken up within an energy-political framework. If changes in state energy policy reflect the impact of political parties, we would furthermore expect to find the same themes, problems and issues to be important here as we have seen to be important in state energy policy. Finally, we would expect to be able to locate significant ideological shifts especially around 1973, when we have identified a period of turmoil in state energy policy.

Comparing the energy political attitudes and activities of political parties of two different nations presents a specific methodological problem stemming from the difference in the historical origins of the parties and in the political system of the two nations. For example, the different electoral systems of Denmark and Britain[2] have given rise to different numbers of political parties. The Danish system is considerably more favourable to small parties than the British system, which leads to much

greater differences being contained within the two to three major parties.

Rather than examine in detail the attitudes of all political parties during the 1950-1980 period, we have concentrated on those parties who have been important in relation to government. In addition to this we have mapped out changes in the range of energy political attitudes within the parliaments of the two nations. For Britain this meant looking into the energy political ideas of groups within the large parties; for Denmark it implied looking for the energy political opinions and attitudes, as well as activities aimed at implementing them. It was decided to concentrate on official policy expressions of the parties: conference resolutions, programmes and other material endorsed by the party (or, in the case of Britain, the party sub-group).

Britain.

In the period under discussion the major political parties of Britain were the Labour Party, the Conservative Party and the Liberal Party. The Labour Party was in government until 1951, while successive Conservative governments ruled from 1951 to 1964, followed by another period of Labour Government from 1964-1970.

During the 1950s economic growth was a major concern of both the Labour and Conservative Parties. The nationalisation in the 1940s of the fuel and power industries had been orchestrated by a Labour government and was in line with the Party's ideas about public ownership. But public ownership was not just a matter of political principle, it was also a means for ensuring efficiency in production. Public ownership opened up the possibility for planning as a means for ensuring future growth in output. The 1950 Labour Party manifesto[3]

emphasized the need of the electricity and coal industries to plan for future expansion enabling them to supply

> "(...) more electricity for the homes and more horsepower for our factories." (Labour Manifesto, 1950).

The size of output was the most important figure in Labour's energy discussions of these years followed by the internal economic efficiency of the nationalized industries. Of three energy-related campaign notes from 1951[4], two were on the development of electricity prices since nationalisation, and concluded that prices had been kept down due to public ownership. The third emphasized the advantages of nationalisation in terms of the benefit to the general public. It was argued that nationalisation should be implemented because it would cause output to rise. Output growth appeared to be the major objective of the fuel industries along with higher efficiency and higher profits:

> "British Electricity last year after meeting all its interest charges made a profit of £13,000,000 bringing the total profit since natinalisation to £41,000,000. Because of improved efficiency electricity charges have risen far less than most privately supplied goods and services. Gas made a £2,000,000 profit, bringing its total profits to £8,500,000." (Labour Party campaign leaflet: 'Socialism Succeeds'. From a series entitled 'We can't afford the Tories!").

The main focus of policies related to energy of the Labour Party in the 1950s was the need to ensure future growth in the output of energy in order to support economic growth in general. Nationalisation and planning were instruments towards these ends. A national energy policy would furthermore contribute to attempts to avoid increasing imports of fuel[5].

Besides nationalisation, another means for securing future energy supply was nuclear power. After the formation of the United Kingdom Atomic Energy Authority in 1954, the

Labour Party identified potentials for scientific and technological progress as well as a potential for economic growth inherent in the project:

> "Atomic energy and other new inventions can bring dramatic increasese in productivity and therefore in wealth and leisure. They will also demand new skills. To meet this demand, Labour will enlist the help of scientists, trade unions and progressive management and begin a real drive for better education." (The Labour Party. Manifesto 1955, p.4).

The Labour Party's arguments for state involvement in the development of civil nuclear power were built on four basic assumptions:

1) More energy would be needed in the future to support economic growth, which was seen as a necessary precondition for heigthening the welfare of the population.

2) Nuclear power was a potentially promising technology in respect to productivity and output capacity.

3) Nuclear power was a result of scientific research (as is evident above, the military origins of the technology were played down). As such, it represented scientific progress, and keeping up with this progress was crucial. Hence, the technology could 'demand' (more education and training, for example).

4) Finally, it was assumed, that providing support for this kind of technological project was a task for the state rather than private industry.

For example, the Labour Paty in 1958 expected that the industrial life of the country would increasingly be related to nuclear development:

> "Our industries to a greater or lesser extent will become dependent on nuclear power and nuclear development" (The Labout Party,1958, p. 30).

Also, the role of the state was emphasized as was the confidence in the capacity of the technology for creating prosperity:

"(...) the Atomic Energy Authority - a public body -is pioneering new techniques, new uses and new methods for harnessing the atom to the service of the community." (The Labour Party, 1958,p.30).

The confidence in science to be able to deliver the methods and tools that would secure welfare in the future was not restricted to discussions about nuclear power. The 1964 Manifesto referred to the 'scientific age' in which we were living, and the new 'scientific revolution' in industry. Scientific expertise was also seen as a remedy for the problem of low efficiency in the coal and gas industries. In order to provide for expansion in the coal industry.

"We need the best brains, the most competent managers and specialists of all kinds." (The Labour Party, 1953, I, p. 13).

Hence, growth in the energy sector depended partly on the activities of the state, partly on the development of science and technology. Public ownership and planning aided by the tools developed by science would ensure efficiency, and efficiency would result from obeying the technological imperative of e.g. nuclear power and supporting the development of this technology.

The Conservative Party which was in government for a large part of the 1950s issued considerably fewer policy statements on energy during this period than did the Labour Party, in spite of the Conservative government actually being in charge of fuel and power production via the nationalised industries. This indicates that the Conservative Party did not consider fuel policy a matter for public debate. This follows from the Party's general interpretation of the role of the state versus the market in industrial affairs. The role of the state in relation to the energy industries was to ascertain that market forces were not impaired, and proposals for financial

support were to be evaluated against the expected effects on the competitiveness of the particular industry. The Conservative governments as we have seen never went as far as actually privatising fuel and power in spite of calls for 'de-nationalisation' from within the Party[6]; as a matter of fact, nationalisation was not mentioned in Manifestos after 1950 (when the Party was in opposition), when re-organisation (rather than de-nationalization) was called for.

The nuclear industry constituted a noticeable exception to the demand for competitiveness within energy industries. The Conservative Party consistently supported the nuclear project. In the 1955 and 1959 Manifestos the Party committed itself to 'pressing ahead' with the technology without any arguments to motivate why the state should support exactly this venture. The 1959 Manifesto, however, indicated that the Conservative Party also considered technoligical progress important: nuclear power was mentioned alongside other technological projects under the heading of 'Technological Advance'. In this context, the danger of radioactive releases from nuclear reactors into the environment was considered to be of less importance[7]. The absence of Party discussion about nuclear power can again be interpreted as stemming from the Conservative conviction that the state, except for supporting the nuclear industry financially, should not interfere with its day-to-day affairs.

Similar observations as above apply to the energy political statements of the Liberal Party until the mid-1970s. Here statements on energy were very thin on the ground. Energy was only discussed in terms of the plan/market question related to the nationalized industries, and this discussion only surfaced towards the end of the 1950s, when it was argued that decision-making ought to take place to a large extent within the single industry, and that employees in nationalised industries ought to be gi-

ven options to buy shares in their own industry and thus obtain a more direct form of influence. Presumeably this was an argument against the policies of the Labour Party and the TUC which aimed at increasing the political influence of the working class by more state intervention and more central control in the interest of the working class.

In the 1960s, party-political discussions about energy died down. No mention was given to energy in the parties' official statements during the 1960s until 1967, when a Labour Party conference decision emphasized the need to ensure that nuclear power would not displace 'indigenous sources', i.e. coal. Again we notice Labour's inclination to protect this industry, but also we notice that it was no longer believed that all fuel industries could expand simultaneously. The development of nuclear power was turning into a threat to a specific group in society: the coal miners. This threat to a particular group was presented as a threat to society. Now energy policy would be necessary in order to foresee future energy demand and ensure that the nationalized industries were not pressed out of business.

These discussions of whether nationalization and planning or market provision of energy would best ensure the growth in energy output and increased efficiency in the industries were abruptly interrupted by the events of 1974. Since 1970, a Conservative government had ruled: it was brought down by a national coal miners' strike in response to the government's anti-inflation policies including an incomes freeze. A period of Labour governments started, which lasted to 1979, when the present period of Conservative government started.

After the events of 1973/74, energy policy was again given a prominent position in Party political documents. The Labour Party Manifesto of 1974 called for the following measures to be taken by government after the election:

- The future of coal should be re-examined;
- public control of the newly discovered North Sea resources should be ensured in order to achieve "maximum public advantage";
- a shift from road to rail transport should be initiated and public transport should be developed;
- international cooperation on exploitation of energy resources should be encouraged;
- government should take the initiative in the establishment of an international Energy Commission which would have as its main task ensuring a rational allocation of oil at the international level.

Whereas the policies of the Labour Party of the 1950s and 1960s had focused on ensuring economic growth as a precondition for social welfare, the focus of the measures proposed in 1974 was considerably more narrowly related to the immediate crises in energy supply and the pressure from the National Union of Mineworkers. Two main objectives in this situation were getting rid of the oil imports which had severe effects on the balance of trade and ensuring a future for the coal industry satisfactory to the National Union of Mineworkers.

Against this background, the Party proposed an increased state involvement in the development of other fuels as alternatives to oil. The Conservative government was criticized for not having supported sufficiently the development of nuclear power:

> "A highly developed nuclear sector is essential to the future economy of this country and calls on the national Executive Committee to approach the Government to bring about substantial expansion of the nuclear programme taking regard to public health and environment within the context of an integrated national fuel policy." (Labour Party Conference decision 1973).

It will be noticed that in addition to the call for an expanded nuclear programme, the decision emphasised that the expansion must not be at the expense of public health

and the environment. This is a significant change from the 1950s and 1960s when party political interest in the side-effects of the technology was absent.

Also the Conservative Party gave energy a high priority in 1973/74. The Conservative Manifesto for the 1974 election addressed the problems under the heading 'Beating the Energy Crisis'. It was claimed that a Conservative energy policy had been developed prior to the problems of 1973/74. The main objectives of this policy were reducing dependence on oil imports and achieving, through national energy planning, a balance between coal, North Sea oil, natural gas and nuclear power. The instruments for a national energy policy had been:

- modernisation of the coal industry;
- acceleration of the exploitation of North Sea Oil;
- creation of the National Nuclear Corporation;
- a new nuclear programme.

These measures signalled Conservative endorsement in practice of state intervention as a solution to energy problems. This approach, which was applied to other types of problems during the Heath government, has been described as a "new corporatism involving close liaison between government and industry"[8], and has been seen as an important change from the free market liberalism which was supported by the party throughout the 1950s.

Energy conservation had come into the focus of the Conservative Party. From 1974 onwards, energy conservation was included amongst the policy objectives of the Party. It was thought that savings in energy consumption could be achieved through voluntary cooperation of 'people'[9]. The party was confident that energy prices were a sufficient incentive for consumers to save energy.

The Conservative Party devoted renewed attention to nuclear power as a means of reducing oil imports. At the same time, increasing the nuclear component would reduce the mine workers' political power, which had just been amply demonstrated. The Conservative Manifestos of January and October 1974 recommended the adoption of a larger nuclear programme, but at the same time bore witness to a new concern related to nuclear technology: it was stated that public safety must be paramount. Earlier, science had been presented as a guarantee of the safety of the technology; now public safety was to be guaranteed by the state, i.e. from outside the scientific and technological community.

The Liberal Party made its bid for an energy policy in 1974 and, like the other parties, its recommendations focused on the supply of energy. The Liberal Party recommended a policy which had at its core controlled exploitation of North Sea Oil and gas resources within the framework of a national energy policy, which would be prepared with due respect to the finite nature of fossil fuel reserves:

> "Energy policy should not consist solely of adjusting supply to meet whatever demand is created by market forces." (Liberal Party Manifesto, January 1974).

A number of measures were proposed for controlling energy demand through market forces: control of consumer prices, incentives for industries to invest in specific technologies or energy sources and government finianced energy schemes. The energy policy of both Labour and Conservative governments was critized for being ad-hoc and inefficient. Instead, government ought to strive towards a clearer defintion of future energy priorities and efficient implementation. The party's recommendation of a market-orientated energy policy hence saw the market as an instrument for politically generated objectives, and it was clearly admitted that self-regulation was not

sufficient in the energy sector. The Liberal Party saw an acceleration of the nuclear project as a way of securing Britian's future fuel supply.

Whereas the main emphasis of all parties immediately upon the oil crisis and the coal strikes had been on future fuel supply, the focus shifted again from about 1976 and new issues were brought into the policy proposals of the political parties. At the same time, internal discussions within the parties about the range and objectives of state energy policy became increasingly visible.

We saw that in 1974 questions of health and safety related to nuclear power had entered the Labour Party's agenda. This signalled a new awareness of the importance of technologies for production and the relation between direct effects (energy production) and external effects on other areas, such as pollution or risk of major disasters. By the mid-1970s energy technology had emerged as a separate issue for debate within the party. Renewable energy technologies began to be debated, for example the 1976 Conference called for increased efforts with regard to 'sustainable and natural sources of energy', while the Conferences of 1977 and 1978 both called for research into sources 'which are free, clean and renewable' and 'have the combined advantages of being pollution-free, not involving the working class in dangerous unpleasant work and not producing unmanageable waste as nuclear power does'. This shows that the renewable sources were seen as solutions to problems which had been experienced in relation to particular fuels (nuclear power: waste management; coal: dangerous mining; oil: expensive imports) as well as one problem common to all energy producing technologies: pollution.

Whereas the Conference decisions represent the solutions advocated by some specific majority within the mass labour movement, the parliamentary party had a different line on

energy technologies. A 1980 Labour Party discussion document[10] affirmed the need to ensure future growth and increased efficiency in energy production. This objective was used as a yardstick against which to evaluate the merits of different energy sources and technologies. Nuclear power was considered to be the only recognized technology able to provide sufficient energy in the future to sustain and improve the standard of living, based as it was on "advanced scientific knowledge" (p. 32). Even though this may be seen as repercussions of the technological optimism of the 1950s and 1960s, the discussion of the effects of nuclear power shows that the technology was being debated according to new criteria. The development of nuclear power, it was stated, must be conditional on public acceptance; and the document held lengthy discussion of different aspects of nuclear power: waste management, civil liberties (consequences of the necessity to protect nuclear facilities against terrorism) and the proliferation of plutonium.

Also in this document, a discussion of the potentials of renewable sources was found. It was concluded that the technologies could in theory offer permament solutions to the country's energy problems, but it would demand an ambitious R&D programme. It is well worth noting here that the Labour Party's attitude to state involvement in energy technology R&D had changed since the 1950s when the party lent unquestioning support to nuclear R&D. The only renewable technology assessed as promising was tidal power, which is a capital-intensive, large-scale technology for electricty production. The technologies which seemed better suited for small-scale use and for heating, such as solar heat collection and bio-gas, were evaluated to be of small significance in the future, and as a consequence, no proposals were made for state support for these technologies: their development was, even though this was not explicitly stated, to rely on market forces.

This indicates an important new issue for Labour Party debates about energy policy: energy technologies were now to be explicitly evaluated. Within the process of evaluation it became increasingly clear that there were no universally agreed criteria upon which evaluation could take place.

Energy, and especially energy technologies, was becoming the issue of a debate between different interests within the party, and new groups within the party became interested in these issues. The Fabian Society, which had not earlier taken any interest in energy policy, became involved in the energy debate, and again technology was a major issue. Two points of view competed here. One argued that the main objective of energy policy was defined by the need of the working class for cheap and plentiful household energy as well as of industry for cheap energy in order to keep up productivity. The other view rested on the assumption that it was in the true interest of the working class to support the development of technologies which did not have the drawbacks of the traditional energy producing technologies. These assumptions led to widely different evaluations of energy producing technologies. The first point of view led to decrying renewable energy because it was not seen to possess any potential for state controlled large scale energy production:

> "(...) very few analysts would see the technically doubtful new sources as potentially having a major effect in the next 30 years. In these cases the issue is whether to have a modest R&D budget or a very modest one." (Goode et.al., 1980, p. 21).

Instead, the share of nuclear power in energy supply should be increased within the context of tighter state control. The opposite view was argued in Fabian Tract No. 475[11], which recommended that nuclear power should be phased out because of the inflexibility and costliness of the technology along with the health and waste problems accompanying it. As the limited use of renewable energy

technologies up till then was seen to rely on conservatism within the electricity industry, a state controlled introduction of renewable energy would demand a restructuring of the electricity boards to ensure more direct trade union and government influence.

The recognition of problems related to technology was also reflected in the Labour Party's attitude to state control of the energy sector from the mid-1970s. Nationalisation and strong state control were still at the basis of energy planning, but there was an increasing emphasis on the capability of the state to handle the external effects of energy production. The 1979 Manifesto maintained that public ownership of the energy industries guaranteed that these industries were run in a safe and responsible way, but added:

> "We shall maintain strict safeguards over the disposal of nuclear waste". (Labour Party Manifesto, 1979, p. 14).

The Labour Party solutions to energy political problems took as its main assumption that more state control was needed. But problems had emerged in relation to the policy process itself: the 1979 Labour Party conference called for a full public discussion of various sources of energy thus indicating that public accountability was not regarded as sufficient. The same conference, however, recommended trade union representation at all levels of decision-making thus indicating that this would solve the problems of accountability. The drive towards increased involvement of interest groups into state energy decisionmaking was also evident in the 1979 Manifesto:

> "We shall strengthen the democratic planning of the long term development of Britain's own energy sources, backed by necessary powers, under full parliamentary control." (Labout Party Manifesto, 1979, p.13).

What was meant by 'democratic planning' was not clear from the Manifesto; but perhaps Smith (1983) gives the answer in the anthology "Renewal: Labour's Britain in the 1980s" where the need for planning is contrasted to the free-market strategy of the Conservative government. Smith recommends re-establishment of the Energy Commission as a means of conflict resolution in energy planning:

> "In the commission, the competing claims of the energy industries, the need of industry and society, the vital concerns of the consumer and, of course, the national interest can be weighed and evaluated on the basis of informed and nationally motivated discussion and debate." (Smith, 1983, p. 54).

Hence the idea of state planning as the best way of serving the interest of the nation in general and the working class in particular was, in a situation where conflicting objectives became increasingly visible, to be saved by an extension of interest participation in decision making. But we have just seen that even within the ranks of the party itself conflicting criteria for evaluating policies were increasingly evident. It is not immediately obvious how these conflicts could be solved to the satisfaction of all involved parties; but apparently it was assumed that an identifiable national interest existed which could be agreed upon by everybody and serve as a common ground upon which the battle between industrial interest, trade union interest and consumer interest could be fought.

A couple of interesting observations can be drawn from this. Firstly, it was now recognized that the interests of trade unions might differ from those of the nationalised industries or of the general public. Secondly, each of these interests were seen as different from the 'national interest', in contrast to the 1950s view that the national interest was identical to the interest of the trade unions which again was represented through the nationalised

industries. But still it was believed that corporative procedures would allow the different interests to be harmonized within a framework of central energy planning.

Also the Conservative Party devoted an increasing amount of attention to problems related to the effects of energy technolgies and proposals for their solution from the mid-1970s. The new issues which we saw to penetrate the Labour Party policy also appeared here. The environment and public participation were taken up in the 1979 manifesto:

> "All energy developments raised important environmental issues, and we shall ensure the fullest public participation in major new issues". (The Conservative Party: Manifesto, 1979).

The Conservative Party still lent its support to the development of nuclear power, and in spite of the commitment to privatisation of the Conservative government from 1979, no proposals have been made for a privatisation of the nuclear industry. Whereas the scope for renewable energy was seen to be small, the 1978 Manifesto called for promotion of alternative sources, as well as for energy savings and in 1980, the Conservative Party conference stated its commitment to research into 'new sources of energy'[12].

The national economic aspects of energy were, however, the most important focus for the Conservative Party. Towards the end of the 1970s new energy technologies were expected to 'pay their way'. The Conservative Party emphasized this point, and argued that renewable energy technologies would have to prove their efficiency in a free market.

Whereas the Labour Party argued that state control was not sufficiently developed, the Conservative Party argued that state control in the form of nationalisation was an obstacle to efficiency. For instance, the Labour government's management of the North Sea enterprise was criti-

cized for being inefficient and blocking productive investment from the private sector[13]. Likewise it was argued that the coal industry ought to be made competitive and efficient through the removal of subsidies. The reliance on coal and hence the political influence of the National Union of Mineworkers was annoying to the Conservative Party; a major rationale for encouraging the development of other sources of energy was getting rid of the dependence on oil and especially coal[14]. Here, the North Sea resources were especially seen as a promising alternative which should be developed.

The recommendations of the party with regard to the decision-making process emphasized the need to get away from direct state involvement in energy production and supply and instead aim at a state control of the energy sector through selective taxes and subsidies. Generally, however, economic efficiency of investments became increasingly important in the Conservative Party's arguments. The role of the state should primarily be within technological R&D. The concrete policy recommendations, however, indicate that the party held strong priorities regarding the future structure of energy supply, and that these priorities were based on political rather than purely economic consideration. For example, the wish to move away from coal and towards a higher proportion of nuclear power in the electricity supply could never be motivated solely by economic considerations. As these priorities would evidently influence R&D allocations for energy technological projects, the market mechanism in the end would serve only as a minor correction to politically determined government priorities.

The new issues of the mid-1970s were also reflected in Liberal Party policy proposals. This party also considered a range of energy technological options. Interestingly nuclear energy, which had in 1973/74 been advocated as a solution to the problem of possible future energy shortage

was seen to be a problematic option. The problems that were identified in relation to nuclear power once more related to the environmental impact, in particular waste management. As alternatives, the Liberal Party recommended "fusion, solar, wave etc." (The Liberal Party: Manifesto, 1979)[15]. These technologies are only similar in one respect: they can be expected not to produce the same (negative) effects as nuclear power. Thus, the negative experiences of one specific technology (nuclear power) was used as the basis of an evaluation of 'alternative' technologies.

The Liberal Party policies also signalled the new awareness of problems in relation to energy decisionmaking. Like the Labour Party, it recommended a re-establishment of the Energy Commission in its 1979 Manifesto, and in addition it was recommended that the discussions within the Commission should be thoroughly publicised. It must be remembered here that the Liberal Party was not, as the Labour and Conservative parties, tied to any specific interest within energy production.

Summary.

Party political discussions in Britain about energy from 1950-1980 developed markedly in terms of the efforts that went into defining priorities as well as with respect to the awareness of political and procedural problems in state energy policy.

The debates of the 1950s in relation to energy focused on ensuring the future growth of energy output in order to provide sufficient energy for future economic growth. The political parties agreed to this over-all objective; the debates were on how best to ensure the expansion of energy supply. There was broad agreement that nuclear power represented a promising option in this respect, that the

initial phases of the development had to be financed by the state, and that the detailed development of the technology should be left to the scientific community. But whereas the Labour Party saw nationalisation as the best means of ensuring growth in the industries, the Conservative and Liberal Parties argued for more market-oriented solutions. It was implicitly agreed, however, that government should not interfere with the priorities of the single industry.

During the 1960s party political interest in energy was almost absent. Only towards the end of this decade did the Labour Party react to problems concerning the future of the coal industry. By this time it was becoming evident that a simultaneous growth in the fuel industries was not, as it had been believed in the 1950s, possible, and that cost of coal meant that its position in the market was severely threatened by oil and potentially by nuclear power as fuel for electricity production. Against this background, the Labour Party began to take an interest in national fuel policy.

The slow building up of problems in fuel supply and proposals for policies to repair shortcomings in the system was abruptly disrupted by the events of 1973/74. The parties' policy statements bear witness to the experienced severity of the situation. Ensuring future fuel supply came into the focus of policy. The parties all reacted by proposing an extension of state control of the energy sector. Common to all three parties were recommendations for instantaneous extension of the nuclear project and intensified interest in the prospects of using North Sea oil and gas to replace imports as well as a renewed interest in looking into 'alternative' energy sources. Whereas this call for fuel diversification was common to the parties as was the implicit agreement that it should be orchestrated by the state, there were disagreement on particular strategies to obtain

diversification. The Labour Party, while recommending increased efficiency in the coal industry, maintained that coal should remain the backbone of Britain's energy supply. To the Labour Party, the impact of the oil price rise on the national economy was the major problem, and it is in this context that e.g. the proposal for a state-initiated shift from road to rail must be seen. The Conservative Party on the other hand was eager to get rid of the dependence on coal and hence emphasized energy conservation and the potentials of the North Sea resources. The Liberal Party emphasized the need to look at resource availability in a longer perspective. The parties also disagreed on the extent of state intervention. The Labour Party recommended that tighter control should be obtained through nationalisation, while the Conservative and Liberal Parties recommended a policy using prices as the main instrument. There was no questioning, however, that energy policy was now firmly being defined as a task for the state.

When the immediate reactions to the oil/coal crises subsided, the parties increasingly identified more fundamental problems in energy supply and consumption. The environmental problems which had first been identified in the late 1960s were now increasingly seen to result from energy production. Increasingly attention was being devoted to energy producing technologies and their effects. In addition, the economic aspects moved increasingly into the focus of political debates about energy. There was a general recognition that energy production had wide-ranging effects, but not on the precise character or relative importance of different effects. The Labour Party emphasized effects related to the workers in the energy industries, while the Conservative Party saw the national economic effects as more important and the Liberal party was concerned about the environment. Thus, there was no longer one overall and generally agreed upon objective of energy policies.

Instead, energy was the subject of political discussion, both between and within the political parties at the end of the 1970s. There was agreement that state energy policy should express the national interest in relation to energy; but what exactly was to be understood by the national interest was no longer clear.

Denmark.

Before the presentation of policy statements of Danish political parties, a few words need to be said about the Danish political system. The Danish parliament is elected through proportional representation. This favours representation in parliament of a larger number of relatively small parties than in Britain[16], and frequent instances of coalition governments. During the 1950-1980 period, however, the Social Democratic Party (social-demokratiet) was in government for 23 years, of which for 14 years they ruled alone. The exceptions to Social Democratic rule were the periods from 1950 to 1953, when a coalition between the Conservative Party (Det Konservative Folkeparti) and the Liberal Party (Venstre) was in government, from 1968 to 1971, when the ruling coalition consisted of the Conservative Party, the Liberal Party and the Social Liberal Party (Det Radikale Venstre), and from late 1973 to early 1975 when the Liberal Party was in power. This indicates that in spite of the large number of political parties, only a very limited number have had direct influence on state policy. For this reason we shall concentrate below on the parties which have actually been in government and only mention other parties insofar as they are assessed to have been influential with regard to energy at particular points in time.

During the 1950s and early 1960s, party political interest in energy was insignificant. Neither party political programmes, election manifestos nor the party periodicals

of the major parties gave any mention to energy questions. Only the Social Liberal Party mentioned energy in relation to industrial policy during the 1950s. In the party's 1955 declaration of principles (principprogram)[17] it was argued that the electricty industry ought to be made more efficient and that the state should cooperate with private industry to make sure that this happened.

The Social Democratic Party mentioned energy the first time in its declaration of principles in 1961. The emphasis was on the potentials of economic growth for creating social welfare. Here, science and technology were seen to play a crucial role, and particularly nuclear power was seen to hold a potential for material progress. It was recognized that nuclear technology involved the potential of destruction, but state control of the technology would ensure that the population could enjoy the "Atomic age without fear". State control of the technology would also serve to present the unfolding of the technology's inherent potential for concentration and monopolization. The party did not during the 1950s or 1960s concern itself with other aspects of energy, and the Programme of Action of 1961 did not offer any concrete proposals for how to go about ensuring social control of nuclear power.

The Liberal Party's policy statements neither were concerned with energy during the 1950s and early 1960s. The general attitude to the role of science and technology, however, was parallel to that of the Social Democratic Party:

> "The technical and economic development have put into man's hands hitherto unknown opportunities for creating a society in freedom and wealth". (Venstre, 1963, p. 10).

The party emphasized that the state ought to intervene only in matters of considerable interest to society "which

cannot be solved satisfactorily in other ways" (op.cit., p.13). It is probably not too bold a guess that the development of nuclear power ranged among these socially important projects.

The Conservative Party was also not concerned about energy through this period.

Towards the end of the 1960s, the potential for social welfare through material abundance was generally seen to fade away. While the implications for the energy sector was not dealt with separately, the Social Democratic Party Conference[18] of 1973 observed that the increasing balance of payments deficits implied a need to reinforce state planning to restrict the growth in private spending.

Also the Liberal Party's attitude to growth had changed. A new declaration of principles from 1970[19] observed that welfare included other aspects in addition to material prosperity. Pollution was identified as a potential threat to welfare. Also it was observed that the prices of coal and oil influenced the balance of payments negatively. As a contribution to solve these problems, the Liberal Party recommended that the share of electricity be increased, and that nuclear power be introduced for electricity production. The use of electricity for heating was thought by the party to contribute less to (air-) pollution than the then prevailing individual oil burners. Again it was observed that intensified state planning was necessary.

Likewise, the Conservative Party noted that in the face of the increasing trade deficits, incomes policy and long-term economic planning was necessary to secure economic growth and employment.[19]

Whilst the parties discussed how best to solve the problems in the national economy and the new group of problems related to the environment, the oil price rises

in 1973/74 focused the discussion sharply on the acute problems stemming from the country's dependence on oil.

The Social Democratic Party, now in opposition after having an election in 1973 which gave rise to the formation of a Liberal minority government, devoted considerable attention to energy questions in 1974. The party monthly, 'Vor Politik' ('Our Policy'), opened its columns for energy political articles by leading social democratic politicians. Energy policy was taken up at the annual meetings and incorporated in general policy statements. The situation was summarized by a former Minister of Trade, who, in considering the specific question of whether to introduce nuclear power made the following general observation:

> "All in all it may be necessary to consider ways in which society can gain influence on which sources of energy should be used for which purposes." (Erling Jensen, former Minister of Trade: Atomkraftværker -ja eller nej (Nuclear Power stations - yes or no). Vor Politik, May 1974, p.4).

In 1975 the party set up an energy policy committee, which formulated the official party position in a leaflet entitled 'Energi'20. The main emphasis here was on the need for state energy policy to reduce the impact on the Danish economy of possible future events like the oil crisis. Hence the main objective of state energy policy should be reducing dependence on imported oil through fuel diversification. The party recommended exploitation of North Sea oil and gas reserves and/or adoption of a nuclear programme. On the demand side, the party recommended a deceleration of growth in energy consumption. International cooperation through the International Energy Agency should be intensified in order to ensure distribution between nations of available energy resources. Finally, environmental as well as social impacts of energy technologies should be taken into consideration in energy planning.

The concern about the effects of energy technologies show that although the necessity for state energy policy was primarily defined in relation to the shock caused by the oil crisis, this was not the only factor present in Social Democratic discussions about energy. In addition to ensuring fuel supply the state was also to evaluate and control energy technological development so as to ensure diversification, while avoiding the negative side-effects on e.g. the environment, which were seen as results of an uncontrolled technological development.

This kind of debate was not prominent within the Liberal Party, which held government at the time. The party's periodical 'Liberal' does not give evidence of any energy political discussion until late 1974, when a number of articles identified energy as an important component of the serious economic problems of the Danish nation[21]. This observation, however, did not give rise to a party discussion about energy policy. The strategic discussions which must have gone before the presentation of the first proposals for regulation of energy consumption must therefore have taken place within the closed circle around the government. But it is evident from the discussions of the economic aspects of the energy situation, that the liberalism generally advocated by the party was not seen as a proper solution to this kind of problem. On the contrary, a high degree of state and even supranational control of energy revenues was advocated just like it was argued that consumption would have to go down.[22]

The Social Liberal Party did not immediately react to the oil crises by issuing policy statements, whereas the Conservative Party argued that the situation called for the creation of a proper national energy policy. Energy was discussed in the party monthly 'Vor Tid' (Our Time) which in February 1974 presented the party's official energy policy. The main components of this policy were: new legislation creating economic incentives for energy conserva-

tion and substitution of other fuels for oil; encouragement for energy R&D; state efforts to encourage exploitation of the uranium reserves of Greenland; plus introduction to nuclear power.

Thus, for all parties, the objective of energy consumption growth was replaced almost from one day to the next by an objective to cut growth in energy consumption. Likewise, the necessity of a strong state energy policy was agreed upon by all political parties regardless of their economic philosophy.

After the immediate panic following the oil crisis had subsided, energy policy stayed in the focus of discussions but new issues were introduced.

The Social Democratic Party still emphasized public ownership as a solution to energy problems. A new declaration of principles from 1977 stated as objectives:

> "Public ownership of national energy resources. Public control of energy supply and development of environmentally benign forms of energy, the development and utilization of which is one way of ensuring independence of foreign and multinational interests." (Socialdemokratiet, 1977, p.22).

The confidence in science and technology to solve the problems accompanying an increasing energy consumption had disappeared, as had the assumption that growth in energy consumption was a necessary precondition of social welfare. It was observced that:

> "New technology which is employed in order to achieve the highest possible degree of competitiveness may clash with considerations of social and human values." (Socialdemokratiet, 1977, p. 11).

Specifically, the attitude to nuclear power changed. In 1976 P. Hækkerup, Social Democratic Minister of Trade,

argued that although the party was satisfied that the environmental problems related to nuclear power had been solved, the necessary investment was presenting a problem as it would influence the total investment capacity of the state decisively[23]. In addition, it became increasingly clear that the party did not want to be responsible for introducing the technology without first having secured the assent of the whole party as well as of the population, and the 1979 Manifesto stated that the party would ensure that the introduction of nuclear power would be conditional on a popular vote as well as the results of state financed inquiries into reactor safety and waste disposal.

The objective to get rid of oil was increasingly supplemented by new issues and problems. More state regulation was the answer to these new problems. In 1978, the economic implications of the energy sector in general (and not just of oil consumption) had come into focus. In the working programe of 1978, the necessity for planning in the widest sense of the word was defended as the best means to ensure that production was "profitable in respect to economic impacts, resource conditions, pollution and social conditions." (Socialdemokratiet, 1978, p.8). In this context, an overall energy policy should be prepared. This policy should emphasize strongly subsidies for investments in energy conservation as well as providing for laws which would make conservation mandatory.

As oil and nuclear power was not seen as desirable long-term propositions, the interest in other sources of energy grew. The policy statements from 1974 onwards emphasized the need for R&D into renewable energy, and also the North Sea resources commanded increasing attention. Here again, the party called for increased state control of the resources, and in particular a publically owned oil pipeline from the North Sea was seen as an important means to ensure social control.

Heating planning, inter-Scandinavian energy cooperation, natural gas, excess heat from power stations, regional price differences on energy, coal imports, insulation were just some of the issues for state energy planning mentioned in the party's working programme on 1980[24].

Also the Liberal Party had accepted the necessity of some kind of state regulation of the energy sector:

> "It has become evident that a reliable supply of energy is a necessary precondition for the existence and development of any modern society. This precondition is not necessarily satisfied". (Venstre, 1978, p.5).

In other words, the market mechanism was thought to be insufficient when it came to ensuring a stable supply of energy. The proposed remedy was state energy policy. At the same time, the party advocated, as an important component of a liberal strategy, the 'neighbourhood society'[25], which involved decentralization of decision-making. The party never, however, considered a decentralization of energy decision-making, which was presented as strictly a matter for, on the one hand, the fuel and power industries on the other, the state.

An overall objective of energy policy in relation to the economy was the need to put brakes on the growth within the public sector. Energy policy was seen as an instrument of economic policy:

> "A realistic energy policy is a precondition of continued economic development, of employment and hence of a high social standard." (Venstre, 1979, p.7).

The basic components of Liberal energy policy[27] were:

- the structure and ownership of the energy industries should remain intact, but the industries were to act in accordance with long term national energy plans.

- The energy industries should, to the largest extent possible, be exempted from taxes and duties.

- The state should only intervene in energy consumption insofar as "general regard to the interests of community indicates that utilization of a specific source of energy is desirable" (Venstre, 1978, p.9).

- In such cases, state subsidies were to be the main instrument for implementing a shift to a new technology or source.

These principles suggest a somewhat tempered liberalism. The proposed measures served to support the energy industry (at that time synonymous with the electricity industry) while at the same time providing for state support for development of new energy sources and technologies. There is little doubt that the party by 'a specific source of energy' was thinking particularly about nuclear power, which recommended on the ground of expectations, that the technology would prove competitive with coal and oil based technologies.

Hence the idea that state energy policy should be founded on an assessment of the advantages and disadvantages of different energy technologies was prominent here, too, even though the Liberal Party partly employed other criteria than the Social Democratic Party and partly arrived at different results using the same criteria. For instance, the party saw consideration for the environment as an integral part of energy technology choice, but argued that in this respect nuclear power was preferable to oil and coal[28].

Also the question of public participation in energy planning was increasingly taken up, but it was argued that whereas it was "important to keep the population informed about society's planning of energy supply" (Venstre, 1978, p.9), the need for an expert-based energy planning was maintained:

> "The preparation of a long-term energy policy demands complicated technical and economic considerations. Hence it is necessary for democracy to make use of individuals who possess particular insight in different areas. The fear of expert-rule should not lead democracy to let itself be led by false prophets (...)." (Venstre, 1978, p.9).

As a consequence, public concern should be countered not by giving the population more say in the decision-making process, but by informing it about "the truth of the matter" (Venstre, 1978, p.50). In this way the party suggested the existence of an objective base of facts upon which an appraisal of energy technologies could take place, which would then justify state subsidies for the technologies proven to be objectively superior.

The public interest in alternative sources, on the other hand, was acknowledged:

> "The population takes a very great interest in wind energy, which, in a democratic society, it is neither possible nor reasonable to neglect." (Venstre, 1978, p.57).

This observation was followed up a year later[29] by recommendations for a stimulation of interest in 'supplementary' sources of energy, while it was now observed that introduction of nuclear power would have to await a satisfactory outcome of safety assessment, and that, meanwhile, the share of coal and natural gas in electricity production should be increased.

The Social Liberal Party also increasingly emphasized new dimensions of energy policy. In 1980[30], the party emphasized the need for social control in relation to the North Sea, especially more political control of the state owned natural gas company was thought pertinent. Also the electricity industry was to be subjected to social control to a larger extent. For instance, choice of fuel for electricity production should be decided by parliament.

The interest in new energy sources was expressed as a recommendation for long-term support for renewable R&D, as well as a demands for increased efficiency in exploitation of North Sea reserves.

Likewise, the Conservative Party found energy an increasingly important issue. Although the party explicitly refused increased state intervention in the energy sector as it would lead to "reduced security of supply and increased costs for citizens and industry alike" (Det Konservative Folkeparti, 1981, p. 37), the number of specific state objectives and measures suggested by the party increased from 1978. In 1978 energy was predominantly seen as important to industry and the introduction of nuclear power was recommended in order to ensure a stable energy supply to industry in the long term[31]. In 1979 the energy spokesman of the party argued that long term state energy policy was a necessity[32]. Such a policy should contribute to economic growth, but in addition it should take into consideration environmental impact and safety in operation of supply technologies. The party's strong preferences for particular fuels and technologies would seem at odds with a non-interventionist philosophy. In 1981, however, the party's programme were more specific on the implementation of state energy planning[33]. It was stated here that prices should be formed in the free market and not be artificially fixed. At the same time, however, the party suggested that nuclear power should be introduced without discussing the impact on the market mechanism of such a massive state investment. In contrast, it was argued that public financial support for hydroelectric projects, geothermal heat, wave power, bio-gas, and liquefication of bio-mass should be conditional on expert-based evaluation of economic efficiency.

This suggests that the Conservative Party had also adopted the assumption that the state was to determine the future combination of fuels and energy technologies on the basis

of the national interest. Specifically, the party suggested that fusion power, solar energy and geo-gas would contribute to the long-term solution to the 'energy problems'. These problems were mainly related to the national economic implication of energy investments. There estimated economic effiency should be a major criterion in evaluation of fuels and energy technologies:

> "The definition of areas within which utilization of natural gas is required should amongst other things depend on socio-economic considerations. (...) Combined heat and power in many cases will be the most economic heating method, and should therefore be employed wherever possible." (Det Konservative Folkeparti, 1981, p.37).

Finally it should be briefly noted that from 1976 other parties in the Folketing contributed energy policy discussion documents. For example, the small Left Socialist Party (Venstresocialisterne) in 1976 prepared a policy statement on energy in response to the growing public occupation with energy questions. The party observed that it was not at all convenient having to prepare an energy policy at a time when a campaign was mounting to mobilize the working class. The energy problems were seen to confuse politics, as they

> "(...) apparently appear to concern society as a whole, making it difficult to see through the class antagonisms which are of course in the final analysis at the root of the problem." (VS Bulletin 1976 NO.162, p.19).

The party argued that nationalization would probably strengthen the interests of the ruling classes because of the centralisation of decision-making. At the same time, the party recommended the formation of an inter-Scandinavian state/co-operative energy company without going into detail as to the proportional influence of the state versus the co-operative sectors within such a company. At any rate, it is hard to imagine that such a

company would not involve a very high degree of centralization.

Choice of energy technologies for the future was also to be a task for national energy policy of the Left Socialist Party The party argued, again without specifying in any detail the implications, that compatibility with socialist ends should be the main criterion for technological choice. Within this framework, nuclear power was considered an unacceptable technology because it would lead to "centralization and monopolization" (VS Bulletin 1976 No.162, p. 19). On the other hand, it was argued that pollution control in electricity production should be initiated, and that this was possible exactly because "it is a question of relatively few central power stations" (VS Bulletin 1976 No.162, p. 19).

The party argued that energy conservation motivated by national economic considerations would not be in the interest of the working class. In the long term, however, a steady state economy would be desirable. The party's proposal for implementation of energy conservation is remarkable: the working class must simply by it self start demanding durable products just like they must demand land use plans which would serve to diminish the distance between dwellings and place of work and thereby fuel consumption for transport.

The energy policy proposals of the party were typical of an oppositional party. The party was not worried about the national economic implications of energy policy nor about the existing infrastructural and organisational conditions.

Summary.

The development of energy policy as a component of party

politics has been marked in Denmark over the thirty years from 1950 to 1980.

During the 1950s, energy was not taken up as a policy issue by the Danish political parties, although we remember from chapter two that the Atomic Energy Commission was established during this period. The party programmes of the early 1960s discussed nuclear power as a means of creating prosperity. The discussion focused on economic growth, and the parties were in agreement that the state should undertake to finance a nuclear project. The Social Democratic Party recommended public ownership in order to ensure that the industry was run in a safe way. There is no evidence, however, of considerations regarding other sources of energy, let alone the interaction between the fuel sectors during this period.

Towards the end of the 1960s, problems in the economy and increasing concern for the environment led some of the parties to consider the role of energy production in creating these problems. The Liberal party resumed its campaign to introduce nuclear power but the argument had changed. Nuclear power was no longer needed in order to facilitate growth in energy consumption. Instead it was needed to replace energy forms which gave rise to large import costs. In addition, the environment had become an important factor in the argument.

It was only in 1974, however, that the parties started considering in any systematic way the role of the state in relation to energy production and consumption. The immediate reactions to the oil crisis show a high degree of agreement on the short term objective: replacing oil with other sources of energy. Also the long term objective of fuel diversification as a guarantee against future fuel crises was generally agreed upon. Energy was defined as a national interest which demanded a national energy policy. Growth in energy consumption was no longer an objective:

on the contrary all parties recommended that energy consumption should be cut either by mandatory conservation measures or by government incentives.

After oil prices had stabilized and energy policy established, the parties increasingly incorporated energy as an important policy issue in statements. The problems which had been visible already before the oil crisis were now seen to become increasingly conspicuous at the same time as the national economic problems did not subside; on the contrary, the balance of payments deficits increased as did unemployment while inflation rates grew. This prompted the parties to consider the economic effects of future choices of energy technology while at the same time acknowledging that it was necessary to take into account effects on the environment, on employment etc. An implicit agreement had been established that state energy policy was an instrument for choosing for the future the fuels and technologies which were to be used in the national energy supply. There was however a growing dissent on the criteria for choice, the importance of different objectives and, following from this, on the instruments which the state should use in implementing energy policy. For example, the Social Democratic Party, which held government, was concerned about public acceptance of state energy policy and made the introduction of nuclear power conditional on a popular vote; to the Liberal Party, public opinion about nuclear power was the result of misrepresentation of facts and this party considered the expected future economic advantages more important.

The range of issues considered by the parties grew. In addition to the effects of particular technologies, the import of fuels was increasingly seen as a liability and establishing an indigenously based energy supply increasingly became an objective for the parties. In this context, the North Sea reserves were given increasing attention, but here again the imposition of other

objectives resulted in different strategies for handling the oil and gas venture. The Social Democrats advocated extensive state control of the project while the Liberal and Conservative parties argued that consumers should be free to choose between fuels.

The parties thus agreed that a national interest in energy policy existed; but there was no agreement as to which priority should be assigned to the policy criteria in preparing energy plans. This uncertainty in identifying energy policy criteria and weighting them against each other did also, as we have seen, given rise to internal inconsistencies within the policy statements of single parties.

General Summary: Political Parties

The degree to which energy policy has commanded the interest of political parties increased considerably during the 1950-1980 period. Both countries witnessed the disappearance of a consensus that growth in energy consumption was both a precondition for and a necessary result of economic growth. This consensus during the 1950s and 1960s gave rise to policy statements which defined the role of the state, in relation to industry as supportive. In particular, the state should encourage technological change in energy supply, and here the focus was on nuclear power which was thought capable of obviating future supply problems.

This consensus has been replaced by a situation where the parties agree that the state, should control the developments of the energy sector, but where, at the same time, there is little agreement as to the objectives of energy policy as well as the means of control. This observation supports the hypothesis of a politicization of energy as regards the political parties.

We shall now seek to pull together the British and Danish developments in order to identity similarities and differences between the two nations with respect to party-political attitudes to energy policy issues over the period.

During the 1950s and 1960s, the focus of energy political thinking in both countries was on the need to provide for economic growth. In both countries, nuclear power was seen by all political parties as potentially capable of providing for ongoing growth in energy consumption for a very long time. In Denmark there is little evidence of any discussion of other sources of energy. In Britain, however, public versus private ownership of the fuel and power industries were discussed by all parties. This discussion focused on economic growth and both public ownership and market-oriented solutions were advocated as the best means to ensure economic growth. Also it is well worth noting again that central state energy planning (and not just planning for the single industry) was not considered by any of the parties.

From the late 1960s, the parties in both countries increasingly focused on the problems of keeping up economic growth on the one hand and the problems accompanying economic growth on the other as they realized that continued expansion of all fuel sectors was inconceivable. Environmental problems were also identified in both countries. In Britain, the coal industry presented a particular problem to the Labour Party which advocated that state subsidies were needed to maintain indigenous fuel production. In Denmark, the increasing costs of importing coal and oil were increasingly seen as a problem. The Conservative Party in Britain and the Liberal Party in Denmark pressed for a new nuclear programme (Britain) and introduction of nuclear power (Denmark) as a solution to these problems.

1973/74 in both countries meant the breakthrough of gene-

ral agreement that the national economic implications of energy production and consumption were so important as to necessitate some kind of social control of the development of the sector. Specifically energy policy should aim at fuel diversification. In Britain, the coal miners' strike only added to these problems. In both countries, all political parties advocated that the adoption of nuclear programmes would contribute to the solution of the problems as would state encouragement for exploitation of North Sea oil and gas. But also there was general agreement that growth in energy consumption would have to be cut. Even if the assumption of a positive correlation between growth in energy consumption and social welfare was still being upheld, it was being suspended by the necessity of reacting to the immediate economic problems.

After 1976, the immediate repercussions of the oil and coal crises had subsided but the party views on energy policy did not return to pre-1973 conditions. It was now generally accepted in both countries and across all parties that state energy policy was a necessity because the problems arising from uncontrolled development in the energy sector had been seen to give rise to problems at the national level.

Parallel to the growing recognition that dependence on coal and oil increasingly created economic as well as environmental problems, all parties considered alternatives. Particularly the North Sea resources and the renewable energy forms were considered by all parties. There was no questioning of the implicit assumption that the state was to plan energy, and that energy policy involved evaluation of different energy technologies. There was also agreement that such evaluation involved the establishment of socio-economic and environmental impacts and studies of safety in operation of energy technologies. But how these impacts were to be established, and how they were to be weighted against each

other was a matter of disagreement between parties. In addition new issues emerged which were initially only considered relevant by a limited number of parties, for instance the British Labour Party's concern about the impact of any particular energy technology on the living conditions of the working class.

While the Liberal and Conservative parties in both countries tended to advocate control through the price system and argued that state intervention should be minimal, they also recommended specific technological strategies which would demand for their implementation extensive control, e.g. as allocation of R&D expenditure for nuclear power. The British Labour Party and the Danish Social Democratic Party (and to a somewhat smaller degree the Danish Social Liberal Party) advocated strong state control of energy production and consumption, taking into account the demands of the population in general and the trade unions in particular, while at the same time ensuring the economic efficiency of investments as well as taking into account the balance of payments.

Comparing this development to the periodisation of chapter 2 (see tables 2.3. and 2.4), we find that the stated policies towards energy of the political parties contain for different periods the same elements (problems, issues and strategies) as are evident in state energy policy of the period, although there is a number of exceptions to this pattern. The 1950s period shows a large degree of consensus between parties adhering to different political philosophies that economic growth was absolutely desirable. Problems were identified as obstacles to growth and technological change was generally advocated as a solution to this problem. Also it was generally accepted that the state ought to support technological advance, particularly the development of nuclear power. This consensus was paralleled by policies creating a favourable climate for the development of nuclear power, improvements

of electricity infrastructure and (in Britain) technological change in the coal industry. In Britain, energy industries were largely under public control whereas government was conservative for the most of the period. Denmark had a privately owned and controlled energy industry and for most of the decade a Social Democratic government. In neither country, however, were the structure of ownership or control of the energy industries changed during the decade in spite of the political dissent in both countries about the appropriateness of public vs. private ownership. The industries were, in both countries, left to plan their own production and sales.

In contrast, the difference between the state energy policies of Britain and Denmark which we identified in chapter two is not parallelled by differences between the policies of the parties of the two countries. In both countries, there was a marked absence of party political interest in energy until the late 1960s. It was as if the problem of state ownership as well as the excitement over nuclear power had vanished suddenly.

Towards 1970 and up to 1973 in both countries political parties became increasingly concerned about energy in a recognition that the expected growth in energy consumption had led to problems that had not been foreseen. The cheapness of oil meant threats to the national economy and - in Britain - local interests. In addition energy was identified as a source of pollution. These issues were identified by the political parties and transformed into policy statements which emphasized state control of energy production as a remedy, but surfaced in state energy policy only a couple of years later, in 1974, when state energy policy and planning was established in both countries. In the late 1960s the governments of the two countries again represented opposite political/philosophical traditions: Denmark had a Liberal/Conservative/Social

Liberal coalition government, while Britian had a Labour Government. This difference may explain the total lack of energy policy initiatives in Denmark in this period compared to the British policy which involved attempts to coordinate sectoral energy policies within the Ministry of Technology as well as an important Fuel Policy statement of government.

During the oil crisis and the British crisis the administrative capacity for dealing with energy was considerably increased in both countries. The political consensus on the need for the state to react to the crisis by developing an energy planning capacity was reflected in the creation of state energy policy agencies, whereas the issues which had been identified from the late 1960s were now incorporated in state policy organisation and policies. Agencies, boards and councils were set up to deal with all conceivable aspects of energy in both countries. This happened in Britain under a Labour government and in Denmark under a Liberal government. Again it seems that the extent of state intervention was determined by the character of the actual problems rather than of the colour of government. But this panic-stricken consensus was soon to vanish: after 1976 we see that the identification of still more problems connected to energy policy in both countries led to the parties adopting different and contradictory positions on future energy supply. The state energy policies reflect this as an accumulation of still more problems areas and considerations being dealt with in policy statements, and still more advanced modelling tools to deal with any conceivable future variation in the assumptions about prices, environmental impact, employment effect of technologies etc.

Toward the end of the 1970s, state energy policy increasingly focused on economic constraints, whereas this focus was not as sharp in the political debate conducted

between and within the political parties, where other considerations still dominated. The economic concern of energy policy was paralleled by similar concerns expressed by particularly the Conservative and Liberal parties of both countries. But there was no consensus on how to arrive at an energy policy from this criterion, as it was itself the subject of debate as to what should be understood by economic efficiency and how it should be weighted against environmental effects, employment effects etc.

Generally we find that the shifts identified in state energy policy parallel shifts in the political focus of the political parties and that these shifts have occurred regardless of the colour of government. Only in one period, from the mid-1960s to 1973/74, can differences in the form and content of energy between the two nations be interpreted as a reflection of the political/economical philosophy of the party in power. For the rest of the 1950-1980 period, the issues in energy policy were taken up in parallel both by the political parties of the two countries and in state energy policy. This suggests that the emergence of these issues were related not so much to the political philosophy of the political parties as to other factors which we will need to explore further. But let us proceed to see how other political groups conceived energy policy issues during the same period.

3.3 Industrial Interests.

We have hypothesized that energy industries influence state energy policy. The aim of this section is to examine this hypothesis. Following our general methodological principles, we will examine changes in the policies advocated by the industries. We will seek to establish whether the issues raised in the course of the period from 1950 to 1980 have been reflected in state energy policy.

We want to examine whether parallels can be established between the industries' expression of policies in a given period and state energy policy issues of the period. In addition we want to examine whether the chronology of issues, problems and policy solutions advocated by industrial interests are parallel in Denmark and Britain.

We want to suggest that not only the specific branch of industry directly involved in energy production commands influence over state energy policy. The cost of energy consumption to industry in general would suggest that these industries would seek to influence the prices of energy. If this is the case, attempts at influencing energy policy could either take place through industrial interest organisations like the British CBI or through personal contacts at a high level. Such contacts, however, are difficult to identify and we have assumed that even if personal contacts were important, the objectives of the pressure they have brought to bear on policy formulation would be evident from policy expressions of the interest organisations.

The energy producing industries besides fulfilling possible statutory demands on their operation are assumed to seek influence on state energy policy to the extent that energy policy is seen by the industry to either threaten the future of that industry or offer the scope for better conditions within the industry.

Having said this, it must be added that a survey of policy expressions over a thirty year period of all industries involved in energy production in Britain and Denmark would be a mammoth task outside the scope of the present thesis. We have, therefore, chosen to concentrate on one branch of the energy industry, the electricity industry. The remaining industries' policies have been covered with the aim of establishing different patterns of industrial influence in the two countries and possible conflicts

between the objectives of different industries. The multinational oil companies were excluded from analysis, as we have wanted to focus on national energy policy, although we are aware that the international aspect of energy is and has been important. We have, however, assumed that the oil companies would seek influence directly through price policies.

As the previous section, this is divided into a British and Danish subsection and within each of these subsections the material has been organized chronologically.

Britain.

The British energy industry can be grouped into fuel industries, which extract and manufacture fuels into a form in which they lend themselves to consumption, and power industries which transform fuels into usable energy. Having said this it must immediately be added that the borderlines here are fudged. The different fuels demand different processes to be turned into end-use energy, and both the coal and gas industries sell fuels direct to the consumer for end use as well as selling fuel for electricity generation. The nuclear fuel industry represents a particularly complicated case, as the organisation behind fuel manufacturing and reactor technological development is very complicated.

During the 1950s, the most important energy industries in Britain were the nationalised coal and gas industries, represented by the National Coal Board and the Gas Council, and the nationalised electricity industry, the structure of which during the 1950s is shown in fig. 3.1.

During the 1950s, the coal industry was faced with demands for coal which exceeded the productive capacity within the available technology and access to labour. The

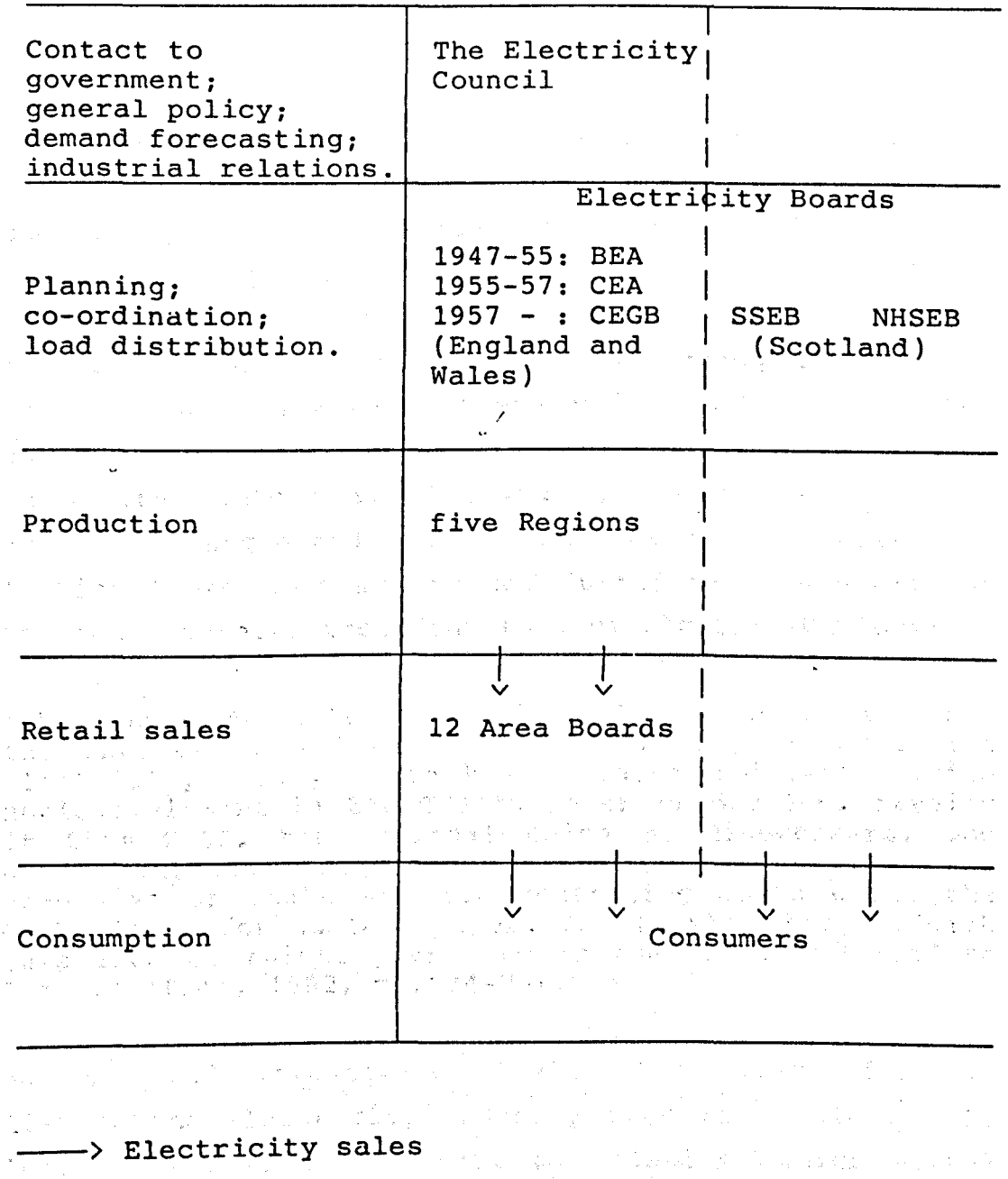
National Coal Board therefore called on the state for measures to ease this situation[34]. The most pressing problems identified by the Coal Board were the need for manpower in the industry. The solution to this problem advocated by the Coal Board was increasing productivity in the mines through a "technical revolution in our industry" (James Brown, deputy chairman of the NCB in The Times, 23 May 1955, p.6). Besides these calls for support for technological change, there is little evidence that the industry actively sought to influence state energy policies either directly or through attempts to influence public opinion. Also there is little evidence that the Gas Council were concerned with issues not directly related to the statutory financial objectives of that industry during the 1950s.

That the energy industries went about their business of providing for an increasing demand for energy is confirmed by a comprehensive survey that we have undertaken of publications of the electricity industry. This survey showed, that the publishing activity of the electricity industry up to 1957 was sparse, and that the British Electricity Authority/Central Electricity Authority only published technical reports on aspects of electricity production, obviously aimed at a narrow readership of power station engineers and afficionados of turbine technology and electricity transmission methods.

The 1956 reorganisation of the electricity industry that eventually resulted in the setting up of the Electricity Council and the Central Electricity Generating Board portended an era of increasing political activity by the industry aimed both at decisionmakers and the general public.

The British electricity industry is under a statutory obligation to meet demand for electricity in the cheapest way possible. Obviously, this obligation is wide open to

Fig 3.1 The Structure of the British Electricity Supply, 1950s.



interpretation. In order to turn it into an operational target for production in the form of a number of watts per unit of time, it is necessary to specify how 'demand' and 'cheapness' should be interpreted. Consumption is usually taken to represent demand, but sometimes a latent demand is assumed to exist, as we shall see. If we move into the future, the stipulated future demand may vary considerably according to the assumptions made about future energy consumption patterns, co-variation between economic growth and consumption growth and a number of other parameters. Likewise, the expected cost of particular methods of electricity generation is a matter of interpretation and depends on which assumptions are made about construction times, fuel and other prices, inflation and interest rates and capacity factors as observed by Ramage (1983). Ince (1982) has suggested that the Central Electricity Generating Board when making and justifying these crucial assumption operates according to a particular ideology:

> "The corporate culture within CEGB is unanimous that the cheapest and best way of achieving an efficient electricity supply is to have a large and fast-growing nuclear element in the CEGB's power production, freeing it from OPEC, the National Union of Mineworkers, and other outside influences as well as giving the economies of scale and low generating costs which the CEGB claims for nuclear power. People who disagree with this line of thinking are few in the CEGB, and tend to leave." (Ince, 1982, pp. 24-25).

Below we shall investigate whether the observation has applied to the electricity industry over the whole of the period, and we will also seek to establish which actual influence the industry has commanded over the energy policies of Britain.

Since its start in 1956, the Electricity Council published the annual 'Electricity Supply', a popularized version of the Council's report & accounts. This publication, as well as the similar 'Power Progress' published by the Central Electricity Generating Board from 1959/60, addressed an

unspecified audience, and may be seen as an attempt to inform the general public about the activities of the industry. The publications reported present and future activities in a factual manner, but the choice of issues changed over the years.

During the 1950s, there was little discussion about the relationship between the industries themselves and the political authorities. There seemed to be no need to call for support nor to seek to influence policies towards specific fuels. And although about 90 per cent of electrical capacity was coal fired in the mid-1950s, the issue taking up most of the space in the industries' annual reports was nuclear power. The electricity industry had been involved in investigating the prospects for nuclear generating as far back as 1953[35], and the industry supported the development of the technology strongly. The development of nuclear pwoer was reported as a 'remarkable story of progress'[36]. The background for this optimism could be seen in the observation that demand for electricity kept growing, and that there was no sign of saturation[37]. The arguments for nuclear power, however, were not phrased in terms of need for the output but in terms of the technological achievement that a civil nuclear programme was seen to represent.

This is also the impression one gets from reading the annual Report & Accounts of the United Kingdom Atomic Energy Authority of the 1950s which presented nuclear technology as both well understood and safe. The scientific origins of the technology was often referred to and the technical feasibility of constructing a nuclear power-station came to represent an argument for actually doing it.

> "The rapid advance in technique and the experience gained in designing the Calder Hall station made it possible to consider a programme for the commercial production of power from nuclear energy." (UKAEA Annual

Report 1954/55, p. 13).

The confidence in science and technology was also evident from the industries' confidence that to any problems arising from nuclear power production, technological solutions would be generated. The Atomic Energy Authroity was well aware of the risks arising to human health from radiation, but was satisfied that these risks were

> "(...) easily measurable and as well understood as those in any other undertaking and can be guarded against accordingly." (UKAEA Annual Report, 1954/55, p.13.)

This confidence also explains the expectation of the Authority that, in the long run, siting of nuclear power stations in remote areas would not be necessary, as well as the Authorities' official reaction to the fire in 1957 in an experimental reactor at the Authority's Windscale site[38]. According to the Authority Historian's Office[39], the accident, while doing only little harm,

> "(...) caused a considerable shock, both inside and outside the Authority, and led to much heartsearching and many investigations." (United Kingdom Atomic Energy Authority, 1979 II, p.13).

The Authority's Report & Accounts, however, did not hear any evidence of such concern. Instead, the opportunity for technological improvements provided by the lessons learnt from the accident were emphasized:

> "Careful measurements have made possible an improved understanding of the relationship between an increase above the normal background radioactivity, following an accident involving the release of radioactive iodine, and the effect on the radioactive content of milk drawn from cows grazing in affected pastures." (UKAEA Report & Accounts, 1957/58, p. 42).

The apparent inconsistency between stating that nuclear

technology was well-understood and admitting that new things still had to be learnt about it was resolved through the concept of technological progress. Technological progress would mean that even in the case of a fully developed and well-understood technology, it would be possible to gain new advantages by applying still more research. In this way, it was for instance expected that a fall in capital costs of nuclear power stations of 30 per cent could be achieved[40]; but even though the Authority attempted to map out future developments, this was difficult:

> "Technological and scientific knowledge is growing so rapidly, however, that no firm long-term programme could or should be formulated." (UKAEA Report & Accounts 1957/58, p.15).

From the late 1950s and throughout the 1960s, the industry increasingly discussed the influence of government policy on their own activities just like there was increasing evidence of an increased awareness of the influence of developments in other fuel sectors. The main theme of the Electricity Council's publications of the 1960s[41] was the need to provide for the increasing growth in electricity demand. Economic growth led to an increased "desire for comfort and labour saving devices" (The Electricity Council, 1964 II) and in this situation electricity was seen to offer an efficient replacement for hard-to-find labour[42]. Competition of the supergrid and increased instruments in the attempts to provide for the expected increase in demand in the future.

But at the same time, competition from other fuels, particularly gas, was beginning to make itself felt. In 1966, the Electricity council observed that the industry was in a difficult position trying to compete with the gas industry, because it had stiffer financial objectives than the gas boards, had to pay a duty on fuel oil, and finally was given a limited freedom by government to choose which

fuels should be used in electricity generation. The last two points clearly referred to government policy measures to protect the coal industry, which was now seen by the electricity industry as a constraint on its attempts to fulfill its main statutory objective.

Also the nuclear industry had begun to make claims for government attention. It pointed out that technological progress demanded investment:

> "The many spectacular achievements which were announced then (in 1954 when the UKAEA was set up, T.A.) and have been announced since were the fruit of ten years' work which till then had been largely unnoticed. The rate of advance continues to be rapid; but further progress can only come from research that is increasingly complex and expensive, both in money and men, and it takes time." (UKAEA Report & Accounts 1958/59, p.4).

It is tempting to see the systematization and development of electricity forecasting procedures in the 1960s as an instrument in a fight to convince government that the industry was of national importance and therefore deserved special attention. It must, however, be remembered that the industry since 1957 had been required, under the Electricity Act, to publish an annual electricity demand forecast for the following six years. Furthermore, from 1963 it was required that the official government target rate for economic growth was adopted as an assumption of the forecasts. Within the framework of these requirements, there was ample space for interpretation.

The actual forecasting procedure was a combination of trend extrapolation and simulation using a simple model of the correlation between economic growth and electricity demand growth[43]. As growth in electricity demand was high in these years, the forecasting method inevitably led to forecasts expecting ongoing growth of size of 7-9.3% p.a.[44] In addition to the expected growth in demand, the adoption of still larger 'planning margins' allowing for

growth in excess of forecasts as well as for plant failure[45] led to adoption of plans for capacity increses of 75% over six years or almost 10% p.a.[46].

The procedures for forecasting and planning and the industry's presentation of these procedures suggested that electricity demand was autonomous in relation to the industry. The electricity industry merely fulfilled its statutory duties by responding as precisely as possible to demand:

> "Modern research techniques are being used to ensure that the industry's forecasts of future electricity demand aare as accurate as it is possible to make them." (Electricity Supply 1963/64, p. 11).

But at the same time, the electricity industry acted like a private industry trying to actively expand demand for its own commodity and obtain as large a share of the 'highly competitive' energy market as possible[47]. This was evident also in increasingly aggressive marketing of electricity in the annual reports[48].

Finally, achieving a continuous supply was an important objective of the industry. The Electricity Council cited the following achievements of the early and mid-1960s as important steps towards the final aim of 99.9% continous supply[49]:

- the operational control systems for controlling load had been improved;
- automatic data-recording methods had been developed;
- the number of manned points had decreased.

The industry went for increasing the size of single power stations because of the economies of scale arising. But the centralisation of electricity supply was seen to have the additional advantage of increasing control over the whole system and thus enabling a higher continuity, as in-

dicated above.

From 1969, there are indications that the relationship between the industries and the surroundings was increasingly strained as was the relationship between the industries. The National Coal Board called for government support of the industry, and the electricity boards were put under obligations to purchase large amounts of indigenous coal. This move was not popular with the Central Electricity Generating Board:

> "Constraints on the free choice of fuel (...) will have penalities, which will extent into the future." (Power Progress, 1969/70).

The Board also reacted to the increasing scrutiny of the industry by Select Committees. The reaction was phrased as a hope that the additional workload arising from inquiries and examinations would not become yet more onerous[50]. The industry observed, however, that public concern about energy was mounting[51], and reacted by increasingly emphasizing in its publications the advantages of the industry's own product (fuel or electricity) as a strategic component of a national energy policy.

Also the nuclear industry found its position threatened. In 1971 the United Kingdom Atomic Energy Authority responded to the Green Paper on Research and Development (cmnd. 4814) by recommending that the Reactor Policy Committee should be consulted in order to ensure that the Central Electricity Generating Board, the Authority, the fuel manufactures and the nuclear power plant manufacturing industry were given influence on research priorities. The Authority observed that introduction of natural gas had led to slow and irregular ordering of nuclear power stations, and called on government to recognize the importance of nuclear power and a strong nuclear industry[52].

Another indication that energy was increasingly politicized is the considerable widening of the argument for nuclear power which can be observed in the nuclear and electricity industries' publications from the late 1960s onwards. Where the nuclear project in the 1950s and early 1960s had been seen to follow on logically from the growth in energy demand and the need for technological progress, it was now argued that nuclear power was preferable to other energy forms because its environmental impact was negligible and its consumption of exhaustible resources small[53]. Also the safety of the technology was emphasized, but whereas the technology in the 1950s and early 1960s had been presented as inherently safe, the existence of the independent surveillance of the Nuclear Installations Inspectorate and the Radioactive Substance Committee were now presented as guarantees that the project was run in a safe way. These bodies had existed for a number of years, the Radioactive Substances Committee from 1948 and the Nuclear Installations Inspectorate (under the name of the Inspectorate of Nuclear Installations) from 1959, but only in the late 1960s did the industry find it necessary to emphasize that nuclear technology was subjected to independent scrutiny. Again this suggests, that the industry was under some pressure to legitimize its activities.

The environment became an increasingly prominent issue. In 1970 the Central Electricity Generating Board observed that the quality of the environment and in particular the issues raised by pollution had received widespread publicity recently. The Board commented:

> "Care for the environment has always been an integral part of CEGB's policy in the siting, design and operation of their plant." (Power Progress 1969/70).

This is true to the extent that visual amenity had been discussed earlier, notably in the early sixties, when undergrounding of high voltage power lines was considered[54].

At the time, however, undergrounding was dismissed on the ground that it was too costly. Hence, until around 1970 the electricity industry had not been concerned about 'the environment' but about specific cases of environmental impacts of their operations; and furthermore, that economic considerations had overriden the concern for visual amenity.

The politicisation was also evident from the sheer amount of published material of the industries, which started growing about 1970 and have grown steadily since. The information efforts can be seen from the increasing use of new media like exhibitions, leaflets, films, packaged educational material etc. as well as from the face-lift that the old media, like the annual reports, underwent[55].

The energy crisis in 1973/74 found each industry was already defending the position of its particular product. The crisis was therefore mainly used as yet another argument in the fight for government attention.

The National Coal Board prepared the 'Plan for Coal' which made financial provisions for an increase in coal production and sales as well as a capital investment of £600 million to provide for new capacity to replace depletion. The plan was endorsed by the trade unions and the Labour government through tripartite discussions. The plan implied an increase in coal-based electricity supply. But, as we have seen, the nuclear industry was pressing for orders, and the Central Electricity Board was reinforcing its pressure on government to get the approval of a programme of American-built pressurized water reactors.

The rest of the 1970s were marked by increasingly aggressive marketing by the energy industries. The issues which had been raised around 1970, particularly the environment, health and safety, remained in the focus of argument. But in addition, public opinion and choice of technologies

came increasingly into focus.

The increasing fuel prices meant that energy took up a larger share of the costs of industrial production. The Confederation of British Industry made efforts to gain influence in energy political decision-making, which indicates that energy policy was increasingly considered an important field. A joint energy policy group was established between the Confederation and the Department of Energy and the Confederation attended the 1976 National Conference on energy and was represented on the Energy Commission. Although the Confederation is generally in favour of free-market principles, since the mid-1970s it has advocated national energy planning, especially as an instrument to ensure further development of nuclear power[56].

The electricity and nuclear industries increasingly recognized the existance of an opposition against nuclear power and increased the activities to "explain nuclear power for the layman"[57]. It was observed, that

> "There can be few technologies that have evoked so much comment yet are so little understood as nuclear power ... It is a complete enigma for many. And fear of the unknown has led to its erroneous assocation with atomic weapons and even into the realm of science fiction. The reality of course is quite different." Mr. S.C. Goddard, ECng, MIEE, Systems Strategy Engineer, in CEGB, 1981 II).

The industry has sought to counter what is thought to be the result of ignorance by disseminating a large number of facts, i.e. mainly statistics about various aspects of nuclear power generation which are presented as 'the facts about nuclear power'[58].

Another new discussion was related to the relative advantages of different energy producing technologies. This discussion appeared in the publications of the electricity industry around 1980, and mainly set out the advantages of

nuclear power against the disadvantages of the 'capricious' technologies for utilizing 'so-called renewable resources'[59].

The renewable energy technologies were dismissed as not economically viable: if it was possible to capture low cost wind energy, this would have been done long time ago, as "nothing stops people building windmills" (Central Electricity Generating Board, 1981 IV). At the most, renewable energy may be used as 'insurance technologies', especially wind power, which

> "(...) might become economic with very large machines of good reliability and a long life if fossil fuel prices rise about a factor two in real terms." (The Electricity Council, 1980, p.21).

We shall not discuss here the further implications of the contradiction between two statements, just note that the industry, while regarding cost-efficiency as important, was in internal disagreement about the level of investments which was to be assumed prior to an assessment of the relative cost efficiency of renewable technologies.

Summary.

Although the British Energy industries are under statutory obligations to produce particular forms of energy under specific financial requirements, they are actively pursuing interests beyond these statutory objectives.

During the 1950s, the industries aimed at increasing output and productivity as far as possible. Technological change, especially the nuclear project, was presented as a solution to the problem of energy shortage, and there is no evidence of any conflicts between the fuel industries.

From around 1970, the industries started more aggressive

campaigns to defend their positions. Public relations activities were intensified, as were attempts to influence the process directly. In this process, the industries increasingly saw each other as rivals. The coal strikes of 1972 and 1974 were used by the electricity and nuclear industries as yet another argument to increase the share of nuclear power, while the oil price rise was used by the coal industry as an argument in favour of strengthening this industry.

From the mid-1970s, new issues entered the publications of the industries. The industries discussed their products in terms of national energy policy which involved evaluation of energy technologies, and the industries developed their own version of the criteria which should be used in such an evaluation. Whereas the environment had been accepted as an important criteria for energy technology evaluation as far back as about 1970, public opinion was only introduced around 1980 as an important issue, but negative attitudes to nuclear power was rejected as the results of ignorance.

Whereas government energy policy considered a wide range of energy sources from 1974, the electricity industry only around 1980 started a discussion about renewable energy. The technologies were generally rejected because they were not seen to be economically viable as a result of their incompatibility to the national grid. But scaling up of especially wind machines was increasingly considered more seriously as they began to look economic.

It will be noted that the basic attitude to technological development of the 1980s differed radically from that of the 1950s. In the 1950s, the industries advocated technological change/progress, almost whatever the cost. As we are approaching 1980, the costs of technological developments, both in terms of state finances but also in terms of health, safety and the environment had become an

issue of debate within the industry, and the need to provide sufficient energy in the future had been replaced by a concern for the future cost of particular energy strategies.

Here the industries favoured strategies emphasizing the energy form produced by the particular industry.

Denmark.

For a large part of the period from 1950 to 1980, Denmark imported all coal and oil for inland consumption. As a result the electricity industry was for most of the period the only Danish proper energy industry[60]. The electricity industry grew from independent companies which were either co-operative ventures, owned by local authorities, or by private (limited) companies. The industries were represented through the national interest organisation, Danske Elværkers Forening, which was set up by the industry itself as far back as 1923, and was to represent the industries in their dealings with the state. For example, Danske Elværkers Forening holds three out of 12 seats in Elektricitetsrådet ('The Electricity Council') which in 1935 was given statutory powers to supervise electricity production, exercise market control and advise government in electrical matters[61]. Although nuclear power has not as yet been introduced in Denmark, preparations for a nuclear project were, as we have seen, initiated in the 1950s. The Atomenergikommission ('The Atomic Energy Commission') and its research centre at Risø represented interest in nuclear power.

During the 1950s, the level of overt political activity beside direct cooperation with government through e.g. Elektricitetsrådet, was low. Danske Elværkers Forening since 1954 issued an annual report[62], but throughout the 1950s and 1960s, it consisted solely of statistical infor-

mation about production, sales etc. plus descriptions of each undertaking.

In the mid-1950s, the nuclear project was initiated, and Atomenergikommissionen set up. In 1956, a number of firms and undertakings within Danish industry, particularly from banking, insurance, the electricity industries and major manufacturing industries, got together in DANATOM, a lobby which aimed at promoting nuclear power. DANATOM put most of their efforts into direct contacts with politicians and newspaper articles[63]. Hence, the nuclear organisations did not through the 1950s prepare policy statement on nuclear power.

The 1960s were quiet in respect to statements from the energy industries. The publications from the electricity industry were limited to the annual statistical bulletin.

Around 1970, the industry's public activities were increased. Danske Elværkers Forening started issuing an annual report[64]. Here it was noted that recent legislation had important implications for electricity supply. The most important legislation was limits for the sulphur-content in fuel oil for power station use and a price and revenue freeze in 1971. The latter measure

> "(...) has been the cause of many difficulties related to the long-term economic planning of the electricity undertakings." (Danske Elværkers Forening, 1972/73).

Another problem encountered by the industry was related to consumption trends. It was observed that electricity consumption since 1970 had risen only by about 7,5% p.a. compared to about 10% p.a. during the 1960s. This loss of momentum was explained as a temporary phenomenon, and a prognosis for electricity consumption of 10.3 %. At the same time the industry's consumption of oil was assumed to be for a large part replaced by coal, which was becoming

cheaper in relation to oil. Also nuclear power was considered a possibility, and the electricity industry had taken initiative in a series of preliminary investigations of siting possibilities. Elsewhere, in the leaflet 'Atomet i fremtidens elforsyning'[66] ('The Atom in the energy supply of the future'), it was argued that nuclear power would be necessary to supplement coal and oil, which would eventually be depleted.

In the face of a growing recognition of the increasing uncertainties about future government intervention as well as fuel price relations, Danske Elværkers Forening in 1972 set up 'Elværkernes Energiudvalg' ('the Electricity Supply Undertakings' Energy Committee') to coordinate the assessment of nuclear technology as well as other energy political issues[67].

Contact with the general public was another new concern for the industry. This was seen as a necessity caused by the need for further expansion of electricity supply in the future:

> "Considering the expected activity of the years to come, Danish electricity supply will have to convey to the public the necessity of the interference with the environment which follows from the development." (Danske Elværkers Forening, 1972/73, p.4.).

As a consequence, a press- and information service was set up in 1972, and issued the pamphlet 'Skal vi ha' el overhovedet?' ('Should we have electricity at all?') presenting electricity as a necessary precondition of prosperity.

The oil price rises in 1973/74 led to an intensification of industry policymaking as well as of the marketing of electricity. The industry initially reacted strongly to the increasing government interference in electricity supply and consumption, but in late 1973 made an agreement with the Minister of Trade to initiate a campaign for

electricity saving to avoid rationing of electricity. In 1974, the industry was faced with 1) a proposal for an Electricity Supply Act, which implied that the development of the electricity industry was to be considered in the context of a national energy policy; 2) a proposal for a Nuclear Installations Act; and 3) a proposal for a duty on electricity. The electricity industry reacted to this interference by arguing that the proposal represented a severe restriction on the freedom of action of the industries.

The internal planning of the industry was also affected by the rapid changes in supply conditions. In the prognosis for electricity consumption until the year 1990, annual demand growth was expected at 8.5% compared to 10% previously. Danske Elværkers Forening commented:

> "It is one thing, that in certain areas energy has been wasted. But the correlation between the development of the domestic product of a society and its energy consumption is to important to curb growth in energy consumption out of hand." (Danske Elværkers Forening 1973/74, p.3).

In the following year, however, no long term prognosis was cited and, it was noted that only those power plant extensions which were already underway would go ahead, while planned capacity increases of 160 MW were deferred.

The campaign for nuclear power was intensified in spite of the uncertainties about future electricity consumption. It was observed that the public debate about nuclear power had arrived in Denmark and that concepts like 'low energy society' and 'zero growth' were being introduced[69]. The industry argued that these concepts were unrealistic, and that growth in energy demand would be resumed in the near future. Public relations activities focussed on nuclear power, and it was argued that nuclear power was a central component of a realistic national energy policy[70]. The

main arguments for nuclear power concentrated on the following aspects:

1) In the long run and "under the assumptions used here" (ELSAM, 1975, p. 28), nuclear power would prove competitive with coal and oil;

2) Diminished dependence on oil would mean demand for other sources for space heating. This would lead to an increase in the demand for electricity which would have to come from nuclear power;

3) "Nuclear power is in certain circumstances environmentally more benign than coal or oil fired power stations." (ELSAM, 1975, p.29).

ELSAM agreed that nuclear power raised questions about health and safety as well as waste management, but concluded that:

> "It is the assessment of the electricity industry that the new techniques which are now available represent acceptable solutions to these problems." (ELSAM, 1975, p. 29).

The Atomenergikommission also intensified its activities. The Commission in 1975 observed that the oil crisis had put nuclear power back on the agenda[71], but also observed that more aspects had been introduced to the discussion:

> "Thus, the entire topic of the environment is now included with much greater weight, and attention is increasingly directed towards control of economic growth in order to arrive at a lower rate of growth for total energy consumption and stronger regard for other qualities of life than material prosperity." (Atomenergikommissionen, 1975, p.5).

Now, industry outside the energy sector also became involved in discussing energy policy. We have already mentioned DANATOM; but also Industrirådet ('The Industrial Council'), an organisation representing the interests of Danish industry, increasingly participating in the debate about energy from 1973. In the face of uncertain price and supply conditions related to energy in the future the In-

dustriråd set out to protect the interests of its member industries:

> "For the sake of production and employment, a future energy policy ought to give energy supply to industry a higher priority than non-industrial purposes." (Breitenstein, 1975, p.23).

Again we note that the existence of state energy policy was taken ad notam: there was no questioning of the necessity of state energy policy, in spite of the declared liberal principles of the Industriråd. Instead, the Industriråd concentrated on applying pressure to the state to influence the direction of national energy policy, especially the future of nuclear power.

After the oil crisis and for the rest of the 1970s, the industry kept increasing its public relations efforts.

Towards the end of the 1970s, renewable energy and control of power supply emerged as important issues in the publications of the electricity industry. All energy sources should be utilized, and utilization of solar energy was absolutely preferable to using fossil fuels[72]. In 1979 it was observed[73], that these sources were not very well suited for electricity production at the present stage of development compared to nuclear power. Only one year after, however, with regard to wind energy, it was observed that whereas this energy form would not for some time be capable of supplying a large amount of energy, it would have to be counted for supplying electricity locally in sparsely populated areas[74]. It was also noted that the experimental wind machines erected at Nibe in collaboration between the Ministry of Trade and the electricity industry[75] would contribute a saving of about 300 tons of oil a year. Nuclear power, which in 1979 was promoted by means of booklets like ELKRAFT's "Atomet i fremtidens el-forsyning", an update of the 1972 booklet, was still recommended by the electricity supply, but now the claims to the

advantages of this technology were played down considerably, and it was agreed that problems existed in relation to safety and waste. Finally, other sources, notably natural gas, were considered as candidates for future electricity supply.

The electricity industry now emphasized that the interests of the industry necessarily coincided with the interest of the consumer as a result of the ownership pattern whereby local authorities and shareholders are in principle in control of the industry. This implied that siting of power stations involved conflicts between only two 'parties': the electricity industry (which represents the consumers) and the environment.

Also heating was taken up as a new policy area. The electricity industry looking for new markets encountered the heating market, for which regulation through the Heating Planning Act of 1979 was underway. The electricity industry argued that more extensive use of electrical heating would contribute to independence from oil, and supported its claims with reference to an analysis of the socio-economic impact of an increased share of electrical heating[78]. It was argued that even though electrical heating demands a larger input of energy than individual oil burning, in the future it would be necessary to include considerations of the kind of fuels that society wants to use, its price and availability as well as the socio-economic cost in terms of total private and public investments, foreign exchange cost and gains in terms of oil savings.

Industry outside the energy sector also intensified their campaign to introduce nuclear power, which was now being presented as not only a cheap source of energy but also an important opportunity for Danish industry to come to the forefront of technological change:

"(...) regrettably, Danish industry is not given the

> opportunity to work with nuclear power technology, which we could learn a lot from. And what we learn is applicable to other areas. (...) Danish industry needs the chance of working with advanced technology." (Director S.T. Lyngsø in an interview in Dansk Industri, 1977, no.9).

DANATOM in 1980 issued a report which was distributed to politicians and industry[77] on the need of the Danish society for nuclear power. It was observed that electricity demand was stagnating, and that nuclear power would not be necessary from a supply perspective. It was argued, however, that compared to other sources and technologies, nuclear power was preferable. Again the effects on the economy, supply security and the environment were emphasized as important criteria for energy technological choices. The environmental effects of coal vs. nuclear power were even compared at a global scale, and DANATOM concluded:

> "To mankind, the use of coal is at least ten times as damaging to health than the use of uranium." (DANATOM, 1980, p.18).

Once more we note the widening out of criteria for technological choice in energy.

Summary.

The Danish energy supply was in a large part of the period based on imported fuels, and the electricity industry was the only Danish energy industry. Throughout the 1950s and 1960s, there is little evidence of political activity short of direct contact to decisionmakers.

Around 1970, the electricity industry and the nuclear establishment intensified their activities. The electricity industry was faced with political interference resulting from national economic problems as well as with

a stagnation in the rate of electricity demand growth and rising oil prices. The industry strengthened its activities within a wider field of energy policy and intensified its public relation efforts. In addition, the plans for a nuclear project which had been moth-balled through the 1960s, when supplies of oil were cheap and abundant, were now resuscitated. This development was given further impetus by the oil crisis, which meant increased government pressure on the electricity industry, and presented it with strong market incentives to shift fuel consumption away from oil. At the same time industries outside the energy sector pressed, on one hand for securing a cheap supply of energy for industry, on the other for nuclear power which was thought to present new opportunities for industry. In spite of the resistance of the electricity industry towards the proposed measures for state control of the industry, in general it was accepted that some state planning of energy supply was necessary in order to secure fuel supplies in the future.

When state energy policy was established as a fact by the mid-70s, the industries sought to influence decisionmaking directly as well as indirectly, through intensification of public relations activities. The industry increasingly argued for their technological and fuel-related preferences in terms of environmental and socio-economic effects. Towards 1980, the industry increasingly enetered into energy planning by preparing its own scenarios. The assumptions of the early 1970s, that growth in energy demand would return by itself, was given up and replaced by attempts to buy into the planned energy supply by presenting the most convincing scenarios.

General Summary: Industrial Interests.

In Denmark as well as in Britain, the character of industrial activities related to energy changed in the

years around 1970. Before 1970, the energy industries of both countries aimed at increasing output to fulfill a growing demand. Regarding energy technology, the industries outside the energy sector were mainly interested in nuclear power, which in both countries represented an opportunity for some industrial branches. The British energy industries sought to influence government more actively than the Danish, which is no doubt the direct result of public ownership and control. Public ownership meant that major investments had to be politically endorsed, while in Denmark the industry was free to extend its operations without political intervention. In both countries, however, the industry called for government involvement in the nuclear project, which was seen as a matter of national interest.

From around 1970, the industries in both countries were faced with obstacles to further growth. In Britain, competition between the fuel and power industries was intensified, and in Denmark, the electricity industry found its expansion curbed by slackening demand and government intervention. Also in both countries, the industries had begun worrying about the environmental impact of energy technologies, mainly in relation to nuclear power. These new issues parallelled government policies aimed at alleviating the effects of increasing trade deficits and inflation, as well as incipient environmental concern present in the legislation of both countries.

Immediately after the oil crisis (and in Britain, the coal strike) the activities of the energy industries in both countries were intensified. In particular, the nuclear establishments and the electricity industries pressed for intensifying government involvement in nuclear power. The industries in both countries from this time on increasingly sought to promote their product in terms of national energy policy. At the same time public relations efforts were increased considerably, indicating that the

industries perceived public opinion as an important instrument in securing their position. Apparently, the industries now expected that the energy supply patterns of the future would be to a large extend politically determined.

This interpretation is supported by the increasing tendency for the industries to argue in terms of national energy policy and in terms of the over-all consequences of particular technological choices. Whereas internal economics as well as fuel prices and prices of other fuels or energy forms were throughout the central concerns for the energy industries, towards 1980 they increasingly phrased their arguments in terms of the socio-economic impact, and the time-horizon of corporate plans was correspondingly increased. This development occurred after the adoption of long-term national energy plans with a time-lag of a couple of years, which leads us to conclude that the energy industry was trying to adapt to issues and methods in state energy policy while still pursuing some central concerns, of which securing the position of the industry has been the most important. This is supported by the attitudes towards nuclear power vs. renewable energy. In both countries, the electricity industry actively promoted nuclear power as a means to extend electricity supply, whereas renewable energy was considered of marginal interest. But towards 1980, as state subsidies for renewable energy became available while nuclear power became less economically attractive, the industry increased its interests in especially wind energy.

Looking back to our hypothesis, we find support for the suggestion that energy was politicized. We have found that the implicit assumptions of the energy industries about growth, about the role of state energy policy, about criteria for choice of energy technologies and about the role of the public changed considerably after 1970. These 'political' concerns or issues were contrasted by the

central concerns of the industries which were to maintain and possibly extend the domain of the particular industry and to pursue short-term economic advantages by e.g. using the cheapest fuel.

We find, therefore, that the energy industries only referred to the national interest after the introduction of national energy policy and that the industry only pursued directions which were seen to be advantageous to the particular industry either in terms of the long term position of the industry in energy supply or in terms of short-term economic benefits. We are led by this to conclude that whereas the energy industry's interests have served as inputs to state energy policy the industries have not been instrumental in defining energy as an issue of national interest. Nor have the industries themselves influenced the change in the range of issues taken up in energy policy. These issues occur in the industries' policies only after they were introduced into state energy policy. We shall therefore have to look to other groups in society to understand why energy came to be defined as a policy area and why new issues have been introduced into this policy area.

3.4 Trade Union Interests.

As with industry, trade unions can be divided into those whose members are directly involved in energy production and those whose members are not. Following the hypothesis that the attempts by a group to influence energy policy are determined by that group's experience of the material conditions related to energy and the hypothesis of a general politicization, we would expect to find a growing number of trade unions involved in energy political activities through the 1950-1980 period. In this section we will investigate if this has indeed been the case, and if there is any systematic correlation between a trade union's

position in relation to energy production and the date of its involvement in energy politics.

As in the previous sections, this one is divided into one sub-section for each nation, and within these subsections, the account is chronologically structured.

Britain.

In Britain, the one union whose members' interests are tied most closely to energy production is the National Union of Mineworkers. Second, come the engineering unions like the Electrical Power Engineers' Association and the Electrical, Electronic, Telecommunications and Plumbing Union, but these unions have members elsewhere than in the electricity industry. In addition to these, a large number of unions have a lesser percentage of their membership in the energy industries. Ince (1981) observes that even the unions with a direct interest in energy tend to have a smallish percentage of their membership working in the field, spread thinly between different energy operations and concludes that this implies that apart from the miners, even the unions directly involved in fuel are obliged to look at energy in general as well as in terms of their own members' interest. This conclusion, however, presupposes that the unions do look at energy at all, and, as we shall see, this has only recently been the case.

During the 1950s and 1960s, only the National Union of Mineworkers was explicitly concerned about the future of British energy supply, and only in terms of the future of the coal industry. The Union was, however, mainly concerned about wages and working conditions in the short term. For example, when coal was imported in the mid-1950s, the mineworkers protested that this would not be necessary if the coal price was determined by market forces. This would mean a higher price of coal and the

surplus of price over cost could be used for improving working conditions in the mines[79]. On the other hand, the mineworkers did not resist very strongly the rundown of the coal industry during the 1960s, when allowances were available for miners who moved to other pits or accepted voluntary redundancy[80].

By 1971, however, a Fuel and Power Industries' Committee was set up under the TUC signalling a growing trade union-awareness of the importance of energy. The Committee brought together members from all unions with members in energy industries and had as its first task to undertake a study of national fuel and power policy. The study warned against over-reliance on oil in the light of stagnation in the national fuel and power industries and called for expansion of the nuclear programme and for securing the future of the coal industry.

The Fuel and Power Industries Committee was given seven seats on the Energy Commission. Besides, the National Union of Mineworkers was directly involved in tripartite decision-making together with the National Coal Board and government, which is probably why the engineering unions took a leading role in the Fuel and Power Industries' Committee. Hence, through the 1970s the unions involved in energy production had direct access to the energy decisionmaking process, and there was no motive to seek wider public support.

After the oil crisis, the TUC's official policy has consistently emphasized the need to expand investments in the coal industry as well as in the electricity industry and nuclear industries. This objective was reconciled with a call for increased energy conservation by recommending that domestic oil and gas production should be cut down[81].

The TUC has been and is consistently committed to economic growth. The role of energy in economic growth has

therefore been a central concern of the TUC. As late as in 1976 the TUC suggested that state energy policy should aim at providing sufficient energy for future economic growth. Specifically, it was seen as important to maintain and expand employment in the coal and nuclear industries. At the same time, the TUC recommended the creation of a central body with representatives from government, the unions and industry to advise on energy policy. This indicates that energy policy was also seen as a means of reconciling economic interests within energy supply.

It was increasingly realized that economic growth was not returning even after the repercussions of the oil crisis had subsided. Therefore, government energy policy increasingly came to be seen by the TUC as a means of creating economic growth and securing employment (as opposed to the earlier argument that energy policy should ensure that sufficient energy was present to fulfill the demands arising from economic growth). This argument was presented in 1979, when the TUC called for increased long-term investments in the energy industry in order to maintain the standard of living[82], and repeated in 1981, when the TUC observed, that:

> "It is now widely understood that adequate and stable supplies of energy at reasonable prices are fundamental to possibilities for economic growth in the UK and in the world economy." (Trades Union Congress, 1981, p.5)

The central concerns within this framework were directly related to the employment interests of the workers in the coal and nuclear industries; still the TUC recommended increased investments in these industries. But increasingly these demands were sought to be reconciled with other considerations.

Since 1977, trade union involvement in the energy debate had revealed an increasing number of inconsistencies in the trade union approach to energy policy. In 1977, the

annual TUC conference called on national energy policy to seek a balanced development of energy resources. An important component of such a strategy was an expanded nuclear programme, which would have to be 'socially acceptable'.

This may be liked with the anti-nuclear opposition within the trade union movement. In 1977, the Amalgated Union of Engineering Workers - Technical Administrative and Supervisory Section published a proposal for a national energy strategy which implied that energy policy should take as its starting point an assessment of the country's energy needs (as opposed to its revealed demand, which may include a large hidden waste of energy). Government should actively support energy conservation and increased use of renewable energy and in addition should ensure workers' control for energy production.

The increasing concern for new issues also made itself felt in official TUC policies. The 1979 Congress called for a policy review to provide the background for a debate within the trade union movement on different future energy options. Aspects of energy which were considered relevant for such a debate included: resources, health and safety and employment. The congress called at the same time for "maximum economy in use" and for "the fullest exploitation of all energy resources." (1979 Congress Resolution on Energy Policy, cited in Trades Union Congress, 1981, p. 126). The review[84] reveals how the Fuel and Power Industries Committee and the TUC imagined that these apparently contradictory objectives were to be achieved. Conservation should be actively supported by state grants for insulation etc., which was seen as an opportunity for employment in contrast to those savings of energy which could be achieved through high energy prices, and which would not necessarily lead to employment. On the supply side, it was argued that the North Sea resources ought to be exploited at a slow rate to ensure this indigenous source against depletion. On the other hand, the TUC did not seem to have

any scruples as to a possible depletion of coal: the coal industry should be given room for expansion by developing coal-to-oil and coal-to-gas technologies and by making the utmost efforts to increase exports of coal and protect British coal from competition from imported coal. These measures, the TUC argued, demanded a stronger energy policy and planning. The TUC proposed that a new Energy Commission be set up which would have a tripartite membership drawn from the TUC, the CBI and the Department of Energy[85]. This Committee would assist the Department of Energy in formulating and implementing a comprehensive national energy policy, and it was assumed that it would represent the relevant interests. The public interest in energy problems was recognized, but it was observed that the practice of public inquiries in cases of energy projects would often delay projects:

> "There is no doubt that there is a need for public consideration of the issues raised by such matters as the overall development of nuclear power. (...) At the same time, the TUC is concerned that the period taken to reach final decisions should be shortened, if that is possible without impeding a full examination of relevant issues." (Trades Union Congress, 1981, p.125).

But at the same time the anti-nuclear opposition was developing within the trade union movement, and by the start of the Sizewell Inquiry in 1982 into the building of a pressurized water-reactor at the Sizewell power station, a trade union consortium was formed against the plans. Furthermore, the National Union of Mineworkers had declared its opposition to nuclear power which was now seen as a direct threat to the coal industry.

By the early 1980's, therefore, any agreement on a TUC energy policy would seem to be the result either of superficiality or coercion within the movement.

Summary.

Until 1971, trade union interest in energy policy in Britain was narrowly related to questions of wages and working conditions within the fuel and power industries. After 1971, however, it was recognized that employment in these industries was threatened as the result of failing demand caused partly by increased imports of cheap oil, partly by government economic policies. Consequently the unions involved in energy production prepared for a more active participation in energy decisionmaking.

Through the 1970s, the National Union of Mineworkers had direct influence on coal policies through tripartite negotiations and, as a result, the official TUC energy policy was dominated by unions in electricity and nuclear power. But it became evident increasingly from TUC policy statements as well as from the emergence of an opposition to the official TUC line on energy, that the interests of the trade union movement could no longer be submerged under the interests of the unions who had members in the energy industries. The new issues which were identified were related to the effects of energy production on the environment and on the working conditions of workers outside the energy industries. These issues were taken up in official TUC energy policy but not given much weight. It seems therefore safe to draw the conclusion that the introduction of these issues in British state energy policy has not been a result of trade union influence.

Denmark.

In Denmark, the reliance on fuel imports has meant that there do not in Denmark exist unions with interests in any particular fuel. The unions with a percentage of their membership in energy are Dansk El-forbund (the Electricity Workers' Association), Specialarbejderforbundet i Danmark

(the General Workers' Union) and Dansk Metalarbejderforbund (the Metal Workers' Association), which all have a considerable part of their membership outside the energy sector. The majority of Danish trade unions are organised in LO ('Landsorganisationen i Danmark', corresponds to the TUC).

Up until 1974, there is no sign that the LO was concerned about energy matters. The organisations' official voice, LO Bladet, did not give any mention to energy policy or to any issues in relation hereto.

After the oil crisis, however, LO Bladet observed, that the oil price rises had had a serious impact on the Danish economy, and it was feared that the economic consequences would be passed on to the workers[86]. Also in 1974, letters to the editor were concerned about nuclear power, both pro et con. It was not until May 1975, however, that the LO Energipolitisk udvalg (Energy Policy Committee) was set up at an LO conference on energy[87] to prepare a trade union policy statement on energy. The need for trade union involvement in energy policy was motivated by pointing to the danger of leaving energy policy to the energy industries:

> "It is necessary that the interests of society, and among these the interests of the trade union movement, are given decisive influence on these questions (i.e. questions related to energy, T.A)." (Landsorganisationen, 1976, p. 9).

Hence, it was implied that the usual labour market relations were no longer sufficient to ensure trade union influence on relevant questions in relation to energy. In order to achieve influence, the LO recommended that energy supply should in the future be subjected to a larger degree of public control, and that trade unions were given formalized influence, for instance (in the case of introduction of nuclear power) through nuclear safety councils

which should draw their membership from the Industrial Inspectorate, local authorities, the local population and the labour force of each station. Furthermore, a national energy policy was needed to secure future economic growth:

> "The experience of the past shows a close relationship between the growth in wealth and the growth in energy consumption - continued growth in a society without a high consumption of energy is inconceivable." (Landsorganisationen, 1976, p.8).

Hence, state energy policy should have as its main objective to ensure a secure supply of energy. The LO thought that this could be achieved through an increased share of electricity in the energy supply, and by introducing nuclear power for electricity generation, as it was thought to be cheaper than oil and coal in the long run. On the other hand, an increase in public transport and a general effort to save energy were presented as desirable objectives that should be pursued actively by the state through a policy of duties and subsidies. Consequentially, in cases other than nuclear power, the objective of lowering costs was overriden by other (implicit) objectives and the resulting technological preferences that were not argued in terms of cost but in terms of social desirability. Also avoiding environmental pollution was seen as an important criterion in choice of future energy technologies, but was not given any weight in the presentation of the strategy preferred by the LO.

After 1978, however, it became increasingly evident that there was no consensus within the LO as to which criteria should be adopted for future energy policy. There was disagreement on which properties of a given energy technology should be emphasized when evaluating its advantages or disadvantages to the working class as well as to the population. For example, the Metal Workers Association saw nuclear power as an opportunity to strengthen employment

within the traditional manufacturing industry[88], while other unions, notably unions and associations with members outside the manufacturing industries, and interestingly including Dansk El-forbund (the Electricity Workers' Association), argued that the criteria for evaluating nuclear power (and by implication, other energy technologies) should include a wide range of effects beside narrow economic considerations. Effects that were mentioned by the unions included: risk of accidents, safety problems, waste disposal, risk to workers, threats to civil rights posed by security measures. As alternatives, the unions recommended increase of the R&D expenditure for renewable energy, and use of natural gas, and increased conservation[89]. It is typical of these unions that the employment or wages of their members did not depend directly on the future price of electricity, and the prospects of employment within a possible nuclear industry were not relevant to these unions either.

By 1980, the LO had revised its policy towards energy, and a policy review[90] was issued in which the main objective of growth in energy consumption was given up because it was observed that a policy aiming at reestablishing economic growth was bound to cause severe problems regarding the balance of payments. Therefore, the objective of growth in energy consumption in the short term had to be replaced by a long-term objective of growth, which was seen to depend on short-run energy efficiency and conservation. In addition the continuing high oil prices were seen as an impetus to aim at increased use of North Sea reserves.

In order to implement these objectives the LO recommended that the state intensified control over energy supply and consumption. On the supply side, the LO recommended state control of the oil sector; a state policy for coal purchases which would ensure a stable supply; continued efforts to solve the problems regarding safety and waste

disposal in relation to nuclear power; and a policy to ensure utilization of renewable energy. On the consumption side, the heating plans should ensure rational use of energy; subsidies should be made available for conservation; public transport should be subsudized; and norms should be adopted for energy consumption of household appliances.

Summary.

Danish trade unions only considered energy policy an important matter after the oil crisis in 1974. Recognizing that the energy industries tried to influence the new state energy planning, the LO tried to press for particular trade union interests to be included in energy planning. Particularly worker influence on energy production, e.g. in relation to nuclear safety, would guarantee that the industry was run in a safe way. It had become vital to ensure energy growth in order to secure economic growth and employment.

After 1978, there is evidence that whereas the trade union movement was in agreement that increased state control of energy production as well as energy consumption was necessary, there was increasingly disagreement over the objectives which should be at the foundation of state energy policy. Although increased employment was an important objective for all unions, there was disagreement on how to evaluate the employment effects of different energy strategies. The unions in manufacturing tended to emphasize the employment effect of cheap energy and power station construction, whereas unions outside manufacturing tended to emphasize the employment effects of conservation, just as they tended to put more weight on external effects of different technologies.

General Summary: Trade Union Interests.

Up to the early 1970s, trade unions were not involved in discussions about national energy policy, except in cases where such policies directly affected the immediate working conditions of the workers in an energy industry. In Britain, the existence of one trade union wholly relying on the development of one fuel, coal, has meant that trade union involvement through the 1950s and 1960s in energy politics was more visible than in Denmark, where no such unions existed.

This can also explain why the TUC fuel and power committee was formed in 1971, while the LO's Energipolitisk Udvalg was not formed until after the oil crisis: by 1971 British economic policies were seriously interfering with the affairs of the energy industries while in Denmark energy did not become a problem to the trade unions until they began to feel the effect of rising energy prices on industrial energy consumption as well as on the relationship between wages and household energy costs.

Both in Britain and in Denmark, the unions most directly dependent on energy supply and prices were at the centre of trade union energy policy preparation from the start. This resulted, in both countries, in the preparation of energy reviews and recommendations for increased state control of the energy sector. The different energy technologies were evaluated on a basis of their expected capacity for producing cheap energy, for creating employment for the aforementioned trade unions, and demands were made that energy policy should include measures to ensure that workers' conditions in the industries were satisfactory to the unions. In both countries, the unions called for influence in energy decisionmaking, and it was argued that this would ensure that energy policy was in the national interest.

Towards the end of the 1970s, increasing fragmentation of trade union views on energy became visible in both countries. Unions whose members were not affected in their work by the effects of fuel prices and technologies increasingly found that it was important to consider the effects of society's choice of technologies on the environment and on the health and safety of workers in the energy industries (even though these workers themselves were evidently more concerned about their employment). The energy policy reviews of the TUC and LO from around 1980 show that these concerns were now considered important but that the main thrust of official trade union policy remained to be employment and economic growth. But both the LO and the TUC countries admitted that growth in energy consumption in the short run would damage the economy. Therefore, active state measures to support conservation measures, the coal and nuclear industries (in Britain), and a Danish oil-and gas industry (in Denmark) all of which would potentially create employment, were recommended.

We may now identify the following periods:

- the 1950s and 1960s: trade union attention to state energy decision-making only as this affected the single fuel industry.

- (in Britain only): the early 1970s: trade unions increasingly affected by competition between energy industries, Unions in energy industries attempt to secure the future of their own industries by influencing decisionmaking.

- After 1973: industry in general affected by rising energy prices. Trade unions demand more state control to secure energy supply for industry. In addition, trade unions outside energy and manufacturing industries begin to make demands with background in external effects of energy technologies (dissent on nuclear

power) and promote technologies which are seen to potentially create employment in other sectors than the traditional energy-industrial sector.

- about 1980: dissent becomes visible as internal inconsistencies in official TUC/LO policies. Growth objective is submerged under the perceived necessity of having regard to national economic problems. Conservation strongly promoted.

The increase in the range of issues which have been considered important, the growing intensity of trade union involvement, and the internal dissent within the trade union movements of the two nations all lead us to conclude that a politicization of energy has taken place within the trade union movement. We note, also, that the adoption of issues related to the environment happened much later in the trade union energy policies than in state energy policy and political party policies, whereas employment -related issues, which only emerged in state energy policy towards 1980, were an important dimension in the unions' energy policy recommendations from the energy early 1970s.

In addition, the division between an official trade union policy emphasizing the importance of stable energy supply and a trade union opposition emphasizing the importance of a safe, environmentally beneficial energy supply, occurred in both countries at approximately the same time (1977-78). Therefore, whilst agreeing with Ince (1981) that there has been a trend for unions outside the energy field to pass or propose motions generally in favour of conservation and alternative energy and against nuclear power, we must conclude that this trend is very recent, as is trade union interest in national energy policy.

3.5 Other Interest Groups.

Whereas the previous sections have dealt with groups which are part of either the traditional political framework or in energy production and labour market policies, we shall now look at groups who have voiced interests outside this system. We have seen in previous sections that after 1970 both the political parties, the energy industries and certain trade unions at different points in time have acknowledged the necessity for technological choices which are based on evaluations of a wide range of consequences of using specific energy technologies. In particular, all groups found it necessary to take into consideration the environmental impacts of energy production. This has prompted us to look to environmentalist groups in order to investigate the origin of this concern.

The main environmentalist groups were identified through literature on energy policy for Britain and from the result of previous work for Denmark[91]. Personal contacts with representatives of these groups led to identification of further groups in the field. As in the previous sections, the emphasis has been on illustrating the trends in the issues and proliferation of groups rather than to provide an accurate map of all interest groups involved in influencing energy policy.

Britain.

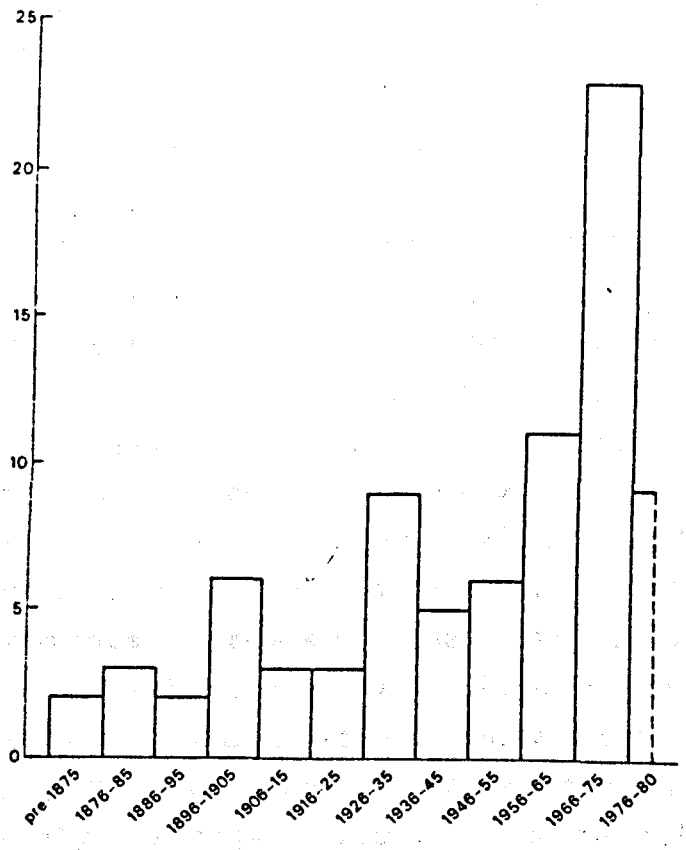
Having observed that the impact of energy on the environment was generally agreed to be an important policy criteria in the 1970s while it was not by any of the aforementioned groups considered at all in relation to energy during the 1950s and 1960s, we now look to the environmental groups to find a possible link between energy and the environment in this period.

During the 1950s and early 1960s, however, there is no evidence of such linkage being made either within or outside the organized environmental movement. The majority of groups that were later to form an opposition against nuclear power were not formed yet; while older interest groups that by the end of the 1970s were trying to influence energy policy, such as the Council for the Protection of Rural England and the Town and Country Planning Association, were not during the 1950s and 1960s giving any attention to energy[92].

Around 1970, environmental concern mounted. Fig. 3.2 shows the dates of formation of British Environmental groups. We can add that none of the groups formed between 1956 and 1965 were at that time concerned about any aspects of energy production.

The link between energy and the environment was first made by Friends of the Earth[93], an international environmental network centered around a London office. Whereas the activities of Friends of the Earth for the years up to 1973 were not directed towards energy, the link between energy and the environment was made in 1972 in a Friends of the Earth publication addressing the issues of the 1972 UN Conference on Human Environment. Here, it was observed that the physical environment was threatened by the present lifestyle of the western world. Economic growth was seen to produce numerous side-effects which could not be handled by the present economic and political systems because these were geared to the pursuit of short term economic benefit. In the context of this prospect of a general environmental crisis, energy was seen to present a specific problem. Potentially, damaging climatic effects could arise from a build-up of CO_2 in the air resulting from fossil fuel burn, which would also cause other forms of air pollution. The depletion of fossil fuels was also seen as a potential problem as were the prospects of radioactive pollution from nuclear power.

Fig. 3.2 Dates of Formation of British Environmental Groups



Source: Lowe and Goyder (1983), p. 16.

Zero growth at a global level of population as well as of consumption per capita was thought to be the only real solution to these problems. . This was to be achieved partly through policies at the supra-national and national levels[95] to stop economic growth, partly through a strong change of value orientation among the population, away from wasteful growth and towards environmental values.

Within this perception of the policy field, Friends of the Earth defined their own role as environmental crusaders,

> "(...) uncompromising in their defence of the environment and uninhibited in the actions they are prepared to take" (Friends of the Earth, 1972, p. 174).

The organisation was "prepared to take aggressive legal and political action to ensure a better environment for everyone" (ibid.), and finally the organisation wanted to

focus public opinion on environmental issues through an active publishing policy and research into environmental issues. The activities and changes of issues of the group (and other environmental groups since) have shown the difficulties inherent in this programme.

Generally, very little time has been devoted to political and philosophical discussions within Friends of the Earth, according to activists of the group. Rather, the organisation has seen it as a major advantage that the activists have managed to submerge political differences under, what by one activist was called, necessity, by another, the general consensus in the organisation[96].Throughout, this necessity or consensus has been defined in relation to topical environmental problems and the activities of Friends of the Earth have been reactions to specific environmental problems. Hence, it was only after 1973 that Friends of the Earth and other environmental groups tried to change actively energy policy. As a reaction to the aforementioned plans announced in 1973 by the CEGB to press for a programme of American designed reactors, Friends of the Earth mounted a campaign in order to counter the plans[97]. The campaign concentrated on proving that the imported design was less reliable and safe than the British design for advanced gas-colled reactor[98]. The campaign methods included media coverage of the case against the American design as well as submission of evidence to the Select Committee on Science and Technology in January 1974. The rejection of the American design in 1974 has later been counted by Friends of the Earth as a 'victory'[99].

1973 also witnessed the creation of the Ecology Party, the original name of which as the People Party. The party grew out of circles connected with Friends of the Earth, the Conservation Society and the Soil Association in an attempt to put environmental concern in a political form[100]. The party differs radically from the 'old' parties by not representing the economic interests of one

group or class. Rather, the party claimed to represent a general human interest in preserving the environment. The aim of the party was

> "(...) to create a self-reliant community based way of life within the framework of a stable economy and a just, democratic society, so that people may live in harmony with each other and the rest of the natural environment by acknowledging and adapting to the limitations of Earth's finite resources." (cited here from The Ecology Party, 1981 II).

This included working for an environmentally acceptable energy policy, but no specific recommendations were made. Also the Socialist Environment and Resources Association was set up in 1973 to identify "the social and economic problems affecting the environment and to formulate socialist policies to deal with them." (quoted here from Lowe And Goyder, 1983, p. 73). At the time, however, none of these groups actively pursued any energy political strategies.

Also in 1973 the proposals for a nuclear power station to be built at Torness in South Scotland mobilized environmental groups all over Britain, and SCRAM, the Scottish Campaign to Resist the Atomic Menace, was formed in 1975 by members of Friends of the Earth, the Conservation Society, the National Farmers' Union of Scotland and the East Lothian Angling Association[101]. SCRAM argued against nuclear power in terms of

- Cost: the capital costs of nuclear power were too large and unpredictable;
- Need: The surplus capacity was considered too large already;
- Reactor safety: no existing reactor design was considered safe, and Torness was a prototype, thus not proven;
- Employment: it was argued that local job creation would be temporary and not offer opportunities for the local skills;

- Waste: no safe methods of waste disposal exist, it was argued;

- Visual amenity: Nuclear stations were seen as ugly;

- Liability: A nuclear power station, it was argued, represented a threat to the local population;

- Proliferation: no means existed for ensuring that plutonium could be kept within a closed fuel circle.

Besides SCRAM a number of other groups were involved in the resistance against Torness: Friends of the Earth Scotland, the Lothian and Borders Anti-nuclear Group and the Torness Alliance. These groups were either ad-hoc groups or groups rooted in the environmental movement. From the outset, the anti-nuclear groups were not concerned about having a formative influence on state energy policy. The objective of the groups was getting rid of nuclear power in general and stopping particular developments. The focus of the groups was on those effects of the existing energy technologies which were seen as negative and unintended. In most cases these effects were expected effects rather than experienced effects; local residents could not have any first-hand experience of nuclear power, and indeed very few people have first hand experience of the negative effects of nuclear power.

Through the rest of the 1970s, opposition against nuclear power increased in terms of the number of groups involved, but in addition some of the groups began discussing energy policy in a wider sense. When it became known in 1975 that British Nuclear Fuels Ltd. intended to extend its fuel reprocessing facilities at its Windscale site[102], Friends of the Earth publically opposed the plans and demanded a public inquiry into the plans. The inquiry was held in 1977. 19 groups, including Friends of the Earth, the Town and Country Planning Association, SCRAM, the Socialist Environment and Resources Association and the Windscale Appeal (an ad-hoc umbrella organisation comprising 9 groups) were formally registered as objectors to the

development. This would suggest that these groups represented different concerns, but there is evidence of a strong network between the groups[103]. This indicates agreement on the central objective of stopping the development, and that political dissents had been submerged under this 'necessity'.

All along, the anti-nuclear groups have been more concerned about the external effects of technology than the wider problem of how to ensure energy supply. This is also indicated by the groups' preoccupation with proving their case in terms of showing the exact kind and magnitude of negative effects which could be expected from the particular development. The nuclear industry, it was argued, had their numbers wrong[104], and it did not take full account of all relevant consequences. This kind of strategy made room for a new type of groups: the 'alternative expert' consultancies like the Political Ecology Research Group, formed in 1976 with the aim of providing research support for political initiatives on environmental issues by means of

> "(...) critical review of government and industrial policies, environmental impact and hazard analysis, and direct participation on inquiries, commissions and committees with the provision of planning aid and expert witnesses." (PERG information leaflet, n.d. (1979?)).

From the mid-1970s, the environmentalist and anti-nuclear groups increasingly pointed to other technologies as alternatives to nuclear power as well as making recommendations for a comprehensive national energy policy. In 1978, Friends of the Earth published 'Nuclear Times' which was a one-off Windscale 'newspaper' describing in the language of tabloid newspapers the events surrounding the Windscale Inquiry. As an alternative, Friends of the Earth called for a national energy policy which should take as its starting point the following questions:

"- Who needs energy?
- How much energy?
- What kinds of energy?
- For what purposes?
- For how long?" (Friends of the Earth, 1978, p.19).

As it will be seen, Friends of the Earth in effect called for a policy which did not take into account the existence of a system of energy supply. This is a consequence of the groups' own starting point: a realization that nuclear power was a logical consequence of a system that put a premium on growth. Assuming that the demand projections of the previous decades had, through economic mechanisms, logically led to production of something that people did not need, i.e. waste of energy coupled with a host of negative effects, it was only logical to proceed by asking: would it be possible to plan the future energy supply from a preliminary assessment of what people actually do need? Here, the 'soft energy path'[105] was seen to offer an alternative. The Friends of the Earth 1978 version of such a path consisted in a national energy policy geared towards energy efficiency and aiming to maximize the share of renewable energy in the energy supply. A number of constraints to such a policy were identified: advantageous loans for small scale experiments with renewable energy were difficult to obtain; the building industry was seen to be resistant to innovations like energy-efficient building designs; and the energy industry itself was seen to represent an important constraint. Therefore the soft path demanded an active effort of the population to demand from the state that it sought to control these powers that had produced the negative effects of energy production up till then:

> "It is therefore up to public opinion (you and I) to counterbalance the entrenched powers by demanding that we pursue the options of a soft energy path -and pursue them soon." (Friends of the Earth, 1978, p.11).

The observation that renewable energy was not being intro-

duced in spite of the environmental benefits which rendered these sources preferable, led Friends of the Earth and other groups to demand a state energy policy which would actively intervene in technology choice. The years between 1978 and 1980 witnessed the publication of several 'alternative energy plans', which all served to prove that other technologies would be more suitable for fulfilling Britain's energy needs than the existing ones. Towards 1980, the alternative energy strategies increasingly emphasized the socioeconomic advantages of renewable energy, so that Taylor and Sanderson were able to conclude that:

> "The economic and institutional arguments have thus become and important part of any credible A(lternative) E(nergy) S(trategy." (Taylor and Sanderson, 1983, p. UK AES-3).

At the same time, the number of groups that got involved in promoting long-term energy strategies increased. Pre-existing groups that had not earlier been interested in energy began promoting their version of energy futures. In 1978 the British Society for Social Responsibility in Science, a socialist society of scientific and technical workers, had formed the BSSRS Nuclear Power Group. This group was in 1980 renamed 'The Politics of Energy Group' "to clarify our direction" (British Society for Social Responsibility in Science, 1981, p. 36). The objective of the group was to emphasize the class dimension of energy policy. Although criticizing environmentalist approaches to energy policy for not identifying properly the social mechanisms shaping the energy technological structure of society, the Society ended up proposing almost the same thing: an alternative energy strategy, which was to take as its starting point the effects of technology, not on the environment, but on the workforce:

> "The above programme (increased state investment in energy conservation, regulation to ensure the introduction of combined heat and power, abandonment of nuclear fission and increased energy R&D, T.A.) should be plan-

ned in such a way as to optimise the job creation potential of the various options and to minimize dislocation." (British Society for Social Responsibility in Science, N.D., p.20).

Also the Ecology Party in 1981[108] made its bid for a state energy policy. According to the party, the main objective of state energy policy should be to ensure that the impact of energy production was as small as possible, even if such a policy had unpopular economic implications, like e.g. a tax on all energy. A new institutional structure was recommended which centred on the creation of energy use centres where citizens should be able to obtain advise on the efficient use of energy. In addition the state should set standards for energy consumption of electrical appliances. That is, the alternative strategy needed strong state control for its implementation. The role of the market was not discussed.

As regards technologies and energy sources, the Ecology Party proposed that all nuclear stations should be stopped immediately; the use of coal should be reduced through energy conservation; whereas the state should lend financial support to the rapid development of renewable energy sources. The party did not discuss the strategy on the background of the present political, technical and institutional setting, nor was there any discussion of the economic implications for the state, the energy industries or the consumers.

Finally, the District Energy Authorities proposed by the party should be under an obligation to develop

"(...) renewable sources in its own area, according to district needs, and depending on the renewable resources available." (Ecology Party, 1981, para. EN 400).

This suggests that the key parameters identified by the party were need and availability of local energy sources.

It was not discussed how the District Energy Authorities should go about identifying needs, although that raises quite serious discussions. We may conclude that the party's proposals represented a thorough criticism of the status quo, but little guidance for those wanting to change it.

But also established interest groups which were not primarily environmentalist initiated attempts towards 1980 to influence state energy policy. For example, the Town and Country Planning Association voiced its concern about aspects of energy policy to do with land-use planning, and criticized the institutional setting of state energy policy for not providing sufficient opportunity for public debate and participation. Again a stronger state involvement was called for as current policies were seen to be "based too much on trends, too little on deliberate policies" (Town and Country Planning Association, 1978 I, p. 166), and the Association emphasized that it was important to arrive at the right energy strategy, even if this would mean big costs in time and money. It hereby implied that the right energy strategy could be arrived at through an impartial assessment of the relative advantages of different technologies. But the Association, itself, presented its technological preferences without revealing the assessment behind them. For example, no explicit reason was given why coal and nuclear power should be given less attention in the future, whereas more weight should be given to investigating

> "(...) the scope for and need for investment in the development of alternative, renewable and benign sources of energy such as the sun, wind and tides." (Town and Country Planning Association, 1978 I, p. 267).

Generally economic arguments were given less weight than arguments related to the environment.

Finally the Council for the Protection of Rural England entered the energy debate, being concerned that

> "(...) in all the public debate about the appropriate patterns of future UK energy investment, a vital area of discussion was being neglected. This concerned the acceptability at local level of a large number of individual developments." (The Council for the Protection of Rural England, 1979, p.3).

The Council therefore argued that it was important to develop a framework which would allow for balancing local interest against national interest in energy policy.

Summary: Britain

Before the early 1970s, there was no evidence of groups outside energy production or parliament concerning themselves with energy policy or planning.

From the early 1970s, environmentalist groups like Friends of the Earth increasingly identified energy technologies (and in particular nuclear power) as a source of environmental degradation.

Only after the oil crisis, however, were attempts made to not only halt or stop developments but actively change the direction of future energy policy. The environmental groups reacted to the proposals for increasing the nuclear programme by trying to prove that nuclear power was not necessary, and that environmentally more benign alternatives existed. Towards the end of the 1970s, a host of new groups as well as existing interest groups had taken up energy policy as an important issue. The concrete proposals for nuclear development, like Torness or the reprocessing plant at Windscale, forced the groups to develop pragmatic and tactical arguments in relation to the particular development. As cost was an important

argument here, the groups were forced to either prove that less costly alternatives existed or reject the relevance of using cost as a main criterion in energy decision-making.

The groups all agreed that the existing technologies had had unwanted effects on the environment, and ascribed this to insufficient energy planning. When it came to positive recommendations for alternatives, however, the consensus often claimed by the energy activists themselves (cf. Friends of the Earth who claimed to be able to submerge political differences under 'necessity') revealed itself as superficial. The groups agreed to the necessity of state energy planning but there was no agreement as to the objectives and basic assumptions that would have to be made. Some groups wanted to emphasize the environmental impact, some employment, some local authority autonomy etc.

Hence, towards 1980 the notion prevailed that it was in principle feasible to control energy supply so as to obtain a desired state of affairs, but little agreement on the criteria necessary to choose between different future states of affairs.

Denmark.

In Denmark there was also no evidence of any interest group involvement in energy policy issues before the early 1970s.

From the early 1970s, however, concern mounted about environmental issues and issues related to energy and pollution were discussed within environmental and disarmament group fora.

As already mentioned, the electricity industry reacted to

the oil crisis by presenting a proposal for a nuclear programme. As a reaction to this step, activists with roots in the environmental and nuclear disarment groups formed the Organisationen til Oplysning om Atomkraft, OOA ('the Organisation for Informing about Nuclear Power'), which was presented to the public with these words:

> "The organisation, being cross-political, aims at as large a public support as possible. It is formed by a group of individuals whose position towards utilization of nuclear power in Denmark is critical." (Organisationen til Oplysning om Atomkraft, 1974).

The Organisation appealed to the Folketing (parliament) to place a moratorium of at least three years on the plans for nuclear power. This would make room for

> "1) an inquiry into the problems associated with nuclear power;
> 2) extended research into and renewed evaluation of other forms of energy;
> 3) preparation of a long term energy policy which has regard to social and ecological considerations." (ibid.)

In its early days, the Organisation was a closed pressure group who directed its activities directly towards government, but during the 1970s increasing emphasis was put on mobilizing the public against nuclear power.110

Another energy interest group, the Organisationen for Vedvarende Energi ('the Organisation for Renewable Energy') was formed during the immediate post-oil-crisis years. The objective of this organisation was to actively promote

> "an energy policy which has consideration for resources and environment and self-sufficiency based on renewable energy sources." (Terney, O. et.al., 1980).

The organisation has primarily attempted to protect the interests of individual renewable energy producers and e.g. by demanding increased state subsidies for the de-

velopment and utilization of renewable energy[111].

After the publication in 1976 of the first national energy plan, the Organisationen til Oplysning om Atomkraft and the Organisationen for Vedvarende Energi published the first alternative energy plan for Denmark[112]. The main objective of the plan was proving that, given the same basic assumptions and reduction in oil imports as used by the Ministry of Trade, an energy strategy without nuclear power was feasible. The plan assumed instead an increased use of natural gas, coal and renewable sources. In relation to the basic assumptions the authors commented that it was questionable whether the assumed economic growth, if feasible, would be beneficial from a quality-of-life point of view. Furthermore the groups remarked

> "In the very long term we will naturally have to disengage ourselves from dependence on fossil fuels, and in particular the reserves of oil and natural gas seem limited." (Blegaa et.al., 1976, p.12).

The Organisation thus argued for an energy policy which would serve to pursue objectives related to the environment and resources rather than to economic growth. Implicit in the plan was the demand for a strong state control of energy supply. It also implied, that it was possible for the state to choose a desired energy future among a number of possible futures, of which the Ministry's plan was only one.

The main activities of the Organisation til Oplysning om Atomkraft were still related to preventing the introduction of nuclear power, and when government in 1976 chose to defer the decision on whether or not to adopt a nuclear programme, this was seen as a victory by the Organisation.

Towards 1980, whereas the Organisationen for Vedvarende Energi was not actively promoting national policy objectives, this has been characteristic of the Organisationen

til Oplysning om Atomkraft. Increasingly a fragmentation of the activities of this Organisation has been visible. This is evident in the 'Folkepjece' ('People's leaflet') which in 1979 was disseminated to all Danish households in an attempt to mobilize popular demands for an alternative energy strategy. The leaflet strongly appealed to the responsibility of the population:

> "We are going to choose ourselves what our energy future will be like. But in order to be able to choose, we shall have to know the options." (Organisationen til Oplysning om Atomkraft, 1979 I, p.4).

Two such futures were portrayed: on the one hand the controlled, expert dominated plutonium society; on the other, a Danish provincial town provided with windmills and solar collectors on the roofs. The question of the controlling mechanisms needed to arrive at this particular future as well as the questions of the social economic implications of the alternative technologies was not touched upon.

In addition, the Organisation increasingly entered into specialisd discussions related to energy policy. Since heating planning was institutionalized in 1979, the Organisation has argued that further specialization of coal based combined heat and power production was politically and environmentally undesirable. Likewise, the North Sea gas and oil negotiations were made the issue of a 'North Sea Campaign' in 1980, in which the Organisation demanded greater state control over North Sea oil and gas. The Organisation also attempted to influence the emergency plans related to the nearby Swedish nuclear station, Barsebäck. Finally the Organisation was involved in evaluating analyses conducted by established research institutions of the prospects, in Denmark, for underground nuclear waste disposal.

Most of these new issues have political implications that

reach far beyond the mere rejection of nuclear power. Alternative heating plans demand considerations related to economy, both as regards acceptable levels of investments and the structure of tariffs (should electricity prices be fixed to ensure that people consumed less electricity? or should differential tariffs take into account income distribution? etc.) The Organisation, being cross-political has only been able to 'submerge' differing opinions on such questions by centering on the resistance to nuclear power. All the other campaigns have been less successful, partly because it has not been possible to devise a strong positive set of objectives for alternative energy planning. In this sense, the Organisation has fed on government initiatives. It has been able to criticise these initiatives but too broadly based to generate alternatives that would command consensus beyond the general recommendation of a state energy policy which should emphasize renewable energy.

Summary: Denmark.

Only after the oil crisis did a political movement emerge which linked energy policy to the environment. The energy movement in Denmark was centered around the Organisationen til Oplysning om Atomkraft, which had as its main objective the prevention of the introduction of nuclear power. Immediately after the oil crisis, the group centred on this resistance, but towards 1980 it increasingly engaged in criticizing state energy policy in other areas and preparing alternative strategies. This became complicated in the light of the group's declared cross-political stance that prevented discussion of basic economic conditions in energy supply.

General summary: Other Interest Groups.

In both Britain and Denmark, groups, that were not direct-

ly engaged in energy production or part of the traditional system of political decisionmaking, became involved in attempts to change state energy policy from the early 1970s. Initially, the groups' acitivities centered on avoiding the extension/introduction of nuclear power, but after the oil crisis and for the rest of the 1970s, and that means after state energy policy was properly established, the environmental groups increasingly questioned the entire basis of state energy policy and put forward proposals for alternative strategies.

In Britain, a large number of local and ad hoc groups emerged in reaction to concrete nuclear developments. In Denmark, there were no nuclear developments to react to the resistance to nuclear power centered on preventing its introduction by appealing to the state. This explains the existence in Denmark of only one large popular movement against nuclear power.

As the groups in both countries were faced with demands for alternatives, they got increasingly involved in constructing alternative scenarios. In Britain, an increasing number of groups with different political starting points each developed their particular alternative which emphasized different dimensions of energy policy, but which were all presented as the solution to energy problems. In Denmark, the existence of a mass movement put constraints on the degree to which social and economic implications of different strategies could be specified. But in both countries, towards 1980, what started as resistance to nuclear power had developed into a search for for alternatives. The concrete proposals would all demand for their realization instruments of state control stretching far behind those of the present, but the groups have either played down this political point or argued that regard to the environment would justify an extension of public control of energy production as well as consumption.

3.6 Conclusions.

The main aim of the previous sections was to establish the chronological order in which new issues have surfaced within the energy policy perception of particular political groups. We also wanted to establish whether this chronology was parallel between Britain and Denmark. We wanted for each group to establish its priorities and identify possible shifts in priorities; and finally we wanted to investigate if the number and character of political groups involved in energy political activities had changed over the thirty years form 1950 to 1980.

We find that our account supports the hypothesis that a general politicization of the energy area has taken place in the period. We have furthermore been able to locate the beginning of this politicization to the years around 1970 in both countries. Before this time, only energy industries, trade unions and to a limited extent, governments took an interest in energy production, and as we have seen, planning activities were (seen with today's eyes) primitive and not subjected to discussions of objectives or alternatives. After 1970, the notion of a politically controlled rational energy planning has pervaded all discussions of energy issues. The increasing number of groups trying to actively influence state energy policy also indicates that energy policy, to an increasing fraction of the population, represented a means for changing undesirable conditions, like pollution or unemployment.

In addition, we find that the account supports our hypothesis that changes in energy policy have originated in response to pressure from political groups. This causal relation cannot be proved in a scientific sense, but we have established that the new issues of state energy policy were taken up by political groups prior to being incorporated in state energy policy. For example, working conditions only became an issue after trade union activities

had highlighted these problems, and the environment only became an issue after the emergence of an environmental movement, and employment only became an issue after trade unions and political parties connected to the labour movement had begun discussing the employment impacts of energy policy. Once these issues were introduced into the debate, they were soon adopted by all groups. Consequently, an increasing number of issues presented themselves as aspects of energy policy which had to be taken into account.

For each class of groups we sketched a periodization within the 1950-1980 period, the sub-periods being marked by a change in the range of issues considered by the group as important in relation to energy policy or a change in the methods used by the group for reaching its energy political objectives. For all groups, and in both countries, the 1950s was a quiet period. The 1960s showed a building up of industrial as well as national economic problems reflected by the trade unions and industries in concerns about the future. The emergence of these concerns, prior to the institutionalization of planning oriented state energy policy, leads us to suggest that state energy policy emerged as a response to these concerns.

The environmental concern of the early 1970s was reflected in the state energy policies of both countries, but did not appear in the energy thinking of the energy industries nor of the trade unions until the late half of the decade. This leads us to suggest that the introduction of environmental issues in state energy policy was prompted by the activities of environmental groups.

In both countries 1973/74 represented a considerable break in energy political activities. The events of those years had direct implications for the national economy and thus for government policies. They represented an economic

emergency for governments, and the resulting energy policies can therefore be interpreted as attempts to avert the most damaging consequences.

After 1976, an increasing number of political groups in both countries sought to influence the objective and methods of state energy policy. These groups all took it for granted that energy production and distribution should be subject, to some extent, to planning, control and monitoring by the state. Also it was taken for granted that technological choices could and should depend on some kind of evaluation of the future consequences of the technologies concerned. At the same time, the opinions of different groups as to which criteria should be adopted in energy decision-making diverged. The energy industries tended to emphasize the importance of efficiency and economies of scale, trade unions emphasized employment etc., and the development of issues within each class of groups was parallel between the two countries.

What remains to be explained now is why new issues arise. We have observed that energy has been policiticized in the sense that political groups have brought new issues into state policy, but where did these issues come from in the first place? Why did the environment become an important issue in relation to energy? Why did the general conception of the role of the state in relation to energy technology change from optimism about the benefits of autonomous technical progress to the notion that the state should control technological change so as to avoid negative effects of technology in the future?

In order to contribute an answer to these questions we shall have to investigate the remaining hypotheses put forward in chapter one. The following chapter will investigate whether changes in the economic and resource conditions can be shown to have had a decisive influence on the shifts just identified, whereas chapter five will

investigate changes in the perception of technology and political approaches to technological change.

NOTES TO CHAPTER 3

1. This identification was based on earlier work on Danish energy policy (Andersen (1981,1982) and on the description by Stott and Taylor (1980); Sandbach (1980); Pearson (1981); Ince (1982).

2. In Denmark the parliament (Folketinget) is elected through proportional representation with a minimum limit of 2% of all votes, while the British Parliament is elected through majority vote within constituencies.

3. All manifestos before 1974 are quoted from Craig (1975) who reprints in full all British general election manifestos from 1900 to 1974.

4. Labour (1951 I).

5. See Labour Party Conference Decisions of 1955, 1958, 1961, 1965. All Party conference decisions are reprinted in Craig (1982).

6. The Times 18/6/1955.

7. Although the amount of radiation discharged from peaceful uses of nuclear power was assessed as exceeding vastly the amount of radiation stemming from nuclear test-explosions, the Conservative government of 1955 was satisfied that no danger to human life resulted in either case (The Times, 22/5/1955).

8. Budge et al. (1983).

9. Conservative Party: Manifesto, October 1974.

10. The Labour Party (1980).

11. Cook (1981).

12. Conservative Party Conference (1980).

13. Conservative Party: Manifesto, 1979.

14. For example the 1979 Conference called for research into energy conservation and the development of sources "other than coal and oil".

15. The mention of fusion alongside renewable energy technologies is interesting, as fusion according to informed sources at the european JET project has only a marginal chance of ever being commercially viable. Furthermore, the use of fusion for electricity production would give rise to problems very similar to those associated with the use of nuclear fission (see e.g. Ramage, 1983, pp.174-179; a more thorough account of the state of the art in fusion is found in The JET Joint Undertaking. Luxembourg: ECSC/EEC/EURATOM, 1983.

16. At the time of writing (1985), 10 parties are represented.

17. Danish political parties issue the following types of policy statements:

    1) declarations of principles. These can be and are revised at different intervals by decision of the annual party congress.

    2) Programmes for action have approximately the same status as the conference decisions of the British parties.

    3) Election manifestos, which are often less elaborate than those of the British parties.

18. Most Danish parties hold an annual meeting, so called. In addition, party conferences are held with longer intervals (4 years for the Social Democratic Party). The annual meeting of the Conservative Party is called Landsrådet ('The National Council'). For an account in English of the organisation of Danish political parties, see Fitzmaurice (1981).

19. Venstre (1970).

20 Det Konservative Folkeparti (1970).

21. See e.g. P. Nyboe Andersen: De Økonomiske udsigter og den nødvendige politik. Liberal 1974 No. 415, pp. 20-24; E. Brøndum: Det er evnen til at give afkald, der er brug for. Liberal 1974 No.7, pp.24-30; H. Christophersen: Folketinget må sikre lønpause i det danske indkomstkapløb. Liberal 1974 No.8, pp.14-18; P. Nyboe Andersen: Danmark og Oliepengene. Liberal, 1974 No.8 pp. 22-27.

22. Christophersen, H. op.cit.

23. P. Hækkerup: Usikkerheden om energipolitikken må fjernes. Vor Politik, Oktober 1976, p.4.

24. Socialdemokratiet (1980 II).

25. 'Det nære samfund' covered intentions to decentralize decision-making in local communities. See e.g. Venstre (1977 I).

26. Venstre (1977 II).

27. Venstre (1978), p. 9.

28. Venstre (1978), p.44; Venstre (1979).

29. Venstre (1979).

30. Det Radikale Venstre (1980).

31. Det Konservative Folkeparti (1978).

32. A.L. Gotfredsen: En aktiv energipolitik skal sikre velfærdssamfundet. Vor Tid, 1979, No.3.

33. Det Konservative Folkeparti (1981).

34. See Reid and Allen (1970), p. 82 f.

35. See The Electricity Council (1982), p. 47.

36. See The Electricity Council (1958), p. 16.

37. Op.cit.

38. For a detailed account on this incident, see Patterson (1976),p. 162 ff.

39. United Kingdom Atomic Energy Authority (1979 II).

40. UKAEA Report & Accounts 1958/59.

41. See e.g. The Electricity Council (1963 I, 1963 II, 1963 III, 1963 IV, 1964 II, 1965 I); Electricity Supply 1963/64-.

42. See The Electricity Council (1966 III).

43. The forecasting procedure of the 60s consisted of the following steps:

    1) Forecasts were made at different levels of the organisation:

    - The Electricity Council calculated future demand on the target growth rate and an assumption of the relationship between economic growth and energy demand of the type

$$\frac{E}{E} = a \frac{GNP}{GNP}$$

      where E is a measure of electricity demand;

    - The area boards prepared local forecasts based on population trends, which are then added up to a national estimate;

    - The CEGB prepared a 6-8 years trend forecast consisting of a projection of past trends in electricity consumption.

    2) The Electricity Council finally adopted the forecast showing the highest demand by the end of the six year period. (The Electricity Council, 1963, II).

44. Ince (1982) shows (p.150 f.) that since the early 1960s the industry's plans have consistently overestimated actual demand with on average 31%.

45. The planning margin was increased from 7% in the 1950s to 17% by 1970 (Reid & Allen, 1970).

46. See The Electricity Council (1966 II).

47. See Power Progress 1967/68.

48. Both pictures and text suggested a connection between welfare,

electricity and modernity: in the language of advertisement the electricity industry appealed to people's sense of fashion as well as their dreams of a materially secure and comfortable life. For example Electricity was prescribed as "Power for Prosperity" (The Electricity Council, 1964) or simply "Electricity - the Future" (The Electricity Council 1966). It was suggested that electricity fulfilled desires for comfort and labour saving devices (The Electricity Council, 1964), and this was even taken to the conclusion, that people had a latent desire for the benefits of electricity (The Electricity Council, 1965).

49. The Electricity Council (1966 I).

50. Power Progress (1969/70).

51. See e.g. UKEAE Report & Accounts 1971/72 where public concern about energy was identified as the result of anxiety about nuclear power coupled with reactions to the increasing prices of traditional fuels.

52. Arguments along these lines first appeared in Power Progress 1967/68.

53. UKAEA Report & Accounts 1972/73.

54. See e.g. Power Progress 1962/63.

55. An example: From 1971 onwards, the UKAEA report came in colour, and the number of photographs was increased. Before 1971, the number of photographs in an issue varied stably between seven and eight; by 1980/81 the number had increased to 42, thus signalling efforts to reach a larger public.

56. See Pearson (1981).

57. This is the title of a series of leaflets published by the CEGB in 1981.

58. These facts were numerical statistics on all aspects of nuclear power: on waste generated (UKAEA Report & Accounts 1973/74 and all following years), on deaths from radiation compared to deaths from road accidents ('The facts about nuclear energy' 1982, and 'Nuclear Facts', 1983, both UKAEA leaflets).

59. See CEGB (1981 IV).

60. The structure of supply and consumption is dealt with in chapter 4.

61. See Electricitetsrådet 1907-1982.

62. Dansk Elværksstatistik 1953/54-.

63. Atomernes hvem-hvad-hvor, (1974) p. 346.

64. Danske Elværkers Forening 1972/73-.

65. Op.cit. p.4.

66. ELSAM (1972).

67. Danske Elværkers Forening 1972/73,p.4.

68. The original proposal implied that concessions for electricity production could be repealed by the Minister; that all undertakings were to obtain concession (in the final version of the Act only electricity producers, and not distributors, were required to obtain a concession). Furthermore the proposal empowered the Minister to interfere directly in supply by e.g. ordering mergers between companies or altering the number and size of supply region.

69. Danske Elværkers Forening 1973/74, 1974/75.

70. See e.g. ELSAM (1975).

71. See Atomenergikommissionen (1975).

72. See ELKRAFT (1979) p.3.

73. Op.cit., p.4.

74. See ELKRAFT (N.D.).

75. The wind research programme was initiated by the Ministry in 1977.

76. See ELKRAFT (N.D.); Danske Elværkers Forening 1978 f.

77. DANATOM (1980).

78. Danske Elværkers Forening (1979).

79. Statement of NUM Conference, cited in The Times, 7 July 1955.

80. See Reid and Allen (1970) p. 88 ff.

81. Policy statement by the TUC in Energy Paper No.6, 1976.

82. Energy Paper No.6.

83. See Pearson (1981), p. 156.

84. Trades Union Congress (1981).

85. Op. cit. p. 123.

86. LO Bladet Vol. 70, No.3, 6/2/1974, p.2.

87. LO Bladet Vol. 71, No.11, p.4.

88. Dansk Metalarbejderforbund (1978).

89. Fagforeningernes Udtalelser om A-kraft og energipolitik i 1979. Working paper for a conference arranged by the OOA. The paper shows the frequency of different arguments against nuclear power as well as alternative recommendations in trade union resolutions of 1979.

90. Landsorganisationen (1980).

91. Pearson (1981); Ince (1982); Andersen (1982).

92. See Lowe and Goyder (1983) p. 37.

93. Friends of the Earth was formed in Britain in 1971, while there is some disagreement between the sources as to whether the international organisation originated in 1969 or 1970. The original founder was David Brower, a former member of the Sierra Club. See Lowe and Goyder (1983) p. 124 ff. for an exhaustive description of the organisation.

94. Friends of the Earth (1972).

95. Friends of the Earth suggested that national energy boards should be created to plan energy supply and ensure that environmental impact was minimized in the siting of energy producing facilities. But the organisation admitted that this was not sufficient, as economic growth would inevitably lead to growth in energy consumption. Therefore, global collaboration was needed to achieve a stable, zero growth economy.

96. According to a personal interview 21 February 1984 with Walter Patterson, co-founder of Friends of the Earth and Renee Chudleigh, Frieds of the Earth energy campaign organizer.

97. See Friends of the Earth Information Sheet: Achievements, 1980.

98. Again according to interview with Walter Patterson, op.cit.

99. Friends of the Earth Information Sheet: History, 1980.

100. See Lowe and Goyder (1983), pp. 72-73.

101. See Flood (1979) p.39.

102. The proposed thermal oxide reprocessing plant as well as reprocessing in general is described by Patterson (1976) pp. 100-114 and Wynne (1982) pp. 34-51.

103. Stott and Taylor (1980) have analysed the relationship between the groups participating in the Windscale Inquiry and found that the groups drew closer together as the inquiry progressed and "the realisation that they were all engaged in a common cause became clearer" (p.37).

104. See e.g. Flood (1979) for an example of 'proving' the industry's consequence analyses wrong.

105. This term was originally used by Lovins (1977) but was adopted by e.g. Friends of the Earth in Nuclear Times (1978).

106. Friends of the Earth (1978) p.11.

107. See Taylor and Sanderson (1983) for a review of the most important alternative energy strategy documents.

108. See The Ecology Party (1981).

109. Energy Policy and Public Inquiries (TCPA policy statement). Town & Country Planning, May 1978, pp. 266-271.

110. See Andersen (1982), p. 124.

111. Op.cit., p.50 f.

112. Blegaa et.al. (1976).

4. ECONOMICS, RESOURCES, ENERGY SUPPLY AND CONSUMPTION

4.1 Introduction

In chapter two and three we saw that issues raised by political groups were reflected in state energy policy. This led us to ask why new issues were originally taken up in relation to energy. What is the origin of changes which for example make political groups look for new sources of energy, make second order consequences of energy technologies an important issue, and why do these changes occur at particular points in time?

The preliminary hypotheses suggest that the material conditions which at any point in time face individual consumers, political groups and state energy policy makers influence crucially the scope for energy political ideas and actions. In order to investigate this suggestion, we shall need to specify what we are to understand by material conditions. We shall suggest that economic conditions, conditions relating to resource availability, energy consumption structures and energy supply structures all represent important determinants in defining the scope of state energy policy as well as the scope of proposals for changing the state energy policy.

The previous chapter indicated that the energy policy recommendations of political groups always involved assumptions about economic growth. Either an expected future rate of economic growth was thought to lead to a particular size of energy demand, or regulation of energy demand was seen as a means to control future economic growth. In either case, we would expect that changes in these assumptions reflect changes in the actual economic conditions. In addition, the economic conditions represent a potential constraint on any energy political strategy insofar as they determine the spending power of the single energy

consumer as well as the investment conditions in the energy sector. We will therefore expect to be able to show that changes in the groups' assumptions about economic growth have been preceded by actual changes in the national economy.

The availability of energy resources presents itself as an almost self-evident constraint on the scope for energy policy. It is well worth noting, however, that resource availability is a relative concept, as Elster observes:

> "Resources are given in some absolute sense, but not in the more interesting sense of available resources, availability depending upon extraction technology. And technology, in turn, obviously is not given, but subject to constant changes." (Elster, 1979, p. 379).

We will now go a step further than Elster and suggest that resource availability not only depends on the development of technologies which change constantly. We want to suggest that new resources are considered only if the use of traditional resources create problems, either by the resource being insufficient, too expensive or by creating negative external effects. Particularly we want to suggest that new resources are utilized if their use gives rise to immediate economic advantages for the consumer, either the individual consumer or the energy industries. If this is not the case, the introduction of a new resource demands state support.

It is therefore to be expected that resource availability in itself only represents a limited constraint on energy policy. We expect, however, that the effects of using particular resources as well as the expected relative profitability of different resources represent an important set of constraints.

Furthermore we suggest that the structure of energy supply and consumption at any point in time represents an

important constraint on the scope for changes. The physical structure of energy supply, power stations, power lines and pipelines, is assumed to specify to a certain extent the flexibility of the system for example, we saw in the previous chapter that the energy industries in both countries preferred technologies which were compatible with the existing supply system. We shall suggest, however, that this type of constraint is not and has not been absolute, but is itself subject to changes in economic conditions, i.e. changes in fuel prices, in rates of consumption growth and in available technology. Only in the short term, we shall suggest, does the structure of energy supply represent a constraint influencing the short-term profitability of different technological and fuel options. Over the 1950-1980 period, we will therefore expect to find that the energy supply structures of Britain and Denmark has changed according to economic changes and that attempts to change the structures have been successful to the extent that they have been able to utilize economic mechanisms favouring the desired outcomes.

Finally it is suggested that the structure of energy consumption represents a short term constraint on energy policy. We suggest that the level of energy consumption depends on the price of energy relative to the income of the consumer as well as the expected levels of prices and wages and the consumption in the previous period. The structure of consumption, i.e. which forms of energy are used for which purposes, depends on the availability of supply options, but also on the prices of different options. We therefore suggest that the success of attempts to change the energy system depends on whether the economic conditions are favourable to the particular changes or can be manipulated so as to favour these changes.

Following these considerations, it is suggested that economic circumstances in general and fuel and energy prices in particular represent the ultimate constraint to at-

tempts to shape the future system of energy supply and consumption. The parallel development of energy policy in the two countries would then be accounted for by a parallel development of basic economic conditions, while the differences could be ascribed to differences regarding resource availability as well as different energy supply and consumption patterns.

In order to examine these suggestions, we shall analyse for each nation the historical development of each of three factors: basic economic conditions, resource conditions and patterns of energy supply and consumption. We shall identify important changes in each of these conditions and relate them to the changes we have identified in the previous chapters.

As indicators of basic economic conditions, economic growth, real income and employment have been chosen, as they have been assumed to be relevant to energy production and consumption. Changes in these parameters have been identified for both countries using textbooks on economic policy.

The availability of resources is described in terms of the actual utilization of resources. We are aware that this method does not give a full picture of the opportunities presenting themselves to decisionmakers, as these include also estimated reserves. There is, however, no material that would allow for a direct comparison of estimated resources between the two countries. Furthermore we have already seen that these estimates do not merely differ over time, but that different groups in society cite different estimates of future resource availability.

Energy supply and consumption will be described in terms of changes in patterns of production and end use as well as energy prices, both fuel prices and end-use energy prices.

In order to enable comparison between Denmark and Britain, the analysis has been split into two sections, each describing the trends for each of the countries.

The long period and the demand for comparability of data between countries have posed great difficulties in finding suitable data. Whereas the local statistical publications of each country are often very detailed, differences in the data collection methods, the nomenclature and the units used means that direct comparison between these data is not possible. International statistics, in contrast, while providing for direct comparison and consistency of method over long periods, are often less detailed than would be wanted. As a consequence of our emphasis on comparability between countries and consistence of method over the whole period, we have used international statistical surveys as the basic material and supplied local statistics only to highlight specific points. A major problem has been the absence of time series on relative prices of fuels and energy as well as on distribution among different types of consumers of end use energy. Whereas this supports the suggestion that energy consumption was not regarded a problem until the mid-1970s, it means that the account of the development of energy prices and consumptions patterns has to be supported by data which are not immediately comparable between the two countries and across the whole period.

4.2 Britain

In the following sections we shall investigate changes in the specific British conditions with respect to economics, resources and energy supply and consumption.

The economy.[1]

At the beginning of the 1950s, the Western European economies were still plagued by the repercussions of World War Two. Britain had experienced severe shortages, especially with respect to fuel supply. Hence, from the early 1950s, economic policies aimed at re-establishing economic growth. Keynesian management was adopted by the Labour government and was employed by the Conservative governments all through the 1950s. Unemployment was small seen with today's eyes: 1.4% on average during the 1950s; and inflation ranged between 0.6 and 4.5% p.a.[2] Upholding economic growth without increasing inflation and trade deficits became a still more persistent problem to which Keynesian management did not seem to provide the answer, and in 1961 the Conservative government launched a limited form of planning in shape of the National Economic Development Council ('Neddy')[3], which comprised members of government, industry and the unions and whose main function it was to identify obstacles to faster growth and recommend measures for removing them. This approach is parallel to the contemporary approach towards energy as identified in chapter two: the overall objective was economic growth, and state activities were geared towards removing possible obstacles. In the energy sector, as we have seen, the 'energy gap' represented one such possible obstacle, which was sought to be averted by financial support for the development of nuclear power which were thought to provide the scope for almost unlimited growth.

During the early 1960s, these trends continued: unemployment was low, inflation more fluctuating. But by the mid-1960s, the national economy was causing severe problems. Economic growth was only upheld at the expense of a growing balance of payment deficit, and sterling was, according to Budge et.al. (1983) "clearly overvalued". In this situation the Labour government successively applied different economic policies. Attempts to establish long-term

comprehensive economic planning through a newly created Department of Economic Affairs were given up against the background of a currency crisis, and instead ad hoc policies based in Keynesian ideas were adopted. A devaluation of the pound in 1967 only served to ease problems for a while. It is against this background that we get the first energy policy statements (see chapter two, p. 14 f.) which aimed at ensuring cheap energy for future expansion. The energy policies of this period may be interpreted as just one dimension of government attempts to tackle increasing national economic problems.

By the time of the oil crisis, inflation had reached 9.2%, and the policies for economic expansion of a Conservative government had aggravated problems. The increase in oil prices added to inflation and trade deficits:

> "Energy, and oil in particular, now assumed macroeconomic significance through its effects in inflation, unemployment, the balance of payments, and the value of sterling, but the high priority attached to developing the North Sea resources offered the hope that the acute balance-of-payments difficulties would be temporary." (Cheshire et.al., 1977, p.48).

It was increasingly clear that the assumptions behind Keynesian management did not hold: unemployment as well as inflation were simultaneously increasing, and increasing public expenditure (which was at almost 50% of GNP in 1975 (Budge et al. (1983)) did not solve the problems. In this period energy policy was intensified, initially as a means of fending off the immediate problems raised simultaneously by the threatened fuel shortage and the balance of payments and inflation problems accompanying the oil crisis.

As the 1970s wore on, it became clear that the problems in the economy were of a more persistent kind. In attempts to ease the situation, a new direction of economic policy was tried out, first by Labour governments, later (after 1979)

by the Conservative government. Incomes policy and cuts in public spending, it was thought, would keep down inflation. Budge et.al. (1983) observe that "the very idea of using public sector spending as the major instrument of economic policy was new". (p.13). At the same time, as we saw in chapter two, the number of uncertainties related to energy grew, and increasing attempts were made at establishing the consequences of different energy strategies.

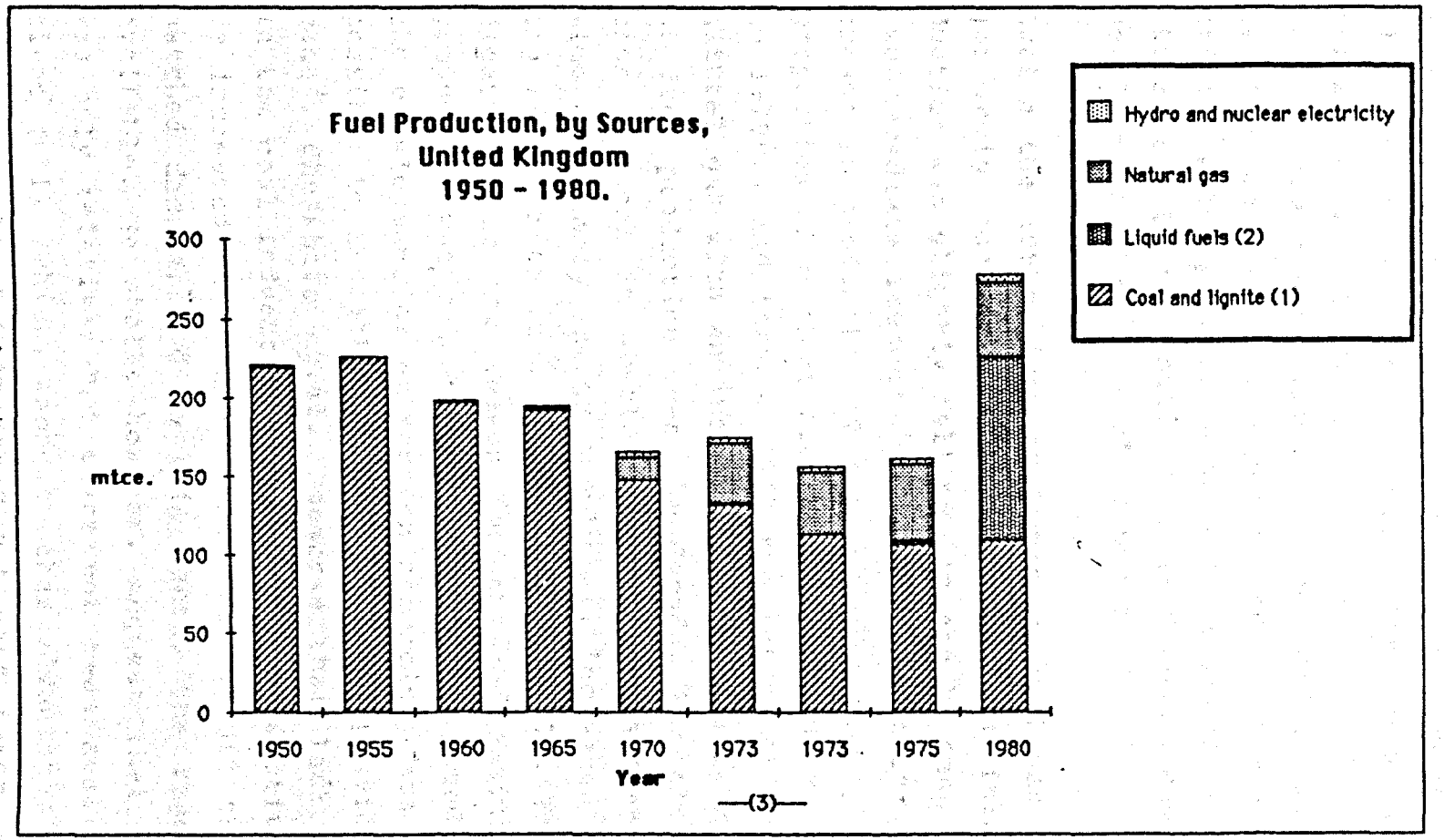
This brief account indicates that the changes in energy policy were preceded by changes in the national economic conditions, particularly the expectations for economic growth and the immediate fiscal problems facing governments. The following sections will investigate the relation between these macro-changes and changes in resource conditions and conditions related to supply and consumption of energy.

Resources.

Traditionally, Britain has relied heavily on coal for its energy supply. But having said this, it can be noted that the use of energy resources in the British fuel supply has fluctuated considerably. Chesshire et.al. in an attempt to arrive at a periodization of energy policy since the Second World War, characterizes the periods by the resource conditions seen to prevail in each period: 'Post-war shortage' from 1945 to 1956 'The oil glut' from 1957 to 1967. Whereas we find these titles inappropriate as characteristics of energy policy, they indicate trends in resource use, which are confirmed if we look closer at primary energy production cf. fig. 4.1

As can be seen from the figure, British energy production declined from the mid-1950s until 1973, and rose again after that. The figures for the single fuels shows more

Fig. 4.1



(1) No lignite was produced in the UK during this period.
(2) Crude petroleum plus liquefied natural gas.
(3) Conversion factors used in the 1983 survey differ from those used in the 1976 survey. For example, the calorific value of 1 tonnes of coal irrespective of origin was set at 1mtce in 1976, but at less than 1 mtce (d (depending on origin) in 1983.

Sources: United Nations, Department of Economics and Social Affairs: World Energy Supplies 1950-1974. New York: United Nations, 1976; ibid.: Yearbook of World Energy Statistics. New York, 1983.

clearly the development beneath the overall changes.

During the 1950s, coal dominated British fuel production totally, and indeed about 90% of primary fuel supply (the total amount of fuel at disposal after imports have been added and exports subtracted), was supplied by coal[4]. In all, fuel imports (mainly oil) came to about 12% of 1950 primary fuel supply. Other sources played only a marginal role in the energy supply of the 1950s. Out of the 0.8-2 per thousand of energy production which was primary electricity[5], the proportion of nuclear power rose through the 1950s from 0% to about 35% in 1960 as a consequence of the development of civil nuclear power.

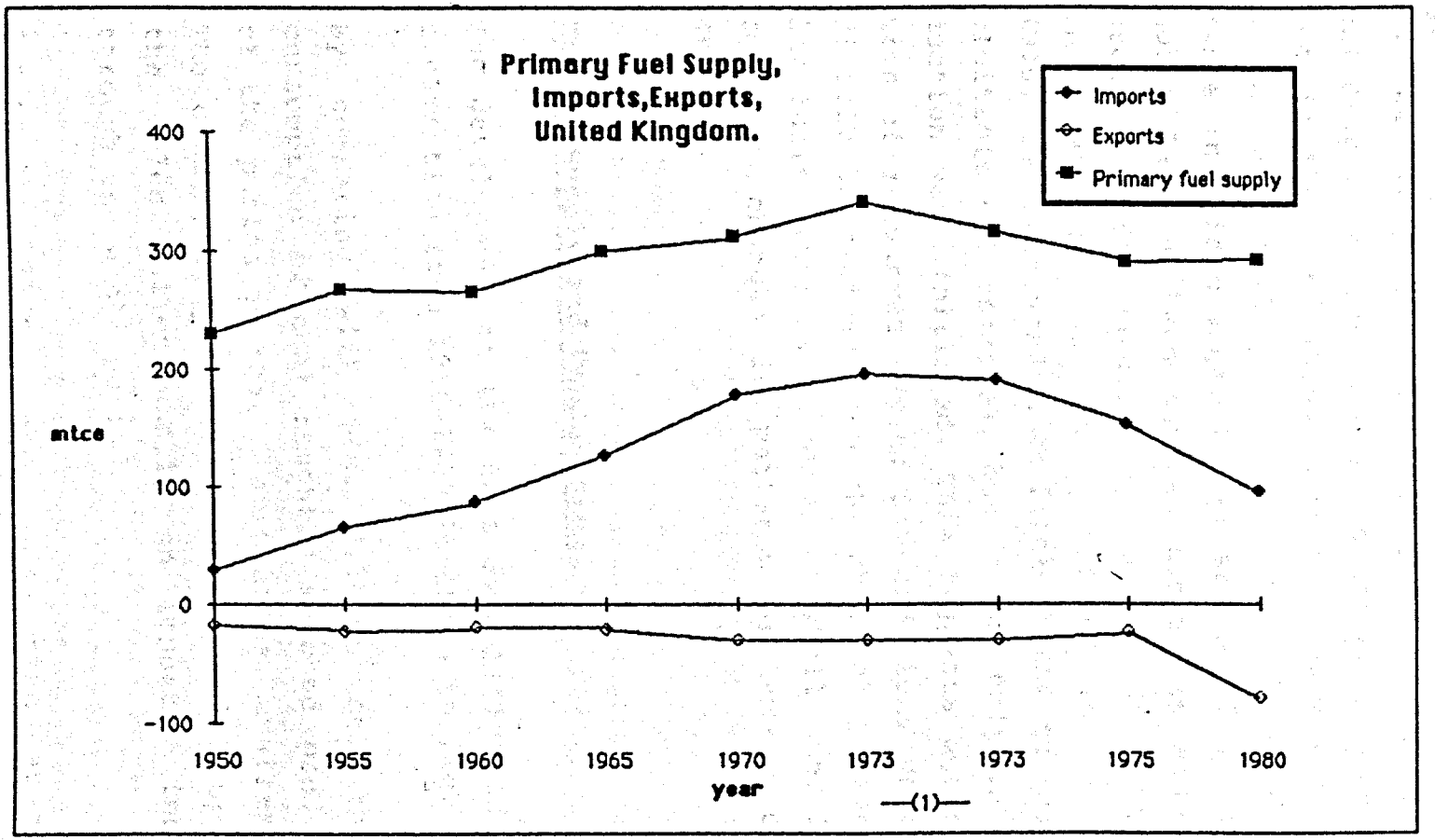
During the 1960s, however, whereas coal was still the major indigenous source its proportion of inland fuel production was slightly falling. As can be seen from fig. 4.1 two immediate reasons accounted for this: a steady increase in production of primary electricity (of which the proportion of nuclear electricity was increasing up to 78% in 1970[6]), and towards 1970 the introduction of North Sea natural gas with an increase from 0.5 per thousand to 9% of fuel production over the decade. But also the production of coal in absolute terms was falling at the same time as primary energy supply was increased by a staggering 18% over the decade from 1960 to 1970. There is no indication that the reason for the decreasing inland fuel production was a physical lack of coal, and if anything, the development of extraction technology meant that it was possible to extract more coal than had previously been the case[7]. Chesshire et.al. observe that lack of investment in the coal industry had meant that productivity could not be increased at a rate which would ensure that production matched demand, and in this sense, the resource was not available. We shall, however, suggest that this obstacle was only relative: had there not been available alternatives (oil) which, amongst other advantages over coal was cheaper, substitution would not have taken place. In the

next section we shall seek to substantiate this assertion by analysing the changes in patterns of energy supply and consumption; for the present we shall limit ourselves to observe that the analysis at this point seems to support the assumption that resource conditions in an absolute or physical sense contributes only in a limited way to an understanding of changes in the composition of a country's fuel supply.

Hence, an analysis of indigenous energy production is not sufficient to understand the changes. Looking instead at the primary fuel supply enables us to assess the implications of energy consumption for foreign trade. Fig. 4.2 shows the composition of primary fuel supply over the whole 1950-1980 period.

The figure shows that during the 1960s up to 1973 imported fuel achieved an increasing significance in British fuel supply, and as we shall see the majority of these imports consisted of oil and oil products. This resource had become 'available' but again not just in the simple sense of the word. Besides being physicially available, for the resource to actually be utilized, additional conditions had to be present. These conditions will be investigated in the following section. For now, we may observe that this introduction of oil as a major element in the British fuel supply was not the result of a planned development intended at producing this result. As we saw in chapter two, the energy policies of the 1950s and early 1960s aimed at increasing energy supply primarily by supporting the expansion of nuclear power and by promoting efficiency in the coal industry, whereas oil imports were not an element in this strategy. Whereas the proportion of nuclear power in primary fuel supply grew from about 3‰ in 1960 to about 3% in 1970[8], it is beyond doubt that the (unintended) increase during the same period of the proportion of oil from 25% to 46%[9] was of greater consequence for the development in the years to follow.

Fig. 4.2



(1) See fig. 4.1, note (3).

Sources: United Nations, Department of Economics and Social Affairs: World Energy Supplies 1950-1974. New York: United Nations, 1976; ibid.: Yearbook of World Energy Statistics. New York, 1983.

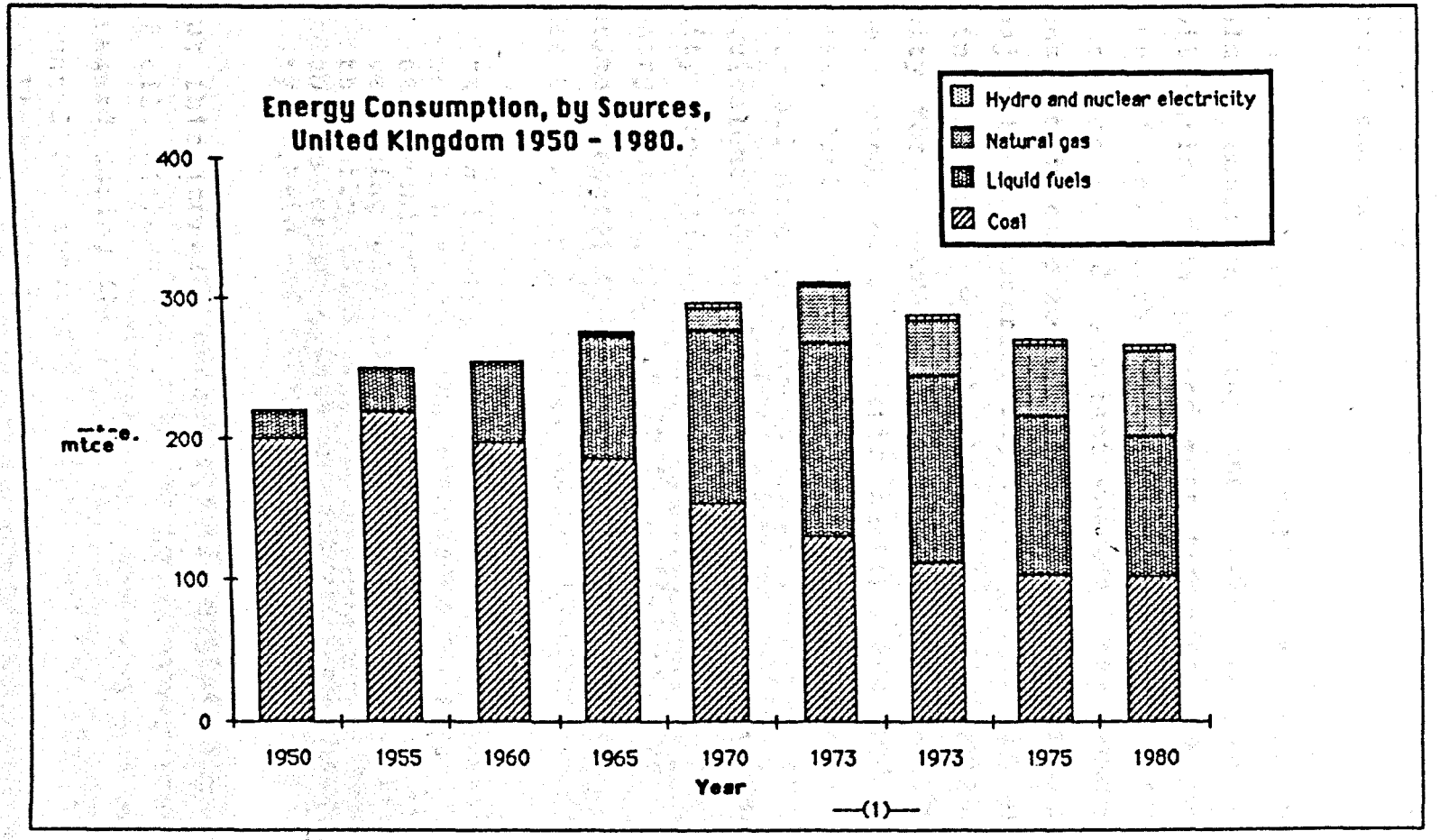
Looking again at fig. 4.1, we observe that after 1973 the composition of British fuel production changed dramatically. Firstly, inland fuel production which had been steadily decreasing started an upturn. At the same time, the relative importance of coal production kept falling. The growth in production is accounted for by a steady increase in the production of natural gas and -mainly - by the build-up of an indigenous production of oil from the North Sea in the late 1970s. Again we must point out that resource availability seems to have been of little importance in this change. The existence of oil reserves in the North Sea had been assumed since the mid-1960s, when BP prospected for natural gas, but at that time recovery of this resource was not considered to be worthwhile. In 1970, BP announced the first finds of commercially exploitable oil reserves, but it was only in 1975 that production was initiated. This suggests again that utilization of resources depend on conditions which cannot immediately be derived from the physical presence of particular fuels within a country. We shall therefore proceed to consider changes in patterns of energy consumption and suppply.

Energy Supply and Consumption

The development of the fuel composition of British energy consumption from 1950-1980 is shown in fig. 4.3

By comparing with fig. 4.1 we see that the inland consumption of coal roughtly matched production for most of the period so that a surplus was available for bunkers. The consumption of oil, however, which up to the end of the 1970s relied wholly on imports, increased rapidly through the whole period.

During the 1950s, energy consumption per capita increased by about 12%. This is a growth of only about 1% p.a. or



(1) See fig. 4.1, note (3).

Sources: United Nations, Department of Economics and Social Affairs: World Energy Supplies 1950-1974. New York: United Nations, 1976; ibid.: Yearbook of World Energy Statistics. New York, 1983.

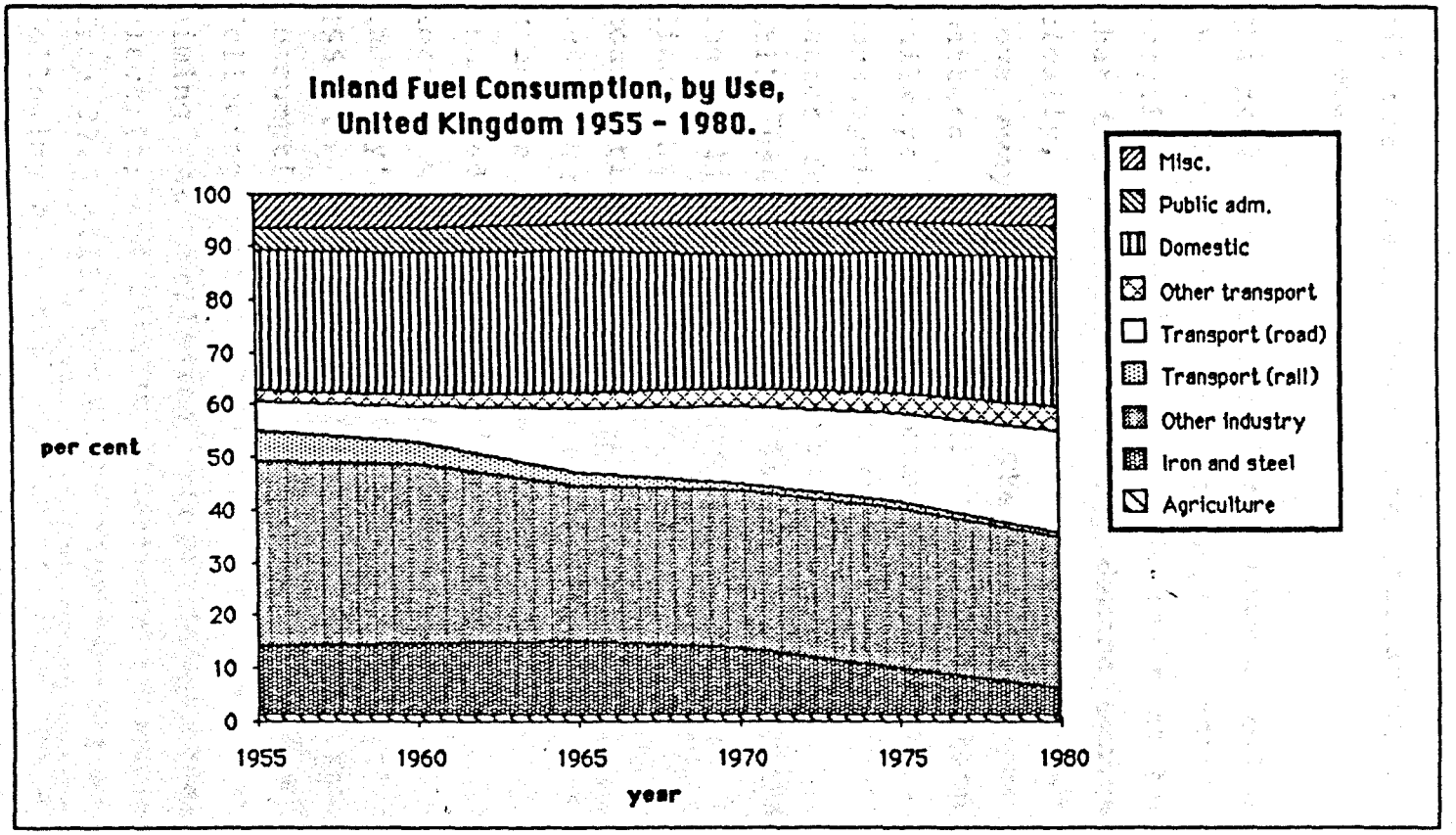
very much below the growth rates which were expected for the period. In contrast, the average annual growth in oil consumption was 11%. In order to explain these trends we shall have to look into the purposes for which different fuels were used to see if changes in the patterns of energy consumption have supported an increasing oil consumption. Fig. 4.4 shows the changing distribution of fuels among end uses.

The figure shows that the pattern of fuel consumption was almost constant during the 1950s. The increasing use of oil during this period must therefore be due to replacement of coal with oil within the single groups of consumers, or to a development whereby the growth in energy consumption came mainly from a growth in oil consumption. A major factor contributing to increased oil consumption during the 1950s was the increasing consumption of electricity for a number of purposes where coal had previously been used, e.g. domestic heating and industrial processess. During the 1950s, electricity consumption increased from 6.1 mtce in 1959 to about 12.2 mtce in 1959. This is equivalent to an increase in fuel consumption in electricity production from 28.4 mtce or approx. 13% of primary energy consumption in 1950 to 44.4 mtce or approx. 17% of primary energy consumption in 1959[10]. About the background for this sharp increase, Reid and Allen observe:

> "Rising incomes and the growing popularity of domestic central heating, the advantages of electricity in terms of cleanliness, convenience and flexibility, good advertising plus the lack of competition from gas tup to the early 1960s, are all factors which have contributed to the rapid growth of domestic demand for electricity." (Reid and Allen, 1970, p. 16).

But this increase does not fully explain the increased use of oil. Although the use of oil in power stations was increased during the 1950s, by 1959 coal and coke still accounted for about 86% of fuel used for electricity generation[11]. We shall therefore have to look for other

Fig. 4.4



(1) The survey of 1965 includes fuel for collieries and refineries in net energy consumption.

Source: Central Statistical Office: Annual Abstract of Statistics. London: H.M.S.O.,, 1965, 1970, 1982.

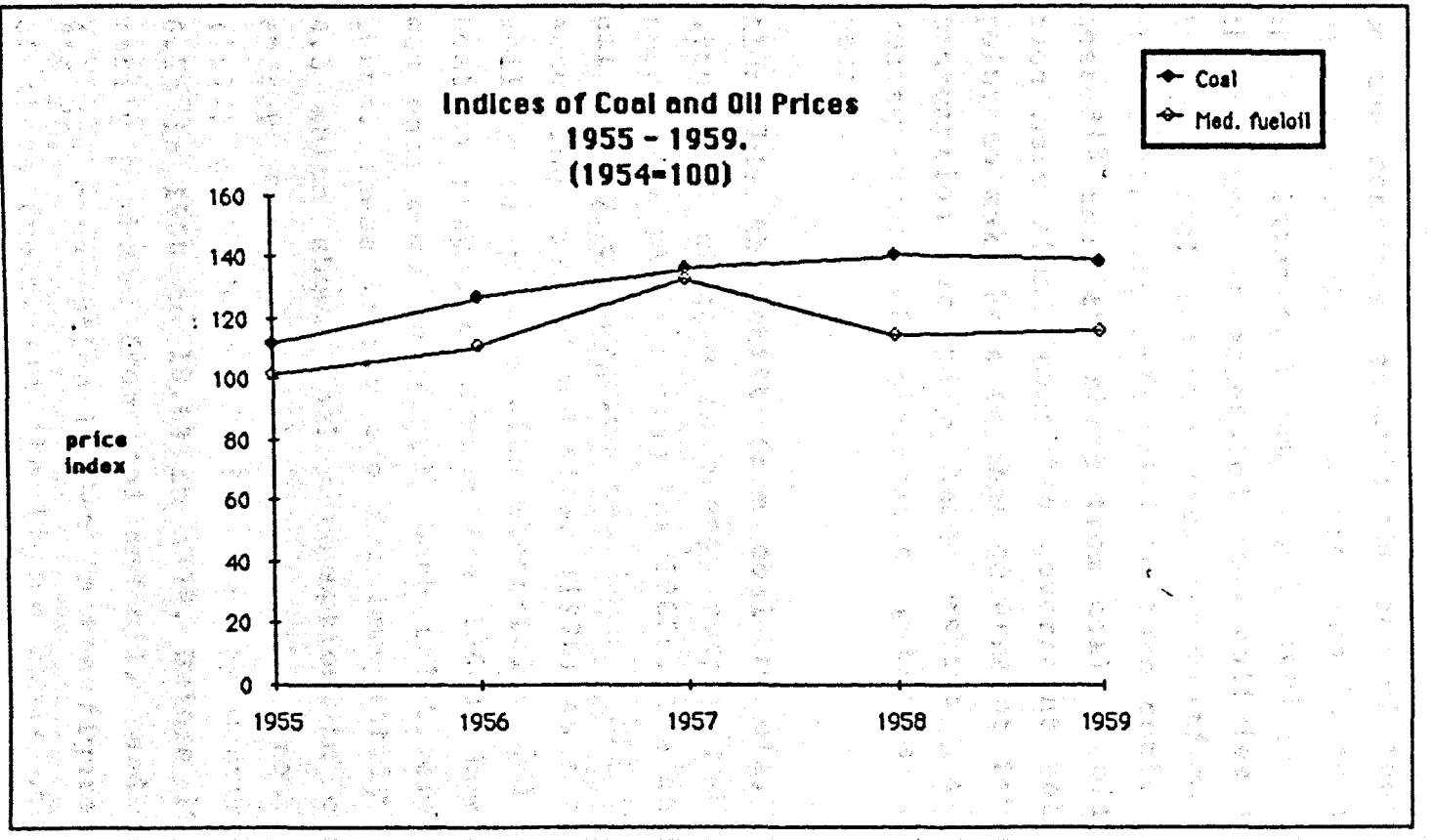
factors.

Fig. 4.5 shows the development of coal and oil prices from 1955 to 1959.

Whereas coal prices kept rising throughout the 1950s, the rise in oil prices were relatively smaller. This means that, in addition to the advantages in handling etc. of oil over coal, there were increasing economic incentives to prefer oil.

The move away from coal and towards oil accelerated during the 1960s, where oil consumption actually overtook consumption of coal. If we look again at fig. 4.4, we notice that the pattern of energy demand changed, if not dramatically, then at least in a direction which supported the move away from coal. The major changes occurred in the pattern of transport. The consumption of energy for railways and water transport decreased, whereas energy consumption for road and air transport increased. The latter forms of transport use oil, whereas the railrods still used coal to a large extent by 1960. If we analyse the decline in the consumption of coal in more detail we find that in all markets save electricity production, consumption of coal fell drastically between 1957 and 1967. Whereas the large decrease in the use of coal for domestic heating was to a certain extent offset by increased use of coal for electricity production, other losses were absolute, like the decrease in the gas industry's consumption of coal from 26.4 mill. tonnes in 1957 to 14.4 mill. tonnes in 1967, and the decrease in consumption for rail transport of 10.6 mill. tonnes a year following government's railway modernization plan of 1955 aiming at replacing steam locomotives by diesel or electric; and finally a decrease in industrial consumption from 37.5 mill. tonnes in 1957 to 20.1 mill tonnes in 1967 following a general switch to oil, gas and electricity in industries.

Fig. 4.5



Source: Central Statistical Office: Annual Abstract of Statistics 1960. London: H.M.S.O.

Whereas some of the components of the shift from coal to oil were planned, like e.g. the railway modernization programme, the most important factors, like the industrial users' switch to oil, were not planned at a national level, and the overall result, a massive increase in oil consumption at the expense of coal, was not intended nor foreseen.

On the contrary, towards the end of the 1960s the result was increasingly seen as problematic as the stagnation of the coal industry became a political problem. As we saw in chapter two, it generated new policies aimed at protecting the coal industry from competition, e.g. by forcing the electricity industries to burn coal. It has been suggested[13] that the shift from coal to oil would have been even more significant had government not intervened. The point to make here is that government intervention in fuel consumption was to a large extent a reaction to the consequences of government policies of the previous period.

Alongside the shift from coal to oil, less spectacular structural changes in energy supply and consumption patterns took place during the 1960s. The share of gas in final energy consumption had been declining in the 1950s, according to Reid and Allen (1970) as a consequence of inability to compete with electricity and oil for domestic heating purposes. During the 1960s, however, the use of gas once more increased, both relatively and in absolute terms. These trends are not immediately apparent in fig. 4.3 which shows fuel consumption in contrast to final energy consumption but according to Chesshire et.al. (1977) gas' share of final energy consumption rose from 6.3% in 1960 to 10.6% in 1970. Before 1968, gas was primarily produced from coal and oil, and therefore in fig. 4.3 gas consumption hidden in the figures for consumption of these fuels. But the figure shows at least one factor contributing to the increase in gas consumption: the

consumption of natural gas increased. The cost of natural gas was considerably below that of town gas and competitive with oil and coal[14]. This made gas an interesting option particularly for bulk consumers, primarily industries which used fuels to generate crude heat, and for whom the fuel cost was high as compared to the capital cost of switching from one fuel to the other.

The development of the gas markets supports this assumption. Since the introduction of natural gas, the industrial market has accounted for a rapidly increasing percentage of gas sales, so that the proportion of natural gas sales for industry rose from 24% in 1967 to 54% in 1975[15].

These changes in energy consumption during the 1960s were accompanied by changes in the structure of energy supply. Electricity production underwent a significant centralization during the 1950s and 1960s. Table 4.1 shows the change in number of stations and the total installed capacity from 1950 to 1980.

Table 4.1 Electricity Production: Number of Stations and Capacity, United Kingdom 1950-1981.

Year	1950	1960	1970	1981
Number of stations	274	234	193	108
Maximum output capacity GW	11.5	25.5	46.9	55.2
Average output capacity/station	41.9	107.7	350.7	511.1

Sources: Power Progress, various years; Central Electricity Generating Board (1983).

The table shows a simultaneos fall in the number of power stations and an increase in the capacity per station. A significant factor here was the introduction of nuclear stations with an theoretical output capacity of 600 MW per reactor. At the same time, however, the difference between the installed capacity and the actual availability of plant has increased, so that, overall, the excess capacity over demand increased[16]. It is difficult to assess the relative importance of this loss of efficiency against the gains in efficiency resulting from large scale generation, as the result crucially depends on the methodology, and involves the question of to whom to ascribe the costs of different supply structures: to the industry, to the single consumer or to the nation? It is beyond doubt, however, that to the electricitry industry, the advantages of centralization have been obvious, and during the 1950s and 1960s, the industry planned for continued centralization. Therefore, the development of a centralized electricity supply structure represents yet another event which is a result of policies which were in the 1950s and 1960s rational solutions to the existing problems, (lack of efficiency and capacity) but which, under different economic and political circumstances, have come to be interpreted as negative. Whereas the modern electricity plants are still able to produce energy in large quantities, they are not very efficient in terms of energy conversion, which has led a number of groups particularly environmental groups to conclude, that electricity for a number of purposes, e.g. heating, is not a suitable form for energy.

The altered patterns of supply and consumption taken together imposed a new set of constraints on the scope for future energy strategies. The increased use of a collective energy supply system for electricity and gas meant for the single consumer increasing reliance on supply industries. Also increasing electricity consumption implied that choice of fuel, instead of being made by single consumers, was increasingly decided at a higher level within

the industry and ultimately by government. This cleared the path for political debate on the relative advantages of different energy sources and methods of production.

After 1973 the rise in total energy consumption was succeeded by an abrupt fall. The prices of oil products rose sharply after the oil crisis, and the biggest increase was in fuel oil. The changes in the prices of oil products are shown in table 4.2

Table 4.2 Prices of oil products. United Kingdom 1971-1980. $ per gallon.

UNITED KINGDOM	1971	1974	1976	1979	1980
Premium gasolene 97 RON	0.69	1.30	1.27	2.19	2.65
Regular gasolene 90 RON	0.65	1.25	1.25	2.16	2.60
Auto diesel fuel	..	..	..	2.26	2.72
Household kerosene	0.27	0.62	0.55	1.01	1.37
Distillate fuel oil	..	..	0.56	..	..
Motor lubricating oil	1.80	4.80	3.52	4.86	..
Bunker "c" fuel oil	4.61	15.12	16.01	23.37	..

Source: United Nations, Department of Economics and Social Affairs: Yearbook of World Energy Statistics. New York, 1983.

These changes were in turn reflected in the price of electricity, which rose on average by 137% between 1973 and 1978[17]. As we can see from fig. 4.1., per capita consumption as a result dropped to the level of 1960.

Consumers' expenditure on fuel as a percentage of total consumer expenditure decreased after a short and very small increase immediately after the oil crisis. The percentage spent on fuel has only varied very slightly over the whole period, from 3.8% in 1950 over 5.4% in 1969 and

to 4.3% in 1980[18]. It must be assumed, therefore, that consumers react to fluctuations in energy prices by regulating the amount consumed. But the demand for the different fuels was not equally elastic: the expenditure on electricity kept rising even in the face of increasing electricity prices, while consumption of coal and petrol for private cars decreased. This leads us to conclude, that increasing dependence on collective systems of energy supply has impaired the speed with which the supply system adapts to changes in relative fuel prices at the level of final consumption.

This development was strengthened by changes in the relative distribution of energy consumption on different users. As we saw in fig. 4.4, industrial energy consumption decreased relative to consumption in the domestic and public sector. Whereas industry's energy consumption was often in the form of crude heat, the latter categories of users consume energy mainly for space heating and electricity, i.e. exactly the energy forms where the tendency towards collective supply has been strong. We find, therefore, that one result of the development in the 1960s and 1970s has been a move away from individual fuel choice and towards collective supply and fuel choice.

Summary: Britain.

The achievement of high economic growth was the main underlying aim of economic policies to the mid-1960s. This followed a previous experience of shortage, to which growth represented a solution. We observed that the emphasis on growth was also behind the energy policies of the same period. The real experience of energy demand growth and economic growth mutually affirmed each other.

By the mid 1960s, economic problems became increasingly apparent, and these were closely related to economic

growth: expansion in the economy seemed itself to create problems which were in principle incomprehensible to the dominant economic (Keynesian) paradigm. We have seen that energy policy was first attempted some years later in attempts to regulate the use of different fuels. We see, therefore, that the change in economic conditions preceded the change in the extent of state control of the energy sector. The oil crisis broke this pattern: fuel conditions suddenly achieved a significant impact on economic conditions. Energy became a vital factor influencing the balance of payments and inflation negatively and adding to the general economic problems. By the mid-1970s, it was becoming clear that Keynesian management no longer provided a solution, and incomes policy and monetarism was adapted. This corresponds with the observation of the previous chapters of an increasing tendency to emphasize the dimensions of energy policy to do with public spending, not only the size of investments but also long term costs and profits.

Also resource utilization underwent important changes during the period. The chronological analysis of these changes supports the suggestion that a new resource has been employed only if the existing ones posed economic or political problems to which the new resource was seen to offer a solution. Thus, nuclear power offered a solution to the problem of achieving fast growth in the coal industry, natural gas offered a cheap and less bulky form of energy than oil etc. We observed that the decision to adopt new resources have been taken at different levels. The decisions to utilize nuclear power was taken by government, whereas the decision to introduce oil was taken by consumers of primary fuel. We concluded that the physical availability of a given energy resource has been of less importance than the degree to which it either seems to offer a solution to energy problems at the national level or to the consumer. We suggested that the consumer's choice of energy is predominantly guided by the relative

prices between fuels and the price of energy relative to the level of income.

Looking at energy consumption and supply over the period, we found that the shift from coal to oil in the 1950s and 1960s was parallelled by a shift in energy consumption from coal to electricity. This was not a planned development but nevertheless it significantly influenced the conditions for energy policy after 1974. Before the institutionalisation of energy policy in the early 1970s, the tendency to move energy decisionmaking away from the single consumer and towards centralized energy industries had already been underway for a long time, supported by the results of decisions taken by the same consumers to shift their energy consumption towards the collective supply systems. As we saw in chapter two, these changes in supply structure remained outside the sphere of politics until they had been identified as causes of problems in relation to the environment.

We shall now proceed to investigate whether the role of the material conditions in relation to energy policy has been similar in Denmark.

4.3 Denmark.

As it is soon clear to anyone investigating Danish energy policy, except for North Sea oil and gas, the country is not endowed with indigenous fuel resources (according to the present definition of 'resources'). In the following sections we shall investigate the implications hereof for Danish energy policy compared to the British situation.

The economy.

Whereas the general trend of economic development in Den-

mark has been parallel to that of England, it also differed in a number of respects. At the beginning of the 1950s, Denmark was still decisively dependent on agricultural production. This produced a situation where the protective policies of the European countries towards their own agricultural sectors led to balance of payment difficulties for Denmark whose beginning industrial expansion implied increased import of production equipment, which was only to a very limited extent produced locally. This in its turn prompted the governments of the 1950s to employ contractive economic policies. Because economic growth was rather slow in Denmark, and this unemployment rates were high, over 8% throughout the 1950s[19]. This explains, at least in part, why the 'energy gap' was not an issue in Denmark in the 1950s. The slow economic growth meant that there was no reason to worry about the growth in future energy suppplies.

From 1957, the national economic conditions became more favourable as a consequence of improved terms of trade. This gave rise to increased investment activity and as a result, industrial production increased by 30% from 1957-1960. From 1960, unemployment started falling, and economic growth took off. Economic growth throughout the 1960s was largely financed by increasing balance of payments deficits. We have suggested earlier that the main problem in relation to energy during this period was now to expand supply at a rate to match the apparently ever-increasing demand. But we have also observed that during the 1960s the Danish state did not attempt any regulation of the energy sector to ensure that sufficient energy was produced. We shall suggest that this was not because the problem did not exist, but because the historical development of Danish energy supply had meant that it could be solved by the private energy industries themselves without any loss of profits.

The oil crisis hit the Danish balance of payments even

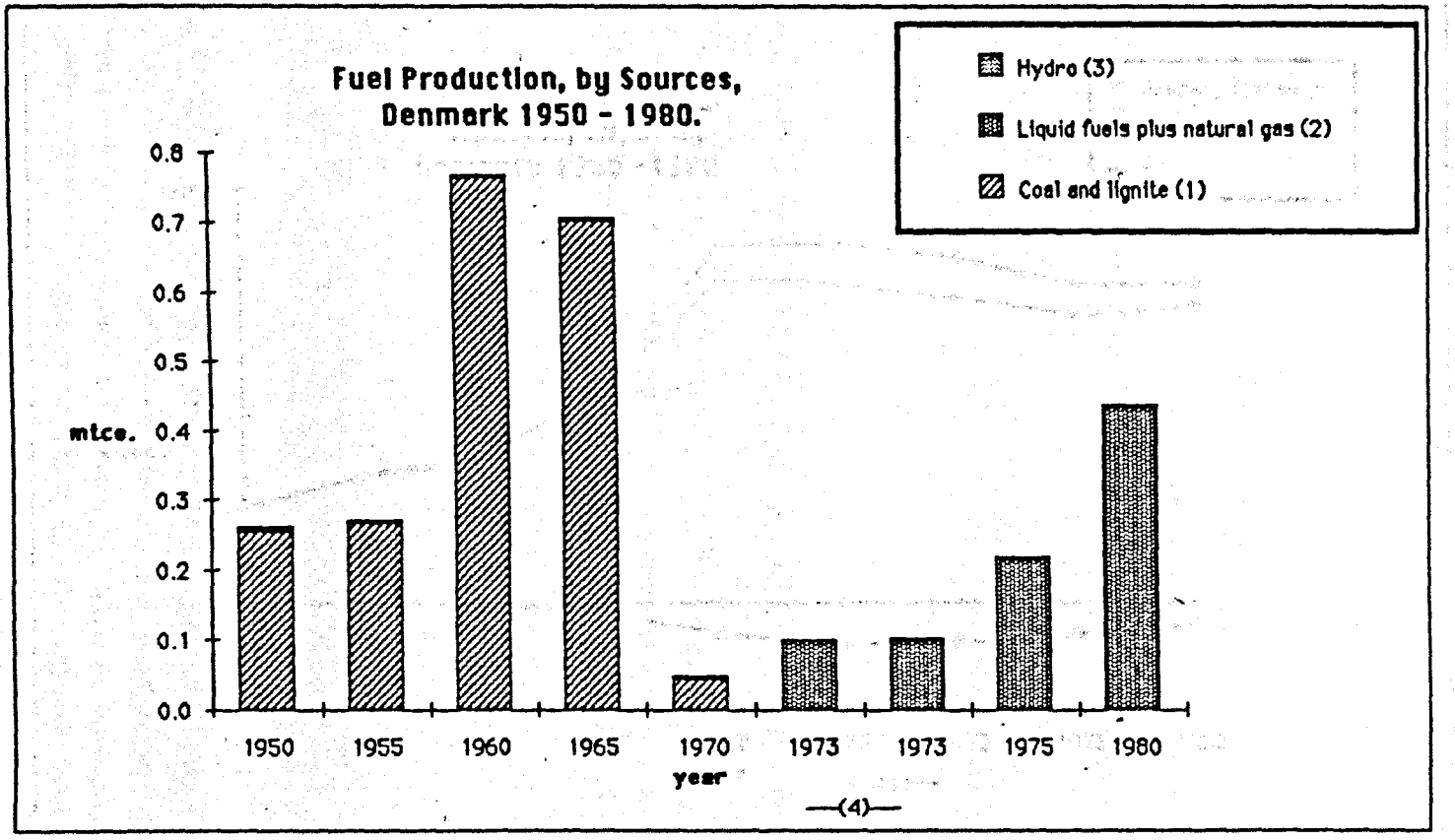
harder than it did the British. This is in accordance with our observation that the Danish efforts in devising a coherent framework for energy policy in order to avoid similar events in the future were more intense than the parallel British activities: in Denmark, the nationl economic implications were relatively more severe.

After 1975 the macro-economic trends have been similar to those in Britain: stagnating economic activity, increasing unemployment and high rates of inflation. Attempts to stimulate the economy in 1975 led to further increases in the balance of payments deficits, and towards 1980 incomes policy and spending cuts became the most important elements of Danish economic policies. Again this is in accordance with the increasing weight on the national economic implications of different energy strategies in energy policy towards 1980.

Resources.

The development of fuel production in Denmark 1950-1980 is shown in fig. 4.6

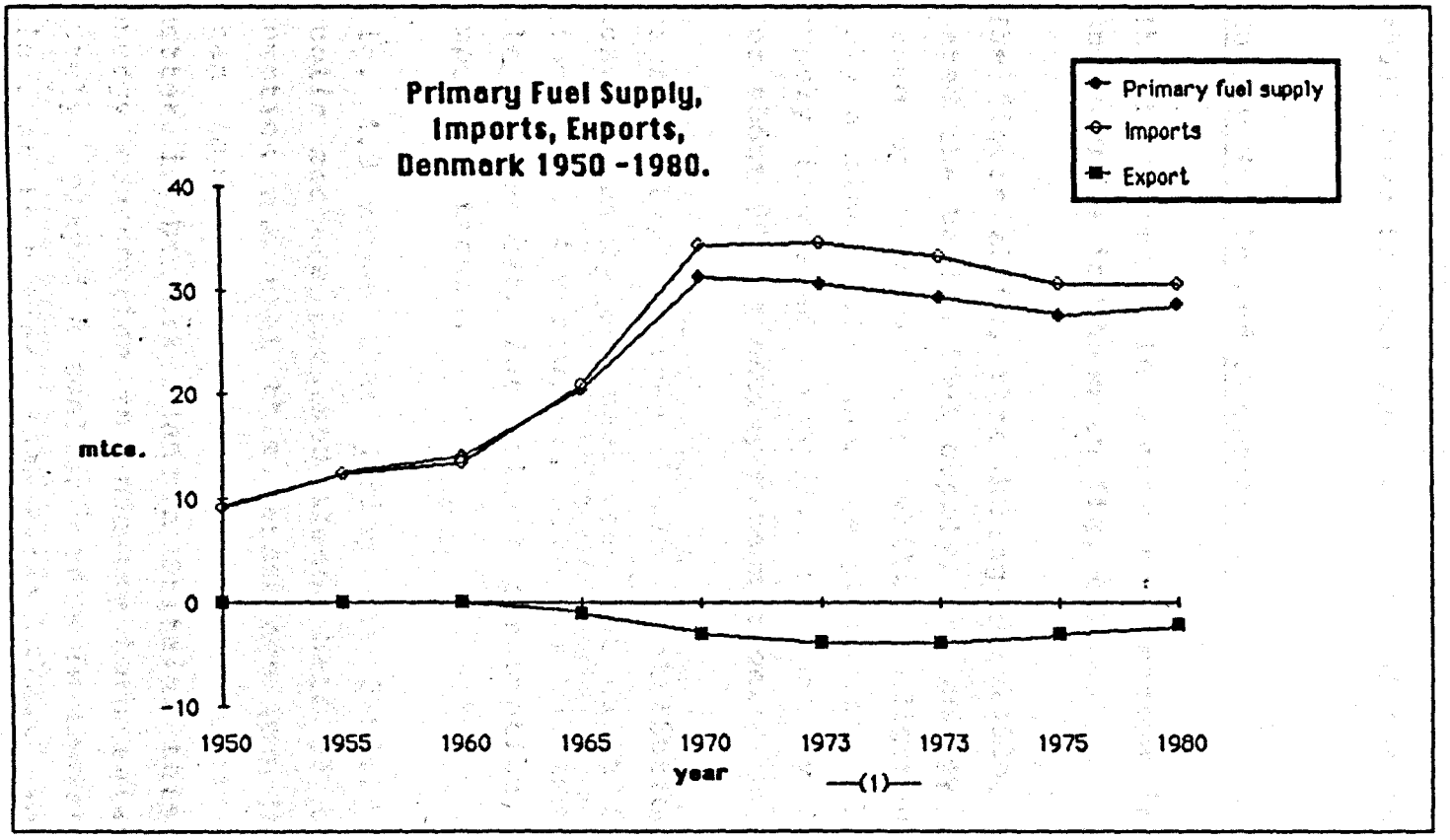
Total fuel production during the period was only 0.1 -0.2% of British energy production. This implies that even considering that Denmark is a much smaller nation than the United Kingdom with a population of approx. 9% of the British, the fuel industries have been of less importance in the Danish economy than they have in the British. Up to 1970, brown coal and lignite dominated inland fuel production. This production declined after 1960 and by 1973 it had stopped. By 1973, however, production of oil had begun in the North Sea. Fig.4.7 shows that Denmark did not rely on its own resources for fuel supply. On the contrary we have to go as far back as 1955 to find primary fuel supply exceeding imports. The access to imported resources has been of much greater importance than the access to indigenous fuels. During the 1950s, the production of brown coal



(1) Brown coal and lignite.
(2) Crude petroleum and liquefied natural gas.
(3) Only hydro.
(4) See fig. 4.1, note (3).

Sources: United Nations, Department of Economics and Social Affairs: World Energy Supplies 1950-1974. New York: United Nations, 1976; ibid.: Yearbook of World Energy Statistics. New York, 1983.

Fig. 4.7



(1) See fig. 4.1, note (3).

Sources: United Nations, Department of Economics and Social Affairs: World Energy Supplies 1950-1974. New York: United Nations, 1976; ibid.: Yearbook of World Energy Statistics. New York, 1983.

and lignite never accounted for more than approx 5% of fuel supply. During the 1970s, the proportion declined even further, so that by 1973 Denmark was wholly dependent on fuel imports. After this time indigenous fuel production achieved an increasing significance, but in 1980 production still accounted for only 1.5% of primary fuel supply. To establish why lignite fell out of use and why an indigenous oil production was initiated after 1973, we shall have to look into patterns of energy consumption.

Energy Supply and Consumption.

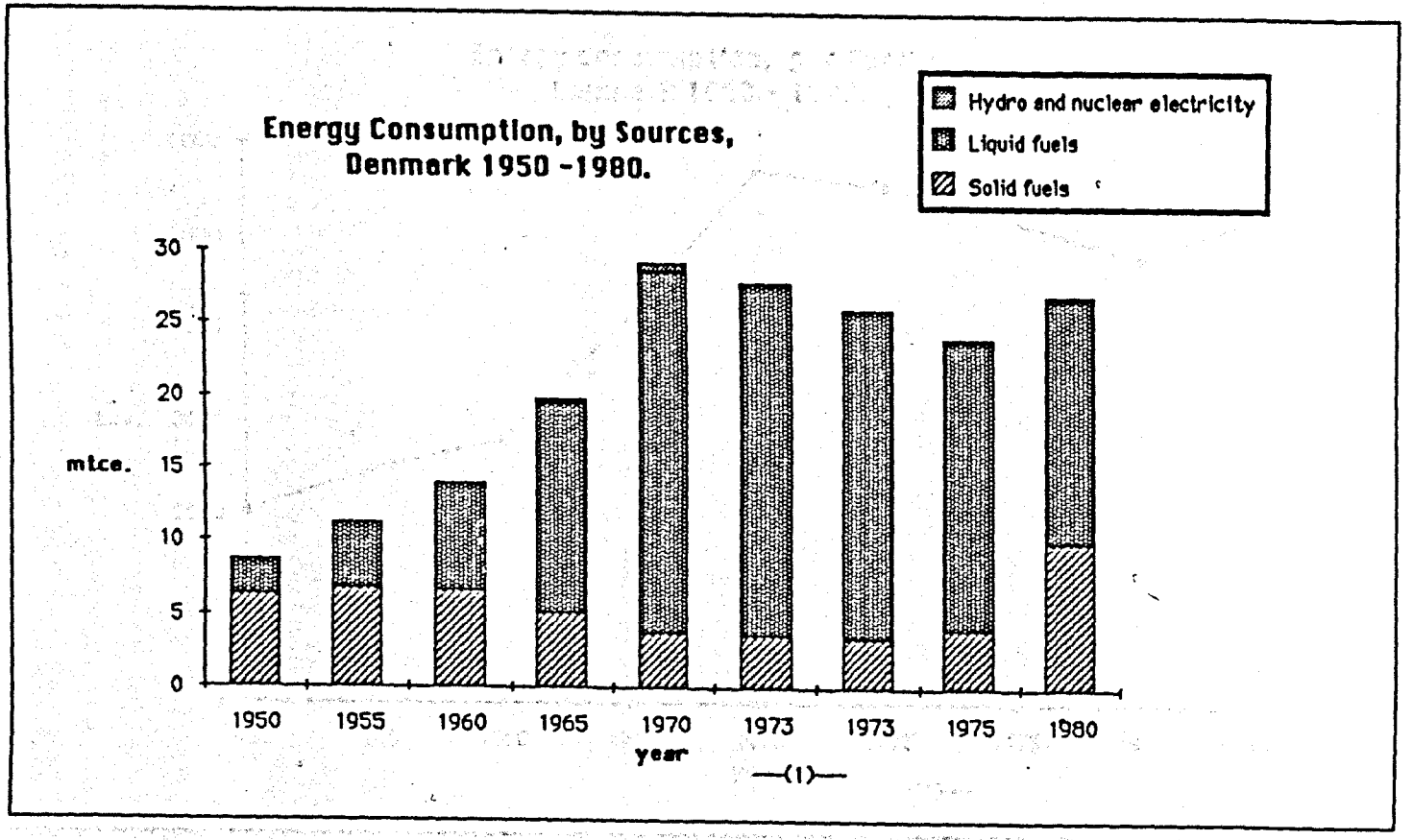
The development in energy consumption in terms of amount and sources is shown in fig. 4.8.

The figure shows, that during the 1950s, solid fuels dominated the Danish fuel supply. The energy supply was mainly based on imported coal while indigenous sources played only a minor role. But the proportion of oil in the fuel supply increased rapidly, so that by 1973 it accounted for about 90% of energy consumption.

Regrettably, a survey showing distribution of final energy consumption by end user does not exist for the whole period. Fig. 4.9 however, although not immediately comparable to the data for British consumption, shows the most important trends.

Fig. 4.9 shows that during the 1950s, the domestic and public sectors consumed almost half of total energy consumption and that this percentage was increasing. Rather than implying that heating conditions were necessarily better in Denmark than in Britain, this indicates, that energy consumption in industry both relatively and absolutely played a smaller role in Danish energy consumption. At that time industrial growth had not yet started in Denmark, and there was no heavy industry of any signi-

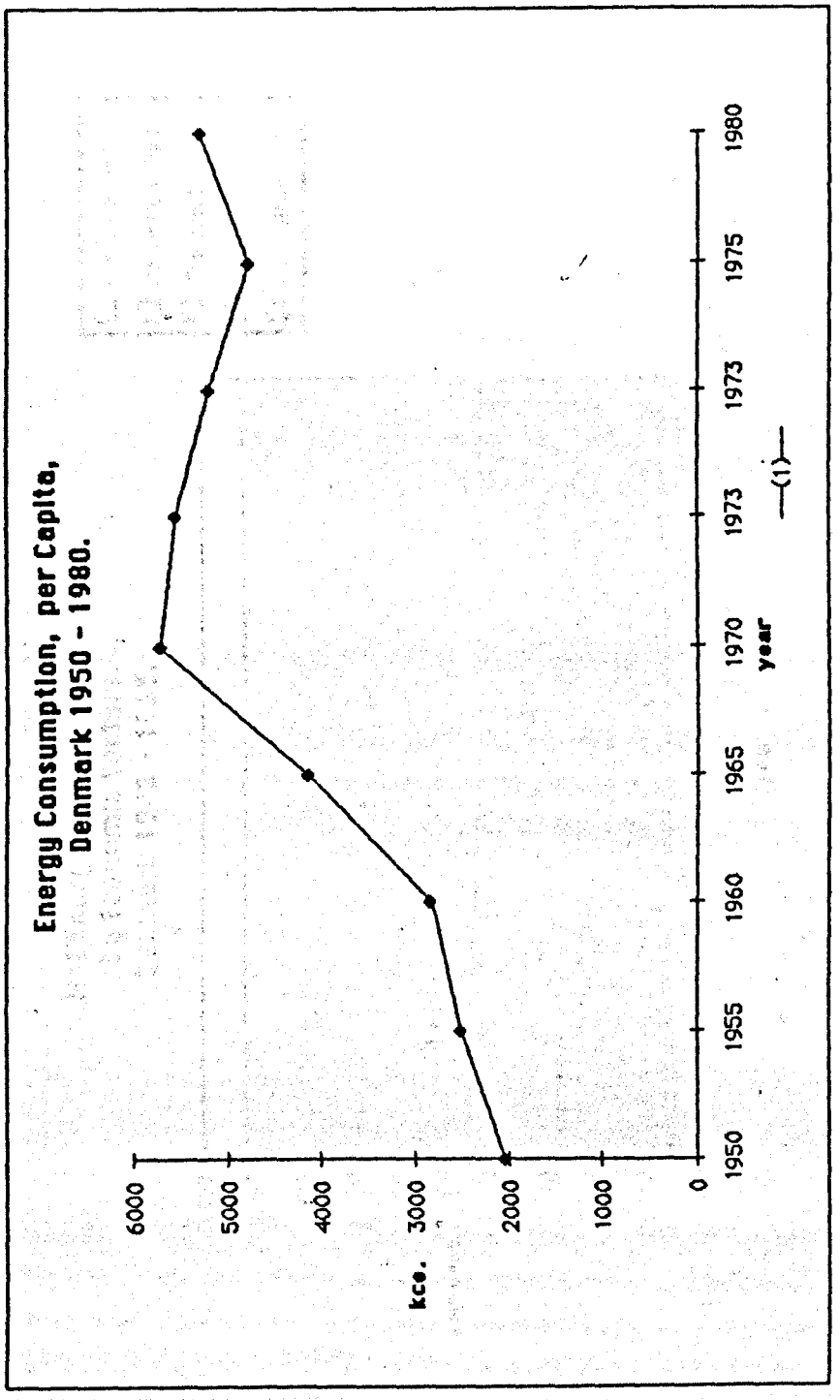
Fig. 4.8



(1) See fig. 4.1, note (3).

Sources: United Nations, Department of Economics and Social Affairs: World Energy Supplies 1950-1974. New York: United Nations, 1976; ibid.: Yearbook of World Energy Statistics. New York, 1983.

Fig. 4.85


Energy Consumption, per Capita,
Denmark 1950 - 1980.
kcs.
6000
5000
4000
3000
2000
1000
0
1950
1955
1960
1965
1970
1973
1973
1975
1980
year
(1)

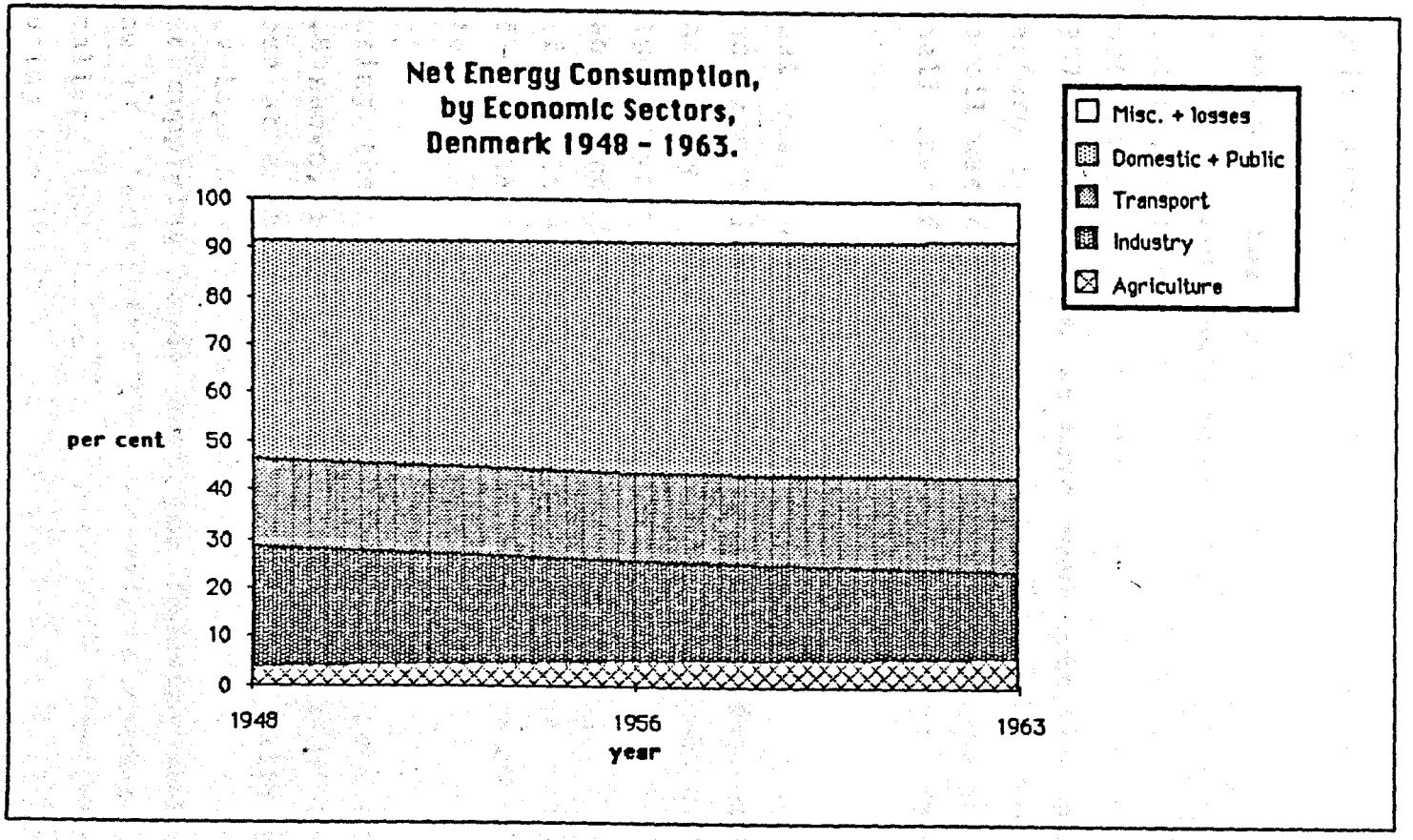


Fig. 4.9

Source: Danmarks Statistik: Statistiske Undersøgelser Nr. 20. København: Danmarks Statistik, 1965.

ficance in the country. The only industries with a significant use of fuel were the tile, cement and glass industries. These industries contributed significantly to increasing oil consumption: an increase of 30% in energy consumption from 1948 to 1956 was obtained solely by oil use[20]. Also in the domestic sector the shift from coal, brown coal, and lignite to oil started in the 1950s, as did the increase in electricity consumption, which in the public sector increased from 2% in 1984 to 5% in 1963[21].

Changes in the relative prices of fuels during the 1950s do not provide sufficient explanation of this shift. In reality, the average price per calorific unit of oil products only undercut the price of coal between 1955 and 1957. Furthermore, we have seen that the state did not interfere in energy consumption at this date, so the shift to oil was not the result of a conscious policy either. We shall therefore have to look for other types of explanantion.

Coal was, during the 1950s and early 1960s, mainly imported from Britain and Poland. The British coal policies of the early 1950s meant that the home market was given highest priority. In comparison, oil offered an apparently secure and limitless supply of energy, which furthermore offered less bulky storage and easier transport, factors of importance especially to large consumers such as power stations or industries.

During the 1960s, this development accelerated. As fig. 4.8 shows, the relative weight of oil in fuel consumption rose at a still increasing rate. Two major sources of this development were the continued increase in the use of oil for supplying crude heat for industry and the increasing use of electricity for domestic purposes as well as in smaller industries[23]. Electricity consumption increased during the 1960s at an average annual rate of 9.7%[24].

This leads us to consider the changes in the structure of energy supply accompanying the replacement of solid fuels with electricity and oil as major end use energy forms. The concentration of electricity supply which we observed in Britain also happened in Denmark. In 1961, 98% of Danish electricity was produced in 16 stations and the remaining 2% of 150 smaller stations; in 1973, 18 stations produced 99.3% of electricity, while only 15 stations produced the remaining 0.7%[25].

Consequentially, by the end of the 1960s Denmark was almost totally dependent for fuel on Middle East oil, and energy consumption was to a very large extent dependent on collective electricity supply. This did not, however, give rise to state attempts to ensure fuel diversification until after the oil crisis, when the consequences of this development were suddenly revealed.

After 1973, the proportion of solid fuels increased rapidly and this time solid fuel meant coal which offered an immediate substitute for oil. It is well worth noting that the shift from oil back to coal occurred before state energy policy had created a framework of control in the form of electricity and oil duties, which were only introduced in 1977. By then coal consumption had already been considerably expanded at the expense of oil. A primary explanation of this is the increase in oil prices, which is shown in table 4.3.

For example, the tile, cement and glass industries in 1975 used 44% less heavy fuel oil than in 1970, and during the same interval increased their use of coal by 434%[26]. Looking at table 4.3 we find that the price of fuel oil more than quadrupled which obviously presented a suitable incentive for switching to coal.

Table 4.3 Prices of Oil Products. Denmark 1971-1980. $ per per gallon.

DENMARK	1971	1974	1976	1979	1980
Prem. gasolene 97/98 RON	0.74	1.39	1.45	2.84	3.34
Regular gasolene 92 RON	0.69	1.35	1.40	2.80	3.30
Auto diesel fuel	..	..	..	1.45	1.87
Household kerosene	0.24	0.69	0.57	1.38	1.80
Distillate fuel oil	..	..	0.64	1.42	..
Light heating oil	..	..	..	..	1.68
Motor lubricating oil	3.62	6.00	6.41	10.37	..
Bunker "c" fuel oil	5.21	16.00	14.90	..	..
Medium fuel oil	..	..	..	..	44.68
LPG	..	..	..	..	..

Source: United Nations, Department of Economics and Social Affairs: Yearbook of World Energy Statistics. New York, 1983.

As shown in table 4.4, the price rise was also reflected in electricity prices, but not in full.

Table 4.4 Electricity Prices. Denmark, 1973-1980.

DENMARK		1973	1978	1979	1980	1981
Copenhagen						
Ore	A	26.90	53.50	52.80	66.00	87.60
	B	23.20	46.40	45.60	58.80	80.30
	C	18.30	38.20	37.30	49.90	69.70
	D	11.00	27.00	26.00	38.00	56.00

The consumers are categorized into four types of household consumers, on the basis of their specific consumption pattern.

Source: United Nations, Department of Economic and Social Affairs: Yearbook of World Energy Statistics. New York, 1983.

This was reflected in a continued increase in electricity consumption even after 1973. The growth rate, however, was considerably smaller than before the oil crisis: only 4.9% a year.

The supply structure underwent important changes during the 1970s. Collective heating systems, i.e. district heating and combined heat and power systems by 1982 accounted for 49% of total consumption for heating[27] compared to 30% in 1975[28]. There was no state regulation of heating before 1979; but from the late 1960s, local authorities possessing heating facilities often attached easements to building sites demanding that the dwellings built there must be connected to collective heat supply. Throughout the 1970s, an increasing percentage of this heat was supplied from combined heat and power stations, so that the electricity companies increasingly dominated energy supply[29]. Again, it must be noted that this development had started before state energy policy stated that an increase in combined heat and power production was in the national interest, and long before heating planning was instituted. Hence, the energy supply structures which had emerged independently of government energy policies were conducive to the development of state energy policy because these structures meant that energy decisionmaking increasingly took place at an aggregated level of supply.

Summary: Denmark.

The previous section has considered the developments in the Danish national economy, in resource availability and resource production and in energy consumption and supply structures in relation to the developments of policy and of political group involvement in energy which was considered in the previous chapters.

We found that macro-economic changes could be identified preceding major shifts in state energy policy issues. Changes in state energy policy issues were seen to follow changes in the dominant economic-political paradigm.

Changes in the use of energy resources in Denmark during the 1950 to 1980 period were not determined by availability of indigenous energy resources; on the contrary, Denmark relied increasingly on imports of oil, even though the existence of North Sea oil was known by the early 1960s. Only after the rises in oil prices following the oil crisis in 1973 did North Sea oil achieve any significance, but even so, oil was predominantly replaced by coal, another imported fuel. We observed that these changes in resource utilization preceded energy policies geared at regulating fuel supply, whereas on the other hand they had a large impact on energy policy by defining a range of problems to which energy policy represented a reaction.

The most significant change in resource utilization patterns was found to follow results of decisions taken by single consumers motivated by the relative advantages of fuels in terms of price and a number of secondary factors (secondary because they would not have counted, had the price been higher): ease of storage, cleanliness, comfort in use. This change, which consisted in a shift towards oil and electricity, began in the 1950s but continued until 1973. The shift to electricity meant that by 1973 the fuel change was for a large part initiated by power stations rather than individual consumers, but it was implemented through the market mechanism whereas elements of government energy strategy which involved the introduction of technologies that were not immediately profitable, like nuclear power or renewable energy technologies, were not implemented.

4.4 Conclusion.

We set out in this chapter to investigate how far material conditions, which we defined as conditions related to macro-economic trends, resource availability and utilization, and energy consumption and supply, could be shown to be reflected in state energy policy and vice versa: how far had state energy policies actually managed to alter these conditions?

With regard to the national economic conditions, the development from 1950-1980 in Britain and Denmark were broadly similar, except that economic growth was lower in Denmark than in Britain during the 1950s. We found that this was reflected in a difference identified in chapter two regarding the importance which was attached by the respective governments to the need to expand energy supply. Furthermore, we are now able to conclude that the issue of whether to plan energy supply was in both countries closely bound up with the amount and character of problems in the economy in general. Looking back to chapter three we observe that out of the political groups, only the parties initially picked up the importance of the energy sector to the national economy. This implies that only the parties as groups can have been instrumental in the central change in the suppositions underlying energy policy about the relationship between market control and state coordination.

With regard to resources, we found that changes in the resource priorities of state energy policy could not be ascribed to changes in the relative physical availability of different energy sources. Instead we found that new sources were only considered if they were thought to offer comparative advantages to those previously used, either economic advantages or for example 'cleanliness'. Hence, the desirability of a new source could not be understood independently of knowledge about the problems which were

identified as results of using the traditional sources. The change in resource utilization have run parallel in the two countries: a shift from coal to oil during the 1950s and 1960s and a shift away from oil and towards coal plus North Sea resources after 1973. These changes have been essentially unplanned, whereas the planned changes like the introduction of nuclear power in Britain and - at a much smaller scale - of renewable energy have remained of relatively much smaller importance in terms of total energy supply. We saw, however, that the resources which were chosen exactly because they were interpreted as advantageous, later came to represent a problem exactly because their use became universal, c.f. the dependence on oil.

With regard to energy consumption, we saw again similar trends in the two countries: a significant trend during the 1950s and 1960s in both countries was a general increase in electricity consumption, especially for domestic purposes. From 1970 the decreasing importance of industrial energy consumption in both countries added to the importance of this development. Also in the 1970s, collective heating was developed or extended in both countries, in Denmark as district/CHP heating, in Britain as natural gas heating. This development, which was a result of individual decisions based on an assessment of the relative advantages of electricity and district heating over kerosene lamps and wood or coal stoves and fires, later came to represent constraints on the individual scope for fuel choice. In addition, however, these 'micro'-decisions produced other results at the national level which were never intended nor expected.

They produced an aggregate change in resource utilization, but in addition the concentration of production facilities also implied a concentration of pollution. A large number of less spectacular power plants were replaced by few, but conspicuous, stations each having a greater impact on the

surrounding environment. In chapter three we observed that this was increasingly recognized as a negative effect of centralization after 1973, whereas there is no sign that it was originally predicted that this effect could become a future problem.

We find that the account supports our suggestion that the emergence of new groups in the energy policy field and changes in the attitudes of existing groups reflect changes in the material conditions in the field. We have found that the politicization of energy was preceded by major changes in the economic conditions as well as the patterns of energy supply and consumption. But we also found that the changes in resource utilization depended on changes in the patterns of energy supply and consumption, and that these changes emerged as aggregate results of state energy policy, individual decisions with energy impacts, and finally state policies in other fields than energy. This suggests a 'closed system' of energy consumers, energy producers and the state, which produces solutions to energy problems as they emerge, but which does not have the capacity to foresee the problems that arise as aggregate or long-term results of applying those solutions.

This conclusion, while adding to our understanding of the origin of resource related issues, does not immediately contribute to an understanding of the origin of the idea prevailing in energy policy from the mid-1970s that one of the main tasks of energy policy should be a comparative evaluation of energy technologies founded in assessments of the totality of their possible future consequences. We shall therefore in the next chapter discuss the historical development of the notion of state controlled technological change.

NOTES TO CHAPTER 4

1. The following section is primarily based on Budge et.al. (1983).

2. Cf. Budge et.al. (1983) table 1.1 p.7.

3. Op.cit. pp.6-8.

4. Chesshire et.al. (1977), p. 38.

5. I.e. electricity generated from sources other than the traditional fuels, e.g. hydro, nuclear power, wind or solar (photovoltaic) cells.

6. See Chesshire et.al. (1977) table 2.2 p. 38.

7. See Reid and Allen (1970) pp. 90-93.

8. Chesshire et.al., op.cit.

9. Ibid.

10. The figures for electricity consumption in GWh stem from Reid and Allen (1970). The further calculation assumes a conversion factor of 1 TWh of electricity = 0.135 mtce end use energy. Finally, following Reid and Allen, thermal efficiency in electricity production is estimated at 21.6% in 1950 and 27.5% in 1959.

11. See Annual Abstract of Statistics, 1960.

12. See Reid and Allen (1970), p. 85.

13. See Reid and Allen (1970) and the Electricity Council (1982).

14. See Reid and Allen (1970), pp. 54-81. Reid and Allen cite an average cost of producing town gas in 1960 at 7.12d. per therm, while the negotiated beachhead price of natural gas in 1968 amounted to 2.87d. per therm as compared to 4-6d. per therm for coal and oil.

15. Reid and Allen (1970), p.70.

16. See Ince (1982) for a detailed account on this.

17. Figure calculated on the basis of information given in United Nations: Yearbook of World Energy Statistics. New York, 1983.

18. Source: Central Office of Statistics: Annual Abstract of Statistics 1960, table 284, 1970, table 311; 1981, table 14.14.

19. Andersen, H.W. (1982), p. 161 f. During the early 1950s agriculture accounted for about 50% of foreign exchange earnings.

20. Ibid., table 1, p. 308.

21. Danmarks Statistik: Statistiske Undersøgelser no.20, table 34.

22. Ibid.

23. See Danmarks Statistik: Statistiske Undersøgelser Nr. 20, 1965.

24. Ibid; Danmarks Statistik: Statistisk Årbog 1971.

25. Andersen, T. (1982).

26. Energiministeriet (1981), p. 98.

27. Energiministeriet, (1981), p. 98.

28. Energiministeriet (1983), p.22.

29. Boligministeriets Opvarminigsmetodeudvalg (1975) p. 4.2.

5. THE POLITICAL CONSEQUENCES OF THE EFFECTS OF TECHNOLOGY.

5.1 Introduction.

The preceding analysis led us to conclude that even though concrete changes in energy policy could be explained by reference to changes in energy prices and resource availability, we were still left to explain the politicization of energy that was identified in chapters two and three. Specifically, we were left to explain the emergence of new groups trying to influence energy policy as well as the tendency for both these groups and energy policy decision-makers to express energy political questions in terms of choices regarding energy technologies based upon comparative evaluations of the effects of these technologies.

Addressing these problems, we suggested, in a preliminary hypothesis, that the emergence of new groups and changes in the attitudes of existing groups reflect reactions to negative experiences of the effects of energy technologies on the physical environment as well as on social conditions and the quality of life. Furthermore, that these experiences have contributed to the politicization of energy as well as to attempts at devising new methods of social evaluation and control of technology. Finally, we suggested that the negative experiences of technological effects have been common to the industrialized world and hence also to Britain and Denmark.

Having suggested that the politicization of energy reflects negative experiences of technology, we have also implied that a change has taken place in the experience of technological effects. More specifically, we shall suggest that in the early part of the 1950-80 period, the effects of technology on society were generally interpreted as beneficial, and policies were therefore focused on improving conditions of technological change. In contrast, from

the early 1970s, the same technologies were increasingly seen to contribute to the creation of new problems in the industrialized world: environmental degradation, urban congestion, growing unemployment to name but a few.

With respect to energy we saw a shift in the policies concerning the technological aspects of energy around 1970. During the 1950s and 1960s energy policies in both Britain and Denmark were primarily geared to supporting technological change in energy production. After 1970 policies were increasingly concerned with avoiding the negative effects of existing technologies and looking for new technologies which might possibly solve some of the problems created by the existing ones. New criteria were adopted with respect to the performance of technologies, and attempts were made at comparative evaluation of energy technological systems.

At the same time, political groups voiced demands for 'alternative' energy technologies to be introduced. We observed that these groups often emphasized the need for society to minimize the negative effects of technology either through strengthened state regulation or aided by a new, ecological morality which would induce the individual to consider the large scale effects of her/his behaviour.

We shall now concentrate on the implications of these parallel developments by isolating the technological component and positing energy technology policies and policy proposals in a framework of science and technology policy and policy proposals. Centering on the hypothesized shift around 1970 we shall need to look first at the previous period: which role was defined for the state in relation to technology?

Which types of technologies did governments support? Which effects were expected to arise from technological

change? Were there any criticism of technology policies? If so, who were the critics?

We shall then proceed to analyse changes in technology policy. Our hypothesis suggests that these changes reflect the pressures of political groups who react to problems which are 1) seen to be created by the application of technology, 2) seen to be so severe as to demand immediate political action, and 3) seen to be inextricably bound up with and therefore insoluble through the economic system. If this is the case, we need to show that the technology policies of states and supranational agencies reflect such problems. Also, we will want to show that the specific issues involved emerged in critiques of contemporaneous policies affecting technological change by concerned individuals and political groups prior to being defined as policy issues. We want to establish that any changes in the focus of technology policy has been preceded by pressures from 'below'.

As we intend to demonstrate that the politicization of technology was a phenomen not limited to a few nations, this chapter will, in addition to Danish and British sources, to a large extent make use of policy documents from supranational agencies such as the OECD and the EEC. For these agencies, as well as for Denmark and Britain, the development of science and technology policy will be traced in terms of the issues, objectives and the documents. In order to document the origins of concern, we shall have to look for possible sources of the critique of the official policies. Possible sources include single scientists directly involved with scientific/technological programmes, groups of citizens directly affected by large-scale technological developments, and pressure groups protesting against specific types of technological development. If such critiques have preceded policy statements, we might expect that this would be reflected in some way in the policy documents e.g. by references in more or less

precise terms to the groups or individuals who have raised the critique. Also we would expect that such critiques would be mentioned in later scholarly work on the effects of technology. Finally, we would expect some media coverage of e.g. protests against particular technological projects.

The format sketched here raises a number of specific methodological problems notably in relation to definitions. Attempts to define 'technology' raise problems similar to those encountered in chapter one with respect to the concept 'energy policy'. As will be evident from the above, the object of the present chapter is not 'technology', but the changes over the 1950-1980 period of the ways in which society has tried to influence technological change and the extent to which these attempts have been interpreted as successful or as failures. Therefore the definition of technology by political decisionmakers is itself a subject of investigation as was the case with energy. We shall need, however, to make some specifications in an attempt to aid conceptual clarity.

As Langdon Winner (1977) observes, 'technology' in today's everyday use tends to cover a large class of phenomena including both things (tools, machines, implements), activities, and social structures[1]. Furthermore, there is one interpretation which is not included in Winner's observations. 'Technology' has frequently been interpreted as a particular form of knowledge or applied knowledge[2]. The content of the concept 'technology' has, we shall suggest, varied historically according to the character of problems in the real world demanding political attention. Winner (1977) observes that:

> "In past decades the term ('technology', T.A.) had a very specific, limited and unproblematic meaning. Persons who employed the term spoke of a "practical art", "the study of practical arts" or "the practical arts collectively". (...) Most people spoke directly of

machines, tools, factories, industry, crafts, and engineering and did not worry about "technology" as a distinct phenomenon." (Winner, 1977, p.8).

To the extent that this is the case we would suggest that this conceptual change reflects a change in the nature of the actual problems facing people, so that the increasing use of the general and abstract term 'technology' would suggest that problems are no longer seen to be located in a single piece of machinery but in the system of which this machinery is only a small part.

Bearing this in mind we shall adopt a very simple working definition of technology, which is adapted from Petersen (1985):

By technology we shall understand instruments or techniques both material and social which are used by human beings for transforming or shaping the natural or social conditions given at any point in time.

This definition is clearly inspired by the Marxian concept of the forces of production[3], but in contradiction to this concept it includes as 'technology' means for transforming social (as well as physical) reality. Hence, the object of the following investigation is the extent to which the state has regulated the development of such means and the extent to which it has been seen by a wider public to be successful in this pursuit. We shall concentrate this discussion on issues relevant for energy policy, while on the other hand we shall only inquire into the whole field of policies for industrial technology insofar as knowledge about these policies is relevant to the understanding of energy technology policies.

What follows is an investigation into the development of issues raised by the policies for science and technology of the Western industrialized world between 1950 and 1980.

The investigation will concentrate on statements about the experienced effects of existing technologies and on the policy recommendations made in response. Furthermore, in the course of the investigation we shall seek to establish the chronological process through which the effects make themselves felt as issues for state policy.

5.2 The 1950s and 1960s: Technology as the Means for Growth.

The first indication that the objectives and scope of technology policy betwen 1950 and the late 1960s was quite different from what was later to be understood by 'technology policy' can be got from later attempts to describe the shift. In a report to the Secretary-General of the OECD on new concepts for science policy, the period from the end of the 2nd World War and up to 1967 is described as an era "in which the attitude towards science and technology was optimistic and hopeful" (OECD, 1971, p.39). In terms of policy, this meant that:

> "much of the thrust of science policy[4] as it developed within the OECD area was concerned with bringing the level of total R & D expenditure as a fraction of GNP up towards that of the United States (...). In this thrust, R & D was regarded as a valuable investment in its own right, almost independent of its subject matter (provided it was sufficiently advanced and "sophisticated") and independent of coupling to the operational problems faced by governments". (Organisation for Economic Co-operation and Development, 1971, p.40).

We shall now suggest that the optimism expressed in science policies was the result of experienced co-variation between technological change and economic growth prevailing in the 1950s and 1960s. Petersen (1985) suggests that this period was one of more or less constant growth in which few conflicts threatened social stability, because of the prospect of a continued increase in the total sum of resources which would (at least in theory)

remove any obstacles for re-allocation to the benefit of all[5]. We shall suggest that this interpretation of the role of science and technology was conducive to technology policies which to a large extent left decisionmaking to 'experts', i.e. scientists and developers. In addition, we shall show that the seeming efficacy of technological progress led to general acceptance of the idea that a scientifically managed society was both feasible and desirable[6].

By the beginning of the 1950s, government intervention in the industrialised world was characterized by fast growth in government R&D funding. This growth has been described by the OECD as:

> "(...) so rapid and so continuous that people were not far from regarding it as an inevitable phenomenon, virtually outside the area of political choice." (Organisation for Economic Co-operation and Development, 1971, p.38).

The interventions were, however, fragmented and not founded in intentions to manage or control a broadly defined field of technology. Single specific technologies, like nuclear power, were heavily subsidized. Also scientific and technological education was supported in an attempt to aid the development of science, in particular physics and related areas, which was expected to contribute to technological progress by supplying new inventions.

Before we proceed to look at the ways in which policies dealt with technology in this period, let us have a brief look at the attitudes to science and technology of the period as they have been described by scholars writing with the advantage of hindsight.

Petersen (1985) argues that during the 1950s and early 1960s science and technology seemed to have become an autonomous force in society: one invention automatically and

inevitably led to the next. This is in agreement with the interpretation of the OECD referred to above, and suggests that the 1950s model of the processes of invention - innovation -development -practical innovation underlying science and technology policy differed radically from later interpretations. This seems to be confirmed to some degree by the definitions of technology offered by the contemporary philosophical critique which was preoccupied with the consequence for humanity of technological change[7]. These early critics drew their concerns from the assumption that modern technologies would indeed succeed in doing what the developers wanted them to. After nuclear weapons everything seemed possible:

> "A technique is a rational discipline designed to assure the mastery of man over physical nature through the application of scientifically determined laws" (Simon, 1951, p. 173).
>
> "Technique is the totality of methods rationally arrived at and having absolute efficiency (...) in every field of human activity." (Ellul, 1954, p. xxv).

These definitions imply that the most important feature of techniques was thought to be their efficiency as means of control. It is important to remember, however, that these definitions were proposed by philosophers trying to inquire into the nature of the rapid technological change which they saw as something new and important. Consequently their conclusions cannot be taken to be descriptions of the actual processes of technological change nor of the role of governments in technological change. We shall therefore have to have a closer look at the elements of the 'model' of technological change implicit in the assumptions of government policies and interest group policy recommendations regarding technology during the 1950s and early 1960s.

In chapter two we observed that the main foci of energy policies in Denmark and Britain in the 1950s and early

1960s were economic growth and technological progress. In chapter three we observed that these foci reflected a general consensus amongst political groups about the absolute desirability of economic growth. Technological change was seen to contribute positively to economic growth by removing obstacles to growth. For example, automation would contribute to greater efficiency in production and thereby help to avert a threatened shortage of labour. The apparent success in applying science and technology to single problems in relation to economic growth led political groups to conceive of technological change as progress. For example, the Labour Party in 1958, summed up the past achievements of science and the expectations derived from these experiences:

> "In the last two decades alone these (scientific, T.A.) discoveries have led to a range of powerful new industries: atomic power stations; jet engines; plastics, synthetic fibre and rubber. All these products are the fruits of pure and applied research. To a very important extent our future prosperity will be determined by what science can discover and by how rapidly we can translate these discoveries into industrial production." (The Labour Party, 1958).

Also, the popular literature abounded with fanciful visions of new technologies, new products, and general material abundance, for example Gabor (1963) 'foresaw' nuclear powered ships, synthesized fuels, totally automated factories and automated systems for the purchase of household goods. At the same time, economic growth was the unquestioned objective of national and supranational policies. Petersen (1985) upon analysing the objectives of OECD policy statements of this period concludes that:

> "It is growth which is to create the basis for full employment; growth, which is to ensure a better standard of living, and growth which is in the final analysis to pay for the welfare state." (Petersen, 1985, p.211).

In both Britain and Denmark, governments sought to create

favourable conditions for economic growth. In both countries, state intervention during the early 1950s was minimal[8], but as the rate of economic growth in both countries remained low, towards 1960 new measures were introduced in both countries with the aim of stimulating economic growth. These measures included the establishment in Britain of the National Economic Development Council[9] and the introduction in Denmark of specific growth-enhancing policy measures e.g. a system of taxes favouring private industry, large public spending especially in the building sector, and increased spending on higher and further education.

Technological change was generally thought to contribute to economic growth. From the observation that technological change had facilitated new material possibilities, there was only a short step to assuming that material welfare for a majority would inevitably accompany technological change. So far, the results of scientific technology could be interpreted as being to the benefit of the large majority. Increasing productivity gave rise to speculations e.g. by Simon (1951) that unskilled workers would in the near future be able to enjoy unprecendented material welfare. In the same vein, Gabor (1964) observed that

> "For the first time in history we are now faced with the possibility of a world in which only a minority need work, to keep the great majority in idle luxury." (p. 104).

This may sound like idealist speculation easily dismissed as unrepresentative. There are indications, however, that ideas very much like these were common currency in the period. For example, a Trades Union Congress statement on technology in 1965 concluded that technological change would in the future contribute to improved conditions for the working class. Automation in industry would lead to unskilled workers being replaced to a still larger degree by skilled workers. This would lead to an improvement of

the skill level of the working class, higher wages, and less toil and dirty work in the industry. It was also foreseen that the distinction between white collar and boiler suit jobs would increasingly be blurred by the introduction of new production equipment. Economic growth, aided by technological change, would make it possible to change the major pre-occupation of society.

> "(...) from that of feeding, clothing and housing its people to that of providing for everybody the services and opportunities previously enjoyed by a minority." (Trades Union Congress, 1965, p.25).

Technological progress was thought to hold the promise of increased generalised welfare, and welfare was most frequently interpreted as synonymous to material prosperity in terms of the 'services and opportunities' mentioned above, but first and foremost in terms of increased and generalized access to buy increasing amounts and varieties of consumer goods:

> "Today the housewife in the supermarket goes into a trance while she heaps her precious goods into her trolley in careless rapture. Who could be sorry for her?" (Gabor, 1964, p.91).

Indeed, remembering postwar shortage, who could, in the 1950s and early 1960s, be sorry faced with the prospects of being able to consume more commodities? With respect to energy, technological change also seemed to contribute to increased welfare. For example, the Danish Social Democratic Party in its 1961 programme stated that technical and scientific progress would lead to social progress and welfare, in particular, the adoption of peaceful nuclear power would lead to prosperity, and similar statements were found in other party programmes of the time. Considering the problems experienced in relation to energy supply at the time: pollution from open coal fires, having to store in each home fuel which was either dirty and bulky (coal) or dangerously inflammable (kerosene), the new technolo-

gies (nuclear power, small oil burners) and the accompanying promises of more of the same must have been compelling to the energy consumers of the 1960s.

But also at a larger scale technological change offered solutions to existing and expected problems. For example, as we have seen, civil nuclear power, developed into a commercial stage, was expected to remove the specific obstacle to exonomic growth presented by the exhaustion of known energy sources. Contemporary writers, projecting this expectation further into the future, foresaw that the introduction of nuclear fusion would solve both the problem of the exhaustion of fossil fuels and the possible health and safety problems arising in connection with the use of fission, as well as other hitherto unknown technologies[10].

In this 'model' of the relationship between science, technological change, economic growth and social welfare, energy consumption played an important role. We saw in chapter 2 and 3 a general consensus during the 1950-1970 period about the close interrelationship between growth in energy consumption and economic growth. Growth in energy consumption was both an indication of increased welfare and the precondition for economic growth.

Later charges that technological change in this period was 'autonomous' in the sense that it was not state controlled[11] are somewhat beside the point. During the 1950s and 1960s, the governments of Europe and the US were heavily involved in science and technology. The involvement, however, did not seek to prevent any development, and the state did not intervene in detailed choices of technology within its policy areas (e.g. choice of energy producing technologies). It would be more appropriate to say that state intervention was market-oriented in this period. Governments sought to ensure that the preconditions for technological progress were present by creating a favoura-

ble climate for the processes of invention and innovation. For example several analyses were made in Britain between 1955 and 1960 of the future need for scientific and engineering manpower in order that sufficient resources were allocated for education and training[12], and in Denmark, a technical-scientific research council (Danmarks teknisk-videnskabelige Forskningsråd) was set up to monitor technical and related scientific research and the education of researchers:

> "(...) in order to support and coordinate the Danish contribution within these areas for the benefit of society and its industry." (Lov om oprettelsen af det teknisk-videnskabelige forskningsråd (Act on the creation of the technical-scientific research council) cited here from Sidenius (1984), p. 285).

In addition to this, subsidies were allocated for the development of technological areas in which commitments had already been established, such as nuclear power and other technologies derived from military research, e.g. supersonic transport and space technology. These technologies were regarded as promising in terms of their potentials for economic growth, national prestige, military advantages over other parts of the world and not least in terms of the expected technological 'spill-over' to other sectors.
Later criticisms of this strategy have frequently ascribed it to technological euphoria, e.g. the abovementioned report from the OECD observed that:

> "If the world was in trouble (the paragraph refers to the period from 1961 to 1967), it was because it had too little, or the wrong kind, of science or had not learned to use it effectively." (OECD, 1971, p. 39-40).

Whether or not this is a precise description of the thoughts of the decisionmakers we cannot say; beyond guessing, however, is the increase in R&D expenditure and the creation of e.g. state financed nuclear research

establishments in a number of countries including, Britain and Denmark.

It would also not be true to say that the technological developments of the 1950s and 1960s were unplanned. On the contrary, as we saw to be the case in electricity production, planning was a necessary accompanyment to increases in scale, and the introduction of new technologies had to be forecast in order that the existing networks could be adapted to it. This, however, was planning within the single technology area, not to be mistaken for the ideas of comprehensive planning of the whole technology field which enters the political agenda by the end of the 1960s.

The emphasis on advanced, large scale technologies was a consequence of seeing technological change as a means to achieve economic growth and welfare was an emphasis on advanced, large scale technologies. This is a logical implication of emphasizing productivity and efficiency in relation to the specified target (the classical example here being 'putting a man on the moon'). With respect to energy we have already seen that during the 1950s, a number of projects were initiated within new technology fields. The nuclear power projects are conspicuous examples of state involvement in advanced technology, but we should not forget that projects investigating possible uses of wind and solar energy were also initiated in both Britain and Denmark. The interest in these projects waned during the 1960s parallel to the shift observed by the OECD from a period of "public faith in the efficacy of science, and high political prestige of scientists (...) above all in the United Kingdom and the United States" (OECD, 1971, p. 39) to a phase in which focus was more on allocation of resources and on the direct role of science and technology in economic growth.

Hence, the 'technological change' which attracted political attention during the 1950s and 1960s was of a particu-

lar kind: it was rational, efficient, large scale, and prestigeous. 'Technology optimism' was optimism related to specific technologies: nuclear power, automation, aerospace, and electronics: Similarly, the science which was to be developed was first and foremost physics and related branches of science: chemistry, mathematics and -to a lesser extent - biology. At the same time as we note this trend in state involvement in technology, the idea that these technologies represented per se progress was reflected in the media. We have already seen in chapter three that the notion of progress in relation to technology, esp. nuclear power, was utilized in the public relations material of the energy industries and nuclear lobbies. Nuclear power in particular seemed suitable as a symbol of the prestigeous technologies[13] involving high science, high risks and the promise of high yields:

> "The Sellafield Project is perhaps the most exciting development in this country: it rises improbably on Cumbria's sea-fringe and even when shrouded in mist (...) the brilliant construction lights are a beacon seen from afar - a symbol of the future which is being made here today". (Leading article, The Times, 29. March 1950).

Another characteristic of the 1950s and 1960s view of science and technology was the expectation that the side-effects, which would accompany technological change, would be mainly beneficial. Side-effects, or unintended effects, are effects which arise in addition to the primary, 'intended' result or the main instrumental purpose of technology. For example, the main purpose of civil nuclear technology is production of electricity, and the main purpose of automation of coal production is increased productivity in coal production. Emphasizing the economic dimension, 'externalities' are costs or unintended effect benefits which accrue to other than those bearing the primary costs and benefits of a certain technology[14]. Using these terms it becomes clear that many of the expected benefits to be derived from technological changes were in fact side

effects: putting men on the moon or producing electricity by means of nuclear fission was expected to produce a 'spill-over' which could also be described as 'external benefits': scientific progress, economic growth, national prestige. As we saw in chapter two, besides the general expectations of economic growth created by technological change, each political group was convinced that technological change could bring particular benefits to its members. For example, it was generally expected that new technologies would increase productivity by replacing workers with machines. Generally, this was interpreted as an unmitigated blessing. But it was also interpreted positively by particular groups. For example, neither the trade unions of Britain nor of Denmark protested against rationalisation, as long as new jobs were available: on the contrary, the new technologies seemed to offer potentials for a general upgrading of the skills and wages of the working class.

This does not mean that nobody was aware of the possibility of adverse consequences of the technological developments. Concern about the negative side-effects of nuclear power raised from two different constituencies: single scientists working in the field and having direct experience with the technology and people directly affected by the effects of large scale technological developments. For example, in 1950 plans for opencast coal mining were opposed by the inhabitants of Worcester, who feared that local farmland would be damaged and the water supply polluted[15]; in 1955 the United Kingdom Atomic Energy Authority had to change its plans of disposing for radioactive materials in disused mines in Gloucestershire because of local protests[16].

But although the fire in the experimental reactor at Windscale in 1957 "caused considerable shock, both inside and outside the Authority" (United Kingdom Atomic Energy Authority, 1979, II, p.13) and although Wynne (1982)

observes, that the subsequent milk ban caused "growing disquiet", there is no evidence of any sizeable public concern in relation to the issue, in fact Wynne also observes, that the only criticism over radioactivity levels and standards came from two scientists, one of whom worked at Calder Hall.

On the basis of these observations of the character of concern about the negative external effects of technologies, we find it warranted to conclude that such concern in the period was limited in more than one sense. Firstly, it was limited to those who had a first hand experience of a particular technology, either by being involved in the development of that technology or by being directly affected by one or more of its physical consequences; secondly, it was not concern about 'technology' in general or 'negative external effects of technologies' in general. It was concrete concerns related to effects which were either known to occur and known to be dangerous or effects which were directly experienced as negative (the milk ban). It was suggested afterwards that in the case of nuclear power this 'lack of concern' about negative externalities was the result of the secrecy involved and the central role of experts which were at the same time employees in the nuclear industry, the result being a manipulated public:

> "There was thus a tight social network controlling the public interpretation of science in this field." (Wynne, 1982, p. 23).

There is no doubt that the nuclear project was kept secret. The interesting point is not whether or not this was the case, but rather whether it mattered to the public concerned. The above quotation by Wynne suggests that public concern is ever latent, and that it can be manipulated and suppressed by powerful groups in society in control of the media. We think that this is an insufficient

explanation for reasons which will be thoroughly discussed in the following chapter, but a few points can be made at this stage. The extreme secrecy involved in the early nuclear project and other projects of military origin were not generally characteristic of technological developments during th 1950s and 1960s. On the contrary, we have seen that the energy industries made available technical information about other technologies for energy production and distribution. But also among these technologies were some that were later identified as sources of negative effects, as we shall shortly see. Furthermore the criticisms (of nuclear as well as coal-based technologies) appear only in the 1970s in spite of the public having had full access to any necessary information about the technicalities of electricity supply for decades. This seems to confirm that there was no latent concern to suppress by means of the secrecy surrounding nuclear power. In fact, Wynne appears to modify the 'conspiracy-thesis' when he observes that the 1950s were characterized by "a euphoric climate" of rapid growth (p.17), and later that "Science, and atomic energy in particular possessed unprecedented political status and national prestige." (p.20). So whereas the evidence is inconclusive when it comes to assessing the reactions of the public to the new technologies of the 1950s and 1960s, we can conclude that at the policy level, negative external effects were not given much attention, and no available evidence indicates that any concern existed about the issue neither in the public nor in political groups.

As regard the expected benefits from technological change in the energy sector, the introduction of nuclear power and extension of electricity supply was generally believed to contribute to a cleaner environment. In Britain, the experience of local pollution from open coal fires leading to the Clean Air Act of 1955 naturally focused attention on technologies which could be seen to solve this problem. In Denmark, owing partly to the smaller size of cities,

partly to the early introduction of district heating, air pollution was not for the majority a direct experience, and the argument that nuclear power and electricity were 'clean' forms of energy was not very important until pollution from the collective supply systems began to affect people more directly.

Another expected benefit of adopting new and more efficient technologies for energy production was the resulting ability to utilize hitherto unavailable resources, or using the existing ones more efficiently. As we have seen, energy policies were aimed at expanding supply, and in this perspective, the consumption of energy resource was crucial insofar as it represented a physical constraint on this expansion. Therefore one role of the new technologies was to push forwards the resource limit or even get rid of it, as it was expected the development of fusion power would.

A somewhat different dimension of the 1950s' and 1960s' view of the role of technology in society shall be briefly mentioned because it appeared as a target for criticism in the 1970s debate on technology. We are talking here of the transfer of scientific models of problem-resolution to decisionmaking in areas of social and political problems. Both Winner (1977) and Petersen (1985) point to a remarkable interest amongst political and social scientists in developing methods of rational decisionmaking during the 1950s and 1960s. Citing contemporary political philosophy, Petersen is able to conclude:

> "The way we handle technology is simply influencing our notions about the ways in which other fields ought to and should be handled. We are able to deduce from cybernetics to society and, Etzioni, to propose grandiose solutions as to how the active society might work. This transfer or contamination from natural scientific and technological thinking also led to conceptual exclusion of problems, solutions and alternatives which could not be dealt with as a consequence of the new, stringent demands on the (social and politi-

cal, T.A) sciences." (Petersen, 1985, pp. 244-245).

Our findings affirm this interpretation as regards energy policy. In chapter two we saw that the objectives of the energy policies of the 1950s and 1960s were to develop methods and techniques that would ensure that energy supply would at any time be able to meet a demand which was interpreted as autonomous in relation to national politics. Within this general framework we found a shift in the emphasis from the early 1950s, when physics and atomic technology were expected to contribute directly to solving social problems, to the mid-1960s when forecasting and planning increasingly came into prominence, indicating a transfer of scientific ideas and methods into energy political decisionmaking.

Summary: the 1950s and Early 1960s

During the 1950s and early 1960s, the effects of applying technology to an increasing number of problems in society were predominantly expected to be positive. These expectations included technology in general, not just energy technologies, and they were common to the whole OECD area including Britain or Denmark. Looking at science and technology policy and keeping in mind the problem definitions and policy solutions of the political groups identified in chapter two, we found that at least among these groups, a considerable degree of consensus could be identified about the desirability of an accelerated development of natural science and science-related technologies and the increased application of technology in all areas of society. Effects of science and technology which were identified as positive were intimately bound up with economic growth, and technological change was generally thought to support economic growth. Different political groups identified different effects of economic growth and technological change as positive. The labour movement and the socialist

and social democratic parties emphasized the potential for redistribution and the possible elimination of certain types of jobs. The conservative parties, on the other hand, saw technological change as a benefit to industry but also as a guarantee of social welfare. What is important to note here, however, is that all groups in society seemed in this period to agree on the desirability of a development in which science and technology was to play an increasingly important role. The negative effects of science and technology were only identified by individuals or groups who were either scientists, directly involved in research in the fields which were generally portrayed as prestigious, or citizens who experienced directly the visual impact of, or environmental pollution from, large-scale technological developments. But such experiences were not reflected by the political groups or in official policy statements where optimism reigned: they were still isolated experiences and could still be interpreted as separate and special problems, not inherent to economic growth or 'technology'.

5.3 The Early 1970s: New Problems are Identified

The (apparent) consensus did not last for more than approximately two decades: towards the end of the 1960s, the negative effects of science and technology began to make themselves felt. This phenomenon has been observed in most later political writing on technology and society. Official policy statements on science and technology policy from the early 1970s referred to the emergence of new problems in relation to science and technology as a major reason for the need to develop new forms of science and technology policy, including increased social control of technological change. In the 1971 OECD report on 'Science, Growth and Society' it was observed that although high levels of economic achievements based on technological advances had produced widespread prosperity, they had alter-

ed "man's environment and his working conditions" (OECD, 1971, p.11). As a result, new problems faced the political decisionmakers:

> "Today politicians and the public are more critical of demands for further expansion (in allocation of funds for R&D, T.A.) and are seriously concerned by actual and potential undesirable "side effects" of scientific and technological developments." (OECD, 1971, p.11).

In this statement there is still some doubt about the significance of these 'side-effects'. Two years later, however, there was no doubt: in 1973, Francois Hetman in a report to the OECD on technology assessment was less ambiguous on these matters. He observed that an expansion period in science and technology had come to an end, and that legislators and the public questioned both the costs and benefits of research but also the very objectives of the scientific/technological venture. As for the reason for this, there was no doubt:

> "The unwanted and often unforeseen side effects of technology are clearly manifest; (...)". (Hetman, 1973, p. 5).

This signals the beginning of a criticism of science and technology which was founded in the observation that rapid technological change had had unwanted effects. What had become of the optimism of the 1950s and 1960s?

We have already observed that single scientists, especially physicists and atomic scientists, back in the 1950s voiced some concern about the application of research, and that these concerns were limited to military technology on one hand and civil nuclear power on the other. At the root of these concerns were two entirely different sets of issues. Firstly, the ethical and philosophical questions involved in the development and subsequent use on human beings of atomic weapons after 1945, caused a large number of scientists to question the role of scientists in the

development of military technology. The secrecy involved in nuclear projects was heavily criticized, and the close relationship between civil and military development of atomic technology meant that this critique was applied to civil projects as well[17]. Secondly, when the civil projects were well underway, critiques were raised about the safety of the power plants. At least some atomic scientists were less sanquine than the editors of The Times who in a leading article in the early years of civil nuclear power confidently proclaimed that:

> "The technical problem of nuclear power production is solved. No major difficulties are seen from the standpoint of safety or that of disposal of radioactive waste. Nuclear power now moves out of the realm of invention into that of ordinary commercial economics -the realm in which the questions are not 'how' and 'whether', but 'how much' and 'how soon'." (The Times, 16 February 1955).

The same year, the President of the British Association for the Advancement of Science in a speech to the British Rotary Club[18] warned that the multiplication of power plants of the current design was premature unless these plants were needed for military purposes. Also, the Windscale accident in 1957 and the subsequent inquiries revealed that a number of scientists felt concerned about the practical handling of safety, the setting of standards for radiation and finally the political demand made on them to arrive at certain conclusions regarding the hazards connected to radiation[19].

It has been suggested that these concerns were systematically suppressed by the state, the media and the nuclear industry in unison[20]; and that the single scientists soon gave up their involvement faced with the tempting career prospects offered by the military-industrial complex[21]. But these suggestions do not contribute to explaining why technology did actually come to the fore as a political problem around 1970. If a power-elite had successfully

suppressed any concern about technology up till then, why did they suddenly stop doing it and by so doing, opened up a wave of criticism and public scrutiny ? In order to begin answering this sort of question, we shall have to have a closer look at the criticism of technology: Who voiced it and on behalf of whom? And what exactly were the nature of these negative side-effects of technology?

Towards the end of the 1960s, as we have seen earlier, the ability to achieve continuous economic growth was being seriously taxed by national economic problems in both Britain and Denmark. The laissez-faire policies of the previous decades were identified as the sources of obstacles to future growth: inflation, trade deficits, bottlenecks in particular sectors. In this situation the first planning oriented energy policies emerged. These policies were indicative of attempts to solve the economic problems by replacing the apparently insufficient market mechanisms by deliberate control. The future, it seemed, no longer took care of itself. Looking into policies for science and technology, we find the same tendency: it was increasingly thought necessary to forecast future trends in order to identify and, if possible, avoid future obstacles and disadvantages, just like it was thought possible to identify and support those trends that would benefit the economy[22]. Like the laissez faire policies, the freedom to invent and develop was identified as a source of problems. Hence the OECD, in a report in 1967 on technological forecasting observed:

> "Technological forecasting is a major input and - in view of the potential harmful effects of new technologies generated at the present pace and implying increasingly far-reaching consequences - is perhaps of foremost concern." (Jantsch, 1967, p.18).

The exact nature of these harmful consequences was not spelt out in any detail in the report, but we can get some hints from its proposals for objectives, subject areas and

methods for technological forecasts. It is pointed out that in "areas such as health, urbanization, and crime prevention", it might be desirable to make assessments of cost/effectiveness for social goals. This indicates that these were problem areas which were seen to be connected to the unrestricted process of technological change. Still, however, it was believed, that the application of science and technology in the form of forecasting techniques and rational decisionmaking could solve these problems, and although it was conceded that "the selection of goals is the most difficult task for social technology" (Jantsch, 1967,p. 91. Emphasis in original), was not thought inconceivable[23].

Only a few years later, the problems appeared on the one hand, more clear-cut and precisely defined, but on the other hand analysts of technology policy were less optimistic as to what could be achieved merely through the application of new methods and techniques in planning based on comprehensive forecasting:

> "Technology creates all sorts of economic, social, and environmental problems. In conjunction with its obvious and oft-praised benefits, technology has transformed regional into national and supernational economies, modified or destroyed social and political institutions, and been the direct cause of massive environmental deterioration. All this is now widely recognized." (Mitcham and Mackey, 1972, p.1).

Let us examine one by one the problems that were identified as being consequences of technology, directly or indirectly, by the OECD policymakers, and compare this to the contemporary political-philosophical critiques of technology to see if we can identify the new problems that had apparently emerged since the mid-1960s.

> "Faith in economic growth has been replaced by a feeling of unease in the face of the prospects opened by it and has been shown to be insufficient in itself to respond to the aspiration of mankind for a better way of

life. What is more, far from bringing only benefits, it is accompanied by more or less traumatic effects". (OECD, 1971, p. 26)

At the general level, economic growth aided by technology had not brought with it the expected welfare in the western world. Hetman (1973) observed:

"Contrary to the belief in the genuine beneficial influence of technology on economy, economic problems do not disappear but are shifted if not exacerbated, by the emergence of new urgent issues. In modifying economic structure in an assymetric way and more rapidly than can be understood and accepted in social terms, technological change intensifies rather than diminishes the urgency of economic problems." (Hetman, 1973, p.43).

In particular, the benefits arising from technological spill-over from a military scientific establishment taking up a still larger proportion of available resources was questioned[24]. The increasing amount of commodities available to consumers - an important aspect of economic growth - was thought a mixed blessing [25] because, although the single consumer may benefit by access to a more varied selection of goods, it may be at the expense of the deterioration of the general living conditions of himself and others[26]. All in all, it was argued, the increase in per capita GNP had not led to proportional increases in welfare; for example, it was suggested that

"(...) among the residents of central cities, the deterioration of urban mass transportation may represent a more serious decrease in living standard than the ability to purchase a television set represents an increase." (OECD, 1971, p.26).

More specifically, it was suggested that the growth process produced side-effects "of a highly non-linear character, appearing rapidly and creating a new collective need for their abatement and control, often with almost a threshold effect" (op.cit. p.28). It is these side-effects that were often seen as the result of the application of

technology in the growth process, and were most often referred to as the reason why social control of technology should be attempted[27].

Economic growth came under criticism from other sides during these years. The 'Limits to Growth' debate[28] followed the publication of 'Limits to Growth'[29] and 'A Blueprint for Survival'[30] in 1972. It is well worth noting, that these studies were published only after a concern about economic growth was being picked up by agencies like the OECD. It is also noticeable that theoretical critiques of technology linking technological change to the structure of capitalist economic growth only surfaces later still. Whereas the environmental problems had been discussed since the late 1960s, it was only in 1974 when David Dickson wrote 'Alternative Technology[30] that the link was made in theory between these problems and the economic and technological growth processes. As is evident, the problems identified in relation to economic growth did not in themselves indicate a special role for technology in creating these problems. We shall therefore have to look more closely into the issues which pointed to technological change as a main cause. It is worth noting, that concern about the effects of economic growth was already showing in the policy documents of a high-level body like the OECD when these studies were published, so the studies cannot have inspired those documents. Furthermore, whereas the policy documents clearly linked economic growth, technology change and unwanted effects, it would yet be some years before philosophical critiques linking economic processes to technological change and discussing the possibilities of creating an 'alternative technology' began[31].

The most important set of problems were related to <u>the environment</u>. Pollution of the environment was mentioned as a serious side effect of economic growth by the OECD in 1970, and a year later environmental pollution was identified as one of a number of

> "(...) cumulative effects resulting from technical choices and mass production, themselves the result of adopting efficiency and economy as the sole criteria of desirable growth." (OECD, 1971, pp. 30-31)

Hetman (1973) ascribes "the obvious pollution and general environmental degradation" (p.5) to technology; and protection of the environment and nature is among the four most important priorities for science and technology policy defined by the EEC.[33]

As we have seen, pollution was by no means a new and unknown problem in the late 1960s. Among other things, the production of energy had for some years created problems in relation to air pollution and also large-scale incidents like the Windscale fire had occurred causing a considerable impact on the environment. Further back still, Dickson (1974) mentions examples of major environmental problems arising before Christ in connection with deforestation in the Middle East.

Also public concern about the environment is not a new phenomenon as observed by Cotgrove (1976, 1978, 1982); Lowe and Goyder (1983); and O'Riordan (1981). All of these authors agree, however, that there has been an upsurge of in environmental interest since the late 1960s. For instance, Lowe and Goyder, investigating the dates of the formation of British environmental groups, found that whereas six such groups were founded between 1946 and 1955 and eleven between 1956 and 1965, the number rose to 22 between 1966 and 1975, and the character of the groups changed. Whereas the early groups were mainly concerned with amenity or conservation, often in terms of species protection or protection of particular types of habitat, the new groups concerned themselves more often with issues ranging across a wider field of questions related to the environment, and in particular there was an upsurge of interest in issues related to resources and to environmental pollution[34]. Sandbach (1981) quotes British and American

studies of public concern about the environment showing a sharp increase in media interest in environmental issues from 1969-72 followed by a slow decline. Sandbach concludes that the results of content analysis of selected newspapers do not necessarily reflect a genuine public concern, as the political stance of any newspaper is bound to influence the weighting of issues within that paper. Whereas we shall not in this place enter into the discussion of the role of the media in creating public opinion, in casu public concern about the environment, it is beyond doubt that the media and certain political agencies referred to such a concern as one of the motives for discussing these issues. Pollution, together with the other side effects of growth and technological changes, "arouse discontent that is not expressed in precise alternative concepts of the types of environment (...) desired." (OECD, 1971, p.660). Somewhat less precisely, Hetman (1973) referred to 'charges' against technology:

> "Technology is charged with a savage exploitation of nature and a respectless misinterpretation of freedom to use natural resources and to consider the planet as an object to dominate." (Hetman, 1973, p.34).

This suggests that the emerging environmental concern was thought to be so widespread and serious as to demand political attention. At the same time both the reports indicate that this concern itself represented an incorrect or overly negative interpretation of the ability of the political system to handle environmental problems. This does not imply, however, that the existence or severity of environmental problems was denied by the OECD; they are just interpreted differently. Thus, it is admitted that

> "Many aspects of developed societies are approaching a condition that may be described as the precursor of saturation, in the sense that things cannot go on growing much longer in some lines without reaching fairly fundamental limits. Indications of saturation are present total population, pollution of the environment, in the size of urban conglomerations, in traffic, in informa-

tion overload impinging on the individual, even in higher education and perhaps, in the view of some people, in the production of knowledge." (OECD, 1971, p. 21).

But it is important to note that in addition to these 'fairly fundamental' limits, the environmental problem as seen from the policy-making bodies had two dimensions: the physical problem itself on the one hand, and the public concern about this problem on the other.

Closely related to environmental problems, resources were identified as a major problem area. The resource area was considered a top priority in the EEC science and technology policy strategy as a problem that should be considered in drafting an OECD policy for science and technology[35]. Again, two dimensions of the resource problem were addressed: the problems raised by the accelerating use of raw materials on the one hand, and the public perception of this problem on the other. For example, Hetman (1973), while observing that "the depletion of natural resources through the unheeding exploitation of nature" (p.33) was mentioned as one unfortunate consequence of technological change, did not see this as a real problem. This conclusion was built on the observation that in the past a major role of technology had been to create new resources and helping to exploit the traditional ones. We have seen, however, that in the energy sector, where the effects of resource shortages (if not absolute, then in effect) had been experienced during the war, there was considerable concern both within the industries and governments to seek to avoid future resource shortages by promoting technologies which would use new resources. This concern, while not initially very strong, was strengthened considerably in the face of a threatening oil shortage and the experience of rapid price rises.

Another problem that could be ascribed to technological change and economic growth was the danger of increasing

unemployment. Whereas the environmental and resource problems as mentioned above were cited as major problems related to technology by the OECD in the early 1970s, this was not the case with unemployment. This may immediately seem paradoxical, as the main purpose of applying technology in production throughout history has been that of increasing efficiency by replacing human labour with (quicker, more efficient) machines. Looking into the philosophical literature on aspects of technological change during the period, we find that while this aspect has certainly not been overlooked, very different conclusions have been drawn from it. In the more speculative writing of commentators such as Williams (1955) and Gabor (1963) observations of the increasing displacement of labour were coupled with the prevailing expectations for unlimited economic growth. The result was predictions for 'the leisure society' in which, the authors feared, there would be a danger of widespread existential problems because some people would not be able to derive meaning from a life in leisure. We can safely say, that these predictions proved wrong in failing to identify one of the most important social problems of the 1970s: unemployment.

How come, then, that the OECD reports which, as we shall see later proposed evaluation of technology on the basis of an assessment of the whole range of consequences, overlooked the employment consequences of technology? Firstly, when the OECD reports were written in 1971 and 1973, unemployment was not yet a large problem. Secondly, we observed above that an important dimension of the problems related to resources and the environment was the public concern pushing these problems to the fore. But in 1971 and 1972, direct individual experiences arising from unemployment were as yet relatively few and scattered, while the effects on the environment were beginning to make themselves felt. Later, in 1975, in a framework for evaluation of technology assessment projects presented by the OECD it was stated that a particularly important aspect in

any assessment of technology was to consider impacts on employment opportunities[36], and in 1977 the EEC under a programme for industrial research gave priority to projects which would contribute to the creation of job opportunities in industry[37]. But by this time, the effects of growing unemployment was not a prediction but an experience in Western Europe. Even so, in policies for energy technology considerations of employment effects were not made until some years later. We must conclude that, in reality, technology assessments only considered already experienced effects of particular types of technology. The capacity to foresee new types of consequences, which is so crucial to the technology assessment concept, was in reality non-existent.

Another type of side-effect was the risk to life presented by the operation of particular technological installations (most prominently nuclear power plant and chemical factories) as well as by the problems resulting from mass use of technologies: Road accidents, air plane accidents etc.). Again, what mattered most to the policy makers of the OECD was the social acceptability of risks. The OECD observed that technological progress inevitably involved some level of risk, and that for some reason widely different standards applied as to the social acceptability of these risks:

> "For example, every developed nation accepts an enormous annual death toll from motor-car accidents, but views with great alarm the possible damage from low-level radiation from nuclear power plants." (OECD, 1971, p. 77).

We saw earlier that the question of safety in nuclear operations was considered an important problem by the anti-nuclear movement. The word 'safety' was used loosely to mean safety against a number of possible risks associated with using nuclear technology: health hazards to workers, operational risks, (accidents with consequences for

the local community and the environment), and risks arising in the associated operations: fuel production reprocessing, and transport (including the possibility of terrorists acquiring radioactive materials for use in acts of political terror).

The quotation above indicates that a certain irrationality seems to guide public acceptance of different kinds of risk[38]. But in addition we have observed that, at least until recently, the safety of other forms of energy technology than nuclear power was not an issue commanding neither public nor political interest save trade union demands for safety in mines. Also, as observed by the OECD, objectively very dangerous and health-threatening technologies (like the car) have not been the subject of public debate to the extent that nuclear power has. In relation to nuclear power, the question of safety was only raised by anti-nuclear groups in the early 1970s, at a time when the industry and government had for quite a long time been aware of the costs arising from the risks, and had established institutions to deal with them. The novel aspect of the 'risk' discussion was that 'risk/safety' at a general level was seen as a problem associated with all kinds of technology.

The development of certain technologies was also seen to cause problems in relation to social integration. The OECD observed that:

> "In human relations, conflict and misunderstanding are evident between generations, between labour and management, and between the academic, corporate, and government segments of society. These conflicts arise in part from genuine divergence of interest and values, in part because the very size of institutions and groups tends to restrict communication outside of particular groups, in spite of the increased ease of communication."(OECD, 1971, p.19).

This problem was seen to be exacerbated by the trend to-

wards large corporations and bureaucracies which organised work in such a way as to maximize control and predictability for the organisation, and the OECD feared that this trend would further strengthen "social attitudes of the Luddite type, hostile to technology and to technology decision-making in general." (OECD, 1978, p.29).

In relation to energy, this type of effect began to show in the mid-1970s when the anti-nuclear group increasingly focused their critique on the inertia in the political economic, and technical institutions making up the 'energy establishment'. The groups, who had tried to influence energy policy, had increasingly had to confront the failure of their attempts to convince governments that the traditional energy strategies were irrational. A search began for reasons for this, and this search was paralleled with a preoccupation among a certain group of theorists e.g. Winner (1977) with the idea of imperatives inherent in the technologies of contemporary societies:

> "Technological imperatives appear in public deliberations as generalized 'needs' or 'requirements' - for example, the need for an increasing supply of electrical power - which justify the maintenance and extension of highly costly sociotechnical networks." (Winner, 1977, p. 259).

The abovementioned problems all had to do with the financial and political dysfunctions - loss of investment, public protests - which had been side-effects of technological development during the period of economic growth. But in addition came the problem complex or syndrome resulting from all these problems occurring at the same time. Decision-makers began to worry about the possible consequences of the growing public mistrust in science and technology:

> "Scientific research became associated in the minds of many with war, and with environmental and social degradation resulting from large-scale application of technology. (...) Interestingly enough, the attack on science and technology came from both right and left.

> From the right they were viewed as wasteful pastimes of scientists of doubtful value to industrial development, from the left as instruments of economic and military domination and irrrelevant to the pressing social problems of the day. High-technology industry was regarded as regressive in its impact on income distribution, and science itself anti-egalitarian in its organisation and mores. Economic growth ceased to be regarded as an unmixed blessing." (OECD, 1971, p. 40).

In this way, the OECD summed up the observed 'disenchantment'. Three things may be noted in this connection: 1) it was suggested that the disenchant was associated with the large-scale application of technologies; 2) the disenchantment seems to have been connected to particular types of technology: when it was suggested that science and technology was viewed by the right as wasteful pastimes of scientists, it is obvious that the charges were not against those technologies that could immediately be seen to be of direct use in the production process, just like it was suggested that the disenchantment of the left was closely related to 'high-technology'; 3) the disenchantment with science and technology was thought to spring from the same source as the disenchantment with economic growth. It is evident from the following OECD reports on technology that this diffuse disenchantment represented a serious problem to the decisionmakers. The first chapter in the first comprehensive report on technology assessment[39] was devoted to "Disenchantment with Technology and Technological Progress". A distinct uncertainty characterized the interpretation of this 'disenchantment' at this stage:

> "What are these attitudes? As far as the public at large is concerned, they are practically unknown and what can be learned by bribes about reactions to specific projects is confusing and contradictory." (Hetman, 1973, p.21).

With respect to energy technology and energy R&D, we have seen that a comprehensive criticism of the role of science in creating problems e.g. in relation to nuclear power on-

ly occurred in the mid-1970s. This means that the oil crisis and the establishment of energy policy as an important element in public policy preceded coherent expressions of discontent with science and technology. Before that time the 'discontent' existed only to decisionmakers interpretations behind the motives of isolated actions and protests against particular technological developments and demands from groups like Friends of the Earth that long-term environmental and social considerations should replace short-term economic rationality on the other.

Both the increased economic and political significance of unwanted side-effects of technology and the fear of growing public discontent interpreted by decisionmakers as results of inability in the part to control technology. It was observed that in the past science and technology policies had merely managed to underpin a technological development which increasingly had produced negative effects. The hope that a free development of science and technology would aid the fulfilling of the aspirations of all social groups in the industralized world had not come true, on the contrary, it had created serious problems. In this light, the sum of problems could be interpreted as one administrative problem: that of control:

> "As technology is directed more towards the solution of problems that have large social and administrative components, the autonomous approach to technology is even less appropriate today than it was in the 1960s." (OECD, 1971, p. 45).

The tools which had been developed towards the end of the 1960s to deal with the emerging uncertainties accompanying technological change, e.g. technological forecasting and systems analysis, were now criticized for having severe limitations under conditions of technical uncertainty, conflicting goals, and implicit non-scientific value judgements[40]. It was now realized that the problems in controlling technology were more complex and had strong

political dimensions. The borderline between technology and politics was getting blurred.

Summary: the early 1970s.

Using the succession of issues in OECD reports on science and technology policy as an indicator of problems in relation to technology, we found that in the years immediately after 1970 a growing realization that 'laissez-faire' technology increasingly produced problems which were left for governments or supra-national political institutions to solve:

- economic growth had led to increased prosperity but not to increased welfare, and had increased the pressure on governments for 'non-market' commodities. This situation was exacerbated by the unexpected effects created by large-scale application of certain technologies.
- the positive side-effects of technological change had failed to appear. For example, the spill-over from military and aerospace technology had not led to the expected advances in civil technology. Instead, the technologies developed during the 1950s and 1960s were seen to give rise to large costs to society in relation to the environment, resources, employment, social integration, and general public mistrust in science and technology.

Taken together, these problems were interpreted by the OECD decisionmakers as reasons for extending the public control of technology.

With respect to energy technologies, of the above problem areas only the environmental effects of energy production and risks arising from the use of nuclear power received any attention before the oil crisis. These problems had, as we saw in chapter three, been raised by groups like Friends of the Earth. Earlier we have termed the emergence

of new groups and issues ' the politicization of energy'. Now we see that demands that energy policy should take into consideration the results of using specific types of technology were parallelled by a widespread recognition that economic growth and technological progress had failed to redeem the 1950s promises of a future in abundance.

If, as we have suggested, changes in state energy policy reflect actions by political groups in society, then we would expect that this 'politicization of technology' would have influenced the assumptions underlying state energy policy before the oil crisis. In chapter two we observed that around 1970, state energy policy was intensified in both countries, albeit most markedly in Britain. This observation alone, however, is not sufficient to establish whether these changes were influenced by the politicization of technology. Before this can be done, we need to look at the development after the oil crisis, in particular we shall have a look at the new policies and methods that were introduced: could they be seen as attempts to solve the problems related to technology? We shall seek to gauge the impact of the oil crisis and its effects on the technological strategies of energy policy in order to evaluate it against the impact of technological effects against. Finally we shall discuss some of the 'paths not taken': the alternatives and utopias which represent different attempts to develop the critique of technology into coherent alternatives for social development.

5.4 Remedies against Technological Problems.

> "Change cannot be left to follow the logic of technology alone; society must adapt itself, both to moderate innovation according to needs and to avoid undesirable side-effects." (OECD, 1971, p.77).

According to the OECD reports, and to the hordes of model-

builders attempting to provide new tools for decisionmaking in this field[41], what was needed was new instruments which would allow social goals to be impressed on technological change. Let us therefore have a look at these new instruments which were adopted in state energy policy and discuss the assumptions on which they were founded.

Until the late 1960s, government attempts to control the negative side-effects of technology were clearly identifiable as reactions to isolated and well-defined problems whose solution depended on state intervention. For example, the Clean Air Act is one such isolated reaction to the specific problem of pollution from coal-fires. In both countries, nuclear power seemed to be an exception from this rule as standards for permissible levels of radiation were set prior to initiating the programmes. But whereas civil nuclear power could not have generated negative experiences, the risks were known from the military uses, so in this sense, nuclear policy was reactive. This conclusion is strengthened by our observation that the standards through the period the policies were adjusted as experience grew.

In the late 1960s, the first reactions to the beginning uncertainties relating to technology emerged in energy policy as an increased interest in forecasting energy demand and supply. The main rationale was to ensure in the future a match between energy supply and demand. Conjectures about possible developments in the technologies for energy production were used to adjust the forecasts, but the predictions appear to have been based on information from within the energy producing industries, rather than in formalized technology forecasting of the sort that is described by e.g. Jantsch (1967). The beginning of the 1970s was marked in both countries by the adoption of new objectives in state energy policies. External effects of energy production in fields unrelated to energy increasingly attracted attention, beginning with consequences for the en-

vironment and safety of workers and the population, widening out to include the consequences for future resource availability (after the oil crisis) and consequences for employment, civil liberties, social integration etc. This development of focus is reflected in the recommendations of the OECD for future technology policies. The central instrument of such policies was to be Technology Assessment. To see if the discussions about Technology Assessment have influenced energy policy, we need to know the basic principles of technology assessment.

'Technology Assessment' is an exceedingly imprecise term, but it is usually used to denote a method or procedure which aims at providing political decisionmakers with information about the consequences of technological developments[42]. In policy statements of the early 1970s, the term was frequently used to denote rather grand schemes which should replace traditional policies towards science and technology:

> "The general aim of technology assessment is to evaluate the social costs of existing civilian and military technologies in the form of pollution, social distruptions, infrastructure costs, etc., to anticipate the probable detrimental effect of new technologies, to devise methods of minimizing the costs, and to evaluate the possible benefits of new or alternative technologies in connection with existing or neglected social needs." (OECD, 1971, p. 82).

Hetman (1973) defined the control of technology as a process analysis, forecasting and assessment of technological futures leading to decisionmaking, and described the central elements of such a process:

> "1) Monitoring and abatement of negative side-effects of existing technologies and development of socially acceptable alternatives.
>
> 2) Screening and selecting of new technologies resulting from already known or attainable scientific results.

3) Need for original R&D in the development of new and desirable technologies in relation to changing social goals and future priorities." (Hetman, 1973, p. 65).

But this concept of technology assessment was so broad as to allow for a variety of interpretations when it was translated into proposals for political practices or institutions. As an example of the problems arising at the theoretical level, one can counterpose two distinctly different interpretations of technology assessment:

"Technology Assessment is a policy-oriented tool. It is to provide decisionmakers with perceptive, impartial information about possible negative first as well as second and third order consequences of not yet fully developed technologies or projects. Consequences include beside economic and safety distinctions, social, regional, local and class-related consequences." (Maaløe, 1982, p. 15).

Technology assessment thus defined is only a small subset of Hetman's broad-ranging social techniques. Maaløe does not address the 'active' aspects of technology assessment to do with developing and selecting alternatives, and neither does he include Hetman's third aspect, the search for desirable technologies. Also narrow, but with a quite different point of view is Elliott and Elliott's (1977) description of the idea of technology assessment:

"The idea is to constitute a special institution, manned by specialists, as a watchdog body, charged with monitoring public and private sector technological plans and projects, with regard to the public interest. This body would report to government (...) and advise on the desirability in the long term of proposed projects." (Elliott and Elliott, 1977, p.130).

This model incorporated, in addition to the monitoring and preparation of consequence analyses, an advisory function. The technology assessment institution should not just draw up the consequences of technologies but also evaluate

their desirability in terms of the public interest. This idea was strongly objected to by proponents for 'neutral' assessments, like Carpenter (1973):

> "(...) Technology assessment does not make decisions. (...) The comparison of options may show that one is clearly outstanding. However, the results should be presented without advocacy permitting the political process to add its context to a neutral objective assessment." (p.366).

The implicit assumption that assessments can be objective or neutral seems naive against the background of the assessment format outlined by OECD (1971) and Hetman (1973). On the other hand, if the idea of technology assessment is narrowed down to a method for analysing the quantifiable consequences of particular technologies on well-defined impact areas, there is more scope for such claims. Looking at the practical experiments with technology assessment, narrowing down of the assessment concept is exactly what has happened. In reality, 'Social Assessment of Technology' or 'Technology Assessment' soon became labels attached to very different studies. The OECD Committee for Scientific and Technological Policy in 1978 reviewed 15 studies which had been made available to the committee by the OECD member countries as representative examples of work in the field of social assessment of technology[43], and found that the actual practise was far removed from the original ideals:

> "(...) Most of them can be labelled technical-economic feasibility studies, broadening the analysis of both technical and economic aspects in comparison with more conventional types of studies." (OECD, 1978, p.42).

A 'proper' social assessment of technology, according to the committee, could not be partial but would have to establish a "systematic inventory of the possible impacts on society" (p.42) including "besides the usual technical and economic ones" (ibid.) the impacts on individuals, social

groups, the environment and value systems and taking into account the options of "those social groups who have previously been considered as external to the decisionmaking process" (p.43).

The few proposals for technology assessment of energy technologies were characteristic of the tendency to focus on single technologies, known and measurable consequences and quantification of impacts. Neither in Denmark nor Britain have energy technology assessments been attempted. A German study reviewed in OECD (1978) was concerned exclusively with the effect of nuclear power plants on the pollution levels of water resources and the atmosphere. Quite a different angle was used by Sinclair (1973) who review British practices and experiences involving evaluations of technologies[44]. Sinclair suggested that the concept of risk in terms of the cost to society of technological hazards should be central to technology assessment:

> "(...) the rationalization of national R&D policies may be effectively assisted by the interconnection of the relative risks arising from alternative technologies with implicit numerical valuations." (Sinclair, 1973, p. 37).

Using this approach it would be possible to allocate, for instance, R&D expenditure in such a way as to optimize the prevention of risk over a number of activities in terms of social costs. As examples of such activities, Sinclair mentions e.g. agriculture, pharmaceuticals, steel handling, nuclear electricity and high rise flats.

Even though neither comprehensive technology assessments including energy technologies nor 'partial' assessments like those sketched above were attempted in Britain or Denmark a number of techniques were being adopted which addressed related problems.

In chapter two, we saw that, both in Britain and Denmark,

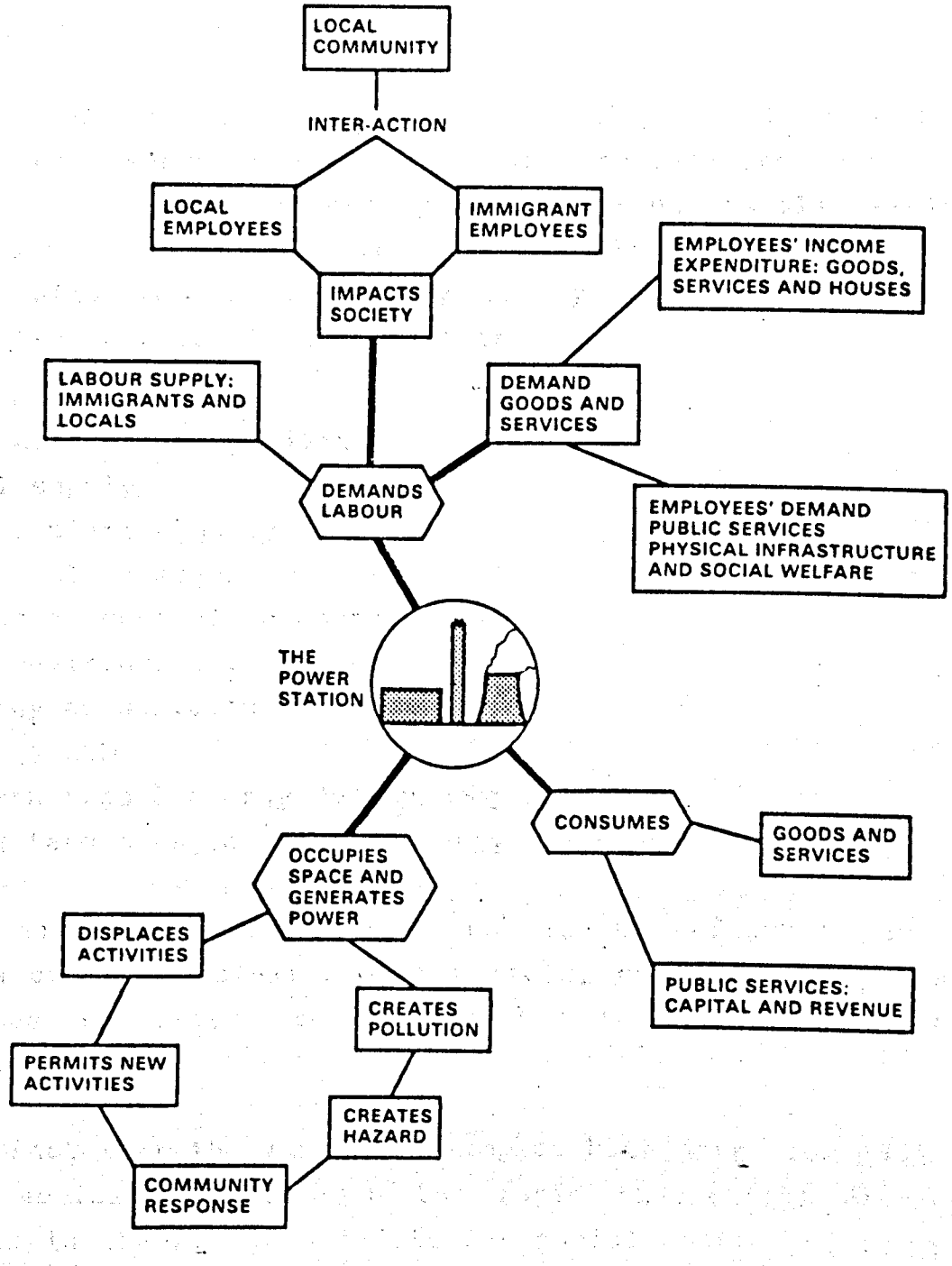
procedures were adopted to ensure the public acceptance of energy policy. For example dissemination of information was thought to ensure that the public became aware of the technical and economic problems in relation to energy policy. In Britain, planning inquiries was adopted as an instrument to ensure that the public was heard in large developments. Again it was characteristic that procedures were either ad hoc as in the case of the information campaigns or directly transferred from other areas as in the case of the public inquiries.

The adoption of techniques like EIA, environmental impact analysis, was another reaction to specific problems arising e.g. in the siting of new power stations. In a report on methods for predicting and monitoring social and economic effects of power stations[45], it was observed that, most likely, power station proposals would become the occasion for sharper debate in localities in the future. The increasing tendency to question the need to expand electricity capacity, represented a potential obstacle to the expansion of the electricity supply:

> "(...) if such opinions gain further currency, there would be increased difficulty in local consultations in using the normal justification that there was a need for new capacity in the national or regional interest, whether or not the technical arguments were sound." (Power Station Impacts Project, 1981, p. 14-15).

In this situation impact analysis should serve as means of providing answers to critical questions about the impacts of the planned developments. Fig 5.1 shows the conceptual model of impacts used in the project. It will be observed that the technological project ('the power station') is given. The task is restricted to modelling effects of this particular development in this particular local area. Obviously this kind of model is a very long way from the systematic approach looking into consequences of whole technological systems against the background of assess-

Fig. 5.1 Conceptual Model of Impacts of Power Station Developments.



Source: PSI Research Team: Power Station Impacts. 1: The Socio-Economic Effects of Power Stations on their Localities. Oxford: Oxford Polytechnic, 1979, p. 6.

ments of social ends. Furthermore, the impact assessment takes place in the implementation of energy policy, not at the level of national energy policy formulation. For the general public this means that they get involved, if ever, only at a stage when it is a question of accepting or rejecting a specific proposal.

That only fragments of the originally grand schemes to counter disenchantment with growth, science and technology found their way into energy policy making was also evident in Danish energy planning. In the 1981 energy plan, the following aspects of energy policy were quite literally treated in watertight compartments:

raw materials
the natural gas project
coal supply
power plant economy
renewable energy
means of control in energy policy
the environment
energy conservation
energy R&D
international energy policy cooperation
long term perspectives in energy planning.

The number and character of the issues reflect an awareness of the complexity of the field, but in reality these issues are never brought together to form a consistent whole.

The fact that the last two examples both date from 1981 is not accidental. Although the rapid theoretical developments in theories and models for social control of technology took place around 1970, the issues relating to different kinds of impacts or consequences of energy technology only emerged state in energy policy at a much later date (again with the exception of issues related to the

safety and environmental impacts of nuclear power). In chapter two and three we saw that new methods were only adopted in energy policy when new problems appeared and were translated into specific demands for change by one or more of the political groups. This implies that the adoption of instruments addressing problems related to the impacts of energy technologies signify the existence of material as well as political problems in this field. When we stress that material problems are a precondition for the adoption of new methods, it is because we want to stress that pressure from a political group indicates the existence of a problem. But this indication is not sufficient to conclude that the state will react to the pressure by adopting the means suggested by the group. For example, in spite of the fact that environmental groups had promoted renewable energy since the late 1960s, it was only after oil prices had begun their rise that any research into these technologies was initiated, and this goes for both countries. Still, however, the bulk of energy R&D was devoted to the technologies that were seen to have caused environmental problems but which still represented solutions to the central problem, the dependence on oil, i.e. coal burning, nuclear power, gas burning. At the same time increasing efforts were mounted to seek to alleviate the problems of the 'traditional technologies' by what is usually termed 'technical fixes': increased control of the labour force at nuclear power plants, higher chimneys at coal fired stations etc. In terms of short term cost, these solutions were obviously most attractive and so were attempted.

Hence 'the social control of energy' in Denmark and Britain after the oil crisis was only oriented towards a very limited spectrum of consequences of which the most important was savings in terms of imported oil. As the general economic crisis deepened in both countries, the importance of this objective increased, and, in this light the emphasis on supporting indigenous production of oil

and gas must be seen.

Summary: Remedies against technological problems.

The observations made here support the suggestion that, whereas the political concerns sparked by the increasing inability of the economic and political systsem to cope with unwanted effects of technological change are reflected in the adoption of new methods in the implementation of energy policy, these concerns have not influenced the central issue in energy policy which in both Britain and Denmark remained the economic impact of society's use of energy. The problems related to the effects of technology were in a sense superimposed on this central concern. Solutions to them were recommended by political groups who experienced a particular set of effects as negative and consequently demanded changes of policies that would (or would seem to) solve this particular problem.

Against this background we shall now briefly review a number of 'alternatives' which are more or less consistent attempts at prescribing solutions to the whole complex of problems related to growth, science and technology. We shall discuss briefly also why particular elements in such strategies must (in the present context, at least) be regarded as utopian whereas others have already been incorporated in state energy policy-making.

5.5 Alternatives and Utopias.

Above we reviewed policy solutions to problems arising from the effects of technology. These changes in technology policies were paralleled by a theoretical development. The policy-oriented theories had in common an acceptance of the basic economic and political structures of the capitalist industrialized world: they represented solutions

in theory to problems raised by technology assuming that the basic economic and political structures remained intact. Parallel with this kind of theoretical development, we find quite a different and distinctly more radical approach to the same problems.

Theoretically you can do anything, so why not create a society which is the positive mirror-image on all counts of the present, problem ridden world? A 'soft technology community':

"ecologically sound
small energy input
low or no pollution rate
reversible materials and renewable energy sources only
functional for all time
craft industry
low specialization
communal units
village emphasis
integration with nature
democratic politics
technical boundaries set by nature
local bartering
compatible with local culture
safeguards against misuse
dependent on well-being of other species
innovation regulated by need
steady-state economy
labour intensive
integrates young and old
decentralist
general efficiency increase with smallness
operating modes understandable by all
datechnological accidents few and unimportant
diverse solutions to technical and social problems
agricultural emphasis on diversity
quality criteria highly valued
food productions shared by all
work undertaken primarily for satisfaction
small units self-sufficient
science and technology integrated with culture
science and technology integrated with other forms of knowledge
weak or non-existent work/leisure distinction."

(Clarke, R.: Soft Technology: blueprint for a research community. Undercurrents 2, 1972. Cited here from Sandbach, 1980).

These principles do in fact in the original text mirror the principles or characteristics of 'hard technology'. This list of principles resembles very closely the problems identified by the OECD, but the theoretical solution here consists of negating the problems and presenting the sum of negations as a solution, regardless of the interrelations between the single components.

That this kind of utopia became the focus of attention for a whole branch of social science from the mid-1970s[46] can be explained by the fact that elements of such a utopia was present in the arguments used by environmentalists in the debates in relation to energy, technology and the environment. Much discussion has centred around the possible existence of a coherent set of values underlying the utopian ideas, whether they have been termed 'post-materialist values'[47], or the 'Alternative environmental paradigm'. The latter was described by Cotgrove (1982) using factor analysis based on a survey of opinions on a number of issues related to the environment. The survey included a sample of the general population and samples of industrialists, trade unionists and environmentalists. The following dimensions were identified:

Core values	Non-material (self-actualization) Natural environment instrinsically valued Harmony with nature
Economy	Public interest Safety Incomes related to need Egalitarian Collective/social provision
Polity involvement)	Participative structures (citizen/worker Non-hierarchical Liberation

Society	Decentralized Small-scale Communal Flexible
Nature	Earth's resources limited Nature benign Nature delicately balanced
Knowledge	Limits to science Rationality of ends Intergration of fact/value, thought/feeling.

Quite a lot of mental energy went into the examination of these values: Are they internally consistent? Are they really commonly held by environmentalists? Which assumptions would have to be made in order to arrive at a society founded on values like these? These were just some of the questions asked by social scientists and others inquiring into these issues. For example, inconsistencies in the soft-technology 'paradigm' might imply that no agreement could be reached even on basic principles, and that would lead to problems even at the apparently wholly practical level:

> "Equipment that is simple to operate may be complex to manufacture; that which is simple to manufacture may require great skill to operate. Trying to make every aspect simple may reduce output to even lower levels than soft technologists (and certainly trade unionists, T.A.) would be prepared to tolerate. At current costs devices like windmills or solar collectors do not provide cheap power, and if economies of scale are to be foregone, could they ever be feasible alternatives? These and a thousand questions like them form a vast and challenging research-and-life programme for all those looking for another alternative." (Harper, 1973, p.303).

Harper's solution to this was 'a long, social revolution'. He saw evidence of the beginning of such a revolution in alternative science, in alternative economics, utopian communities and the emergence of critical theories about capitalism, imperialism, technocracy and alienation.

But, as we have seen, society is not a package-deal. While in some corners of society it might have been be possible to recognize the contours of 'alternative' ways of life, the mainstream of economy and politics was still concerned with economic growth, employment and other traditional items. Just like the OECD ideal of the consequence-oriented society was a package-deal of which only fragmented ideas and isolated models were adopted in policy-making, so these utopias represented package-deals, and more challenging ones, in that they assumed the abolition of economic rationality. But just like the OECD's ideals, fragments of the utopian ideals appeared in issue-specific policy recommendations.

An example of such a theoretical single-issue strategy is Amory Lovins' (1977) 'Soft Energy Paths'. Lovins suggests that a 'soft' technology which is environmentally benign and efficient with respect to energy consumption can be implemented through government action. According to Lovins, technologies are 'soft' if they possess the following characteristics:

1) They use renewable energy;

2) they are diversified;

3) they are flexible and relatively 'low' technology, not in the meaning of being unsophicated, but rather easily understandable;

4) they are adapted to the need for net energy with regard to scale and geographical distribution.

5) They are adapted to the need for net energy with regard to quality of energy[48].

Energy technologies like these could be implemented, according to Lovins, by increasing government intervention in the energy sector. He proposed a three-step strategy:

1) Correction of institutional barriers that prevent a spread of energy conservation;

2) removal of subsidies to conventional fuel- and power

industries;

3) gradual attainment of correspondence between energy prices and the cost of replacing the dwindling supply of cheap fuels[49].

These measures should be initiated by government, whereupon the market mechanism would do the job of replacing 'hard' with 'soft' technology. Lovins argued that the adoption of soft technologies would give rise to 'economies of small scale'. For example, a decrease in capital costs of power production would result from mass-production of small-scale production systems. Industry just had to be convinced that such a strategy is profitable:

> "This will demand a philosophy of production oriented towards technical simplification, low replacement costs, slow obsolescence, high reliability, many units and low gross earnings; but these are well known concepts of mass-production. The resistance of industry towards this would probably dwindle when the possibility of profit was perceived." (Lovins, 1977, p. 60) (Emphasis added).

The approach whereby the state provides the market with incentives for producing particular items in particular ways presupposes a consistent long-term planning, and indeed Lovins recommended the adoption of a planning horizon of 50 years. In the absence of political consensus, such a strategy seems highly unrealistic. In addition, Lovins suggested that the adoption of a soft energy path would be an important step towards a new social order. Lovins was not very clear on this point. On the one hand, he emphasized that the soft energy path was consistent with a liberal society and would yield advantages for all social groups (p.41, 174); on the other, he argued that choice of technologies imply choice of values, and that soft technologies implied values like frugality, simplicity, diversity, local community, humility and craftsmanship (p.77).

At a still more practical or pragmatic level, we (as we

saw in chapter three) find the alternative energy strategies put forward by the different political groups. These strategies relate to the 'soft-technology paradigm' in a similar way that the technology assessment studies relate to the idea of technology assessment. The alternative energy strategies promoted, as we have seen, particular (renewable energy-) technologies without paying much regard to the political and economic context.

In practice, as we have seen, the renewable energy technologies were introduced, albeit as yet at a small scale, into the energy supplies of both Britain and Denmark as one possible solution to the problems inherent in the traditional energy-producing technologies. But the introduction of these technologies did not change the basic economic or organisational structures of the energy supply of either country. They were introduced only to the extent that they seemed to represent viable solutions to the traditional technologies.

2.6 Conclusions.

These observations of the interrelationships between the complex problems interpreted as related to economic growth and technological change, the theoretical 'solutions' to these problems, and the reactions of the political system prompt us to ask with Hahn:

> "While technology may often be identified as a causal factor, it usually is not the controlling decision element. Has technology for some reason been singled out to be the whipping boy? Or is it just more handy as a relatively more tractable and explicit feature to manipulate in complex policy level decisions? (...) Why don't we hear the phrases economic assessment, social assessment, environmental assessment or assessment? (Hahn, 1973, pp. 1014-1015).

Against the background of the above review, a first answer

would be: we do hear them. We have seen that both the original concepts of technology assessment and the alternative strategies represent frameworks for such 'total assessments'. The question is therefore: why don't we have them?

At this stage of the analysis it is possible, based on our observation of the historical development of energy policy, to give a number of good reasons for this. The analysis seems to suggest that changes have been brought about, not by design, but by a complex process in which political groups have reacted to what they experienced as negative conditions by trying to change these conditions. Also they have looked for theoretical explanantions as to why the contemporary social structure produced undesirable results, and for possible solutions.

But, in addition, our analysis has shown that in spite of calls for evaluation of non-economic effects of technologies, the economic factor has consistently been of greater importance.

This chapter, together with the two preceding chapters, has given support to the hypothesis describing the elements of historical processes involved in the changes in energy policy. They have also given support to the hypothesis, that this process has been common to Britain and Denmark. We have still to discuss the theoretical background for these observations. To this discussion we turn in the next chapter. Here we shall investigate in more depth the problem still before us: what is the relationship between changes in policy and changes in the real problems that this policy addresses? What is the role played by the state? By industries? By individuals? By political groups? Which process (or processes) links problems to reactions?

NOTES FOR CHAPTER 5

1. Winner argues that the use of the word technology falls in one or more of the following categories:

   a) Objects usually referred to as technology: tools, machines, instruments etc. Winner denotes these objects apparatus.

   b) Technical activities: routines, skills, methods, procedures. Technical activities are distinguished from other types of activities by being purposive and rational. Winner terms these activities technique.

   c) The present-day use of technology furthermore refers to organisation, i.e. such social arrangements which are rational-productive (like firms or research establishments).

   d) Finally, 'technology' is used to denote networks which combine people, apparatus and organisations across distances (e.g. telephone systems or electricity grids).
   (Winner, 1977, pp. 11-12).

2. See e.g. Jantsch, (1967), p. 15; Organisation for Economic Co-operation and Development (1971), p. 17.

3. See for instance 'Capital', vol. 1. Sandbach (1980) represents a narrower interpretation of technology in a Marxian framework, using 'technology' as synonymous to 'fixed capital'. His inability to uphold this definition (e.g. the Green Revolution is described as a technology) indicates some of the problems inherent in a direct application of Marxian terms to phenomena outside the sphere of production.

4. 'Science policy' is defined here as "policy for the development of technology, as well as policy for science as ordinarily understood" (Organisation for Economic Co-operation and Development (1971), p. 37.

5. Petersen (1985), p. 331-339.

6. According to OECD, op.cit. the period from 1961 to 1967 was characterized by science increasingly being related to a wide range of national problems "beginning with health and extending into the social and economic domain generally." (p.39).

7. In Mitcham and Mackey (1972) several philosophical essays from the 1960s are reprinted. Ellul (1954) represents the earliest comprehensive critique of the social consequences of technology.

8. See Budge et.al. (1983); Hansen (1972).

9. See section 4.2

10. Gabor (1964) saw nuclear fusion as "our boldest hope", while Williams (1967) was contemplating the introduction of new materials and techniques to replace coal and oil.

11. The 'laisser innover' explanation attributing the main thrust in technological change to market forces and skills of particularly capable entrepreneurs is referred by Hetman 1973 and attributed to inter alia Myron Tribus.

12. See the Advisory Council on Scientific Policy: Scientific and Engineering Manpower in Great Britain 1959. Cmnd 902 xx. London: HMSO 1959; Ministry of Labour: Scientific and Engineering Manpower in Great Britain. London: The Ministry of Labour and the Lord President's Office, 1956.

13. Cammilleri (1984) observes the success of the First International Conference on the Peaceful Uses of Atomic Energy in "establishing nuclear power as the symbol of modernity and progress." (p.13).

14. For this interpretation of side-effects, unintended effects and externalities we are indebted to Winner (1977) and Hetman (1973).

15. The Times, 17 July 1950.

16. Op.cit. 29 January 1955.

17. Camilleri (1984) describes the reactions of the Los Alamos scientists after the implications of the project had become clear and observes that the scientists were sharply opposed to the military. Also in Britain scientists were concerned about the nuclear project. The Council of Atomic Scientists' Association complained about the secrecy of the project which they thought conducive to protection of vested interests, inefficiency and lack of public influence in influencing the objectives of the project. The Council proposed that reports should be issued at regular intervals through the HMSO (The Times; 23 January 1950).

18. Sir R. Robinson quoted in The Times, 6 September 1955.

19. Wynne (1982), pp. 20-23 documents this concern by referring to the inquiry reports published after the accident.

20. See Wynne (1982), pp. 22-23.

21. See Camilleri (1984), p. 13 f.

22. Jantsch (1967) strongly emphasizes the need to be able to identify technological potentials and limitations so as to be able to increase efficiency in resource allocation, by identifying and hedging against major risks of loss of investments.

23. "The problem is to break out of the extended present, the 'logical future' and select, for a normative approach, the best feasible anticipation in order to make it the 'willed future' (...). To achieve this most difficult task, a feedback system must provide the framework for the evaluation of alternatives." (Jantsch, 1967, p. 92).

24. OECD (1971) cites the example of Japan, having the smallest military budget in percentage of GNP and the highest growth among in-

dustrialised nations (p.43).

25. Ibid, p. 35 f.

26. The classical example is that of the car, which to the individual represents increased freedom to travel. When, however, car-ownership becomes common, it is accompanied by traffic congestion, traffic accidents, pollution etc. The result is that the benefits from car-ownership to the individual decreases, and that general living conditions are negatively affected.

27. For example, a committee under the Danish Teknologirådet (The Technology Council) in 1980 published a report on technology assessment in which it was observed, that "The Criticism of technological development to a certain extent derives from uncertainty with respect to certain consequences of technology (...). At the global level pollution and ruthless exploitation of resources have given rise to problems which for their solution demand changes in the development process. Within each separate nation technological change has impacts on e.g. employment and patterns of consumption, and a sizeable proportion of public expenditure in health and social services is due to technological change." (Teknologivurdering i Danmark, 1980, pp. 8-9).

28. See O'Riordan (1981) p. 52 ff. for a discussion of the assumptions and conclusions of these studies as well as the reaction to their publication.

29. Meadows et.al (1972).

30. Goldsmith et.al. (1972).

31. Dickson (1974).

32. OECD (1970), ch. 5.

33. The European Economic Communities Commission (1977 I).

34. These conclusions are drawn on the background of the research done by Lowe and Goyder (1983) on the central concerns of environmental groups.

35. OECD (1971); Hetman (1973).

36. OECD (1975), p. 30. Interestingly, it is observed that the assessment projects evaluated in the study did not consider this aspect in any depth.

37. The European Economic Communities Commission (1977 I).

38. Slovic and Fischhoff (1979) and Elster (1979) discuss different aspects of the use of 'risk'. Slovic and Fischhoff here cites a study in which different risks associated with thirty technologies were ranged on nine qualitative scales by the persons participating in the study. It was found that the benefits of nuclear power were evaluated remarkably low, while the risks were

seen as extremely high.

39. Hetman (1973).

40. OECD (1971), p. 47.

41. Cetron and Barthocha (1973) give an overview of models in technology assessment. A comprehensive evaluation of technology assessment projects is found in OECD (1975), while proposals for participatory structures for social control of technology are given in Boyle et al. (1977).

42. Technology Assessment as a concept was first formulated in the US Congress' Science, Research and Development Committee. (See Hetman, 1973, p. 54f; Cetron and Bartocha (eds.), 1973).

43. OCED (1978).

44. The inquiry by the Roskill commission into the siting of a third London airport is frequently cited as the case which has most closely resembled technology assessment in Britain. For discussions of the inquiry and its results, see e.g. Hetman (1973) p. 20 f; O'Riordan (1981) p. 16. In the event, the site chosen on the basis of a comprehensive cost-benefit analysis was rejected after it had been met with "public outcry" (Sinclair, 1973, p. 64). The implications of this chain of events are not recognized in Sinclair's proposal for a technology assessment methodology.

45. Power Station Impact Project (1981).

46. See e.g. Cotgrove (1975, 1976, 1978, 1982); O'Riordan (1981); Sandbach (1981); Gorz (1978, 1981); Goodwin and Taylor (1982).

47. This term was used by an opinion poll on attitudes towards science carried out for the EEC by polling institutes in 8 countries, among them Britain and Denmark, in 1977. Here, three categories of value systems were identified by using an index constructed as follows: the persons questioned were asked to choose from four items the most and second most important goal for society. The answers were then categorized as follows:

		Second priority			
		A	B	C	D
	A	-	2	1	2
First	B	2	-	2	3
priority	C	1	2	-	2
	D	2	3	2	-

Items: A: Keep order in society

B: Increase people's participation in government decisions

C: Fight rising prices

D: Guarantee freedom of speech

Scores: 1: Materialists

2: 'Mixtes'

3: Post-materialists

According to this scale, the survey found that the following percentages of the British and Danish population supported these 'value-systems':

	DK%	UK%
1	44	43
2	49	52
3	7	5
total	100	100

48. Lovins (1977), p.57.

49. Ibid., p. 37f.

6. ENERGY POLICY AND SOCIAL PROCESSES.

6.1 Introduction

So far we have described and analysed in some detail a tiny fraction of history, namely that of energy policy from 1950-1980. We shall now remove ourselves somewhat from the fascinating and confusing maze of empirical detail and ask if this history makes sense to us. Clearly, as a description of a policy field it makes sense, but is there something more to be learnt from it? In other words, is there a theory which will allow us to understand this development, i.e. the changes that we have recognized across the energy policy field?

In each of the previous chapters we have begun by presenting the specific set of problems addressed by that chapter followed by a presentation and discussion of the particular hypothesis due for investigation in that chapter. The subject matter of the present chapter, however, differs distinctly from that of any of the previous chapters as we are now returning to our original intention of establishing a theoretical framework for understanding the processes underlying changes in the energy policy field. This involves arguments of a more theoretical nature than those of the previous chapters. Considering this, and bearing in mind that we are suggesting an explanatory framework which may appear unusual or controversial, we have chosen to display, prior to the presentation of the hypotheses, the argument that has led to their formulation.

The description of the historical development of the energy field pointed to the importance of investigating the processes involved in change or transformation from one period to the next. The analysis also suggested that elements which must be explained include: the process whereby consensus dissolves and is replaced by conflict; the rejection of the ideas and values and objectives; the

process whereby new problems are identified; the process whereby elements of a new or 'alternative' solutions gain consent; the process which gives rise to formation of political groups representing new ideas, goals and solutions; and the process whereby the purposive changes that are initiated in one period e.g. by means of energy policy, at a later date come to be experienced as predominantly negative.

The pertinence of emphasizing a diachronic perspective (i.e. a perspective which emphasizes the relations between events across time rather than stressing functional causal relations between phenomena which may be deduced on the basis of an analysis of one particular section of history) is clear if we consider the implications of the historical changes we have witnessed in the energy policy field. During the 1950-80 period a number of sub-periods were identified which were characterized by different conceptualization of energy problems and different patterns of reaction to such problems. Within each period, these patterns changed little - we may say that each period exhibited a stereotypical pattern of reactions. We identified such periods of stereotypical reactions first in state energy policy. We then saw that the political groups also exhibited such patterns of reactions within similar periods. The 1950s and 1960s (up to about 1969) could in this way be interpreted as one period which was characterized by a high degree of political consensus regarding the objectives of state involvement in the energy field, the role of energy in creating economic growth, and the role of economic growth in securing social welfare.

In relation to energy, this consensus was expressed in a shared belief in the desirability of rapid technological change ('progress'), and by implicit agreement on non-interference of the state into the day-to-day affairs of the energy industries.

Now, we have put forward some suggestions for factors which might explain this particular situation within the energy policy field, but doing so does not contribute to answering the question as to why the situation changed. Which processes did contribute to changing it? Why could the consensus not be upheld? This question is raised if we observe the situation after 1970. During the large part of the 1970s, the energy policy field became increasingly dominated by state activities in the form of planning, while at the same time political conflicts in energy became increasingly evident. We have seen, that the range of issues in energy policy widened out considerably -indeed, a widespread acceptance of the need for state 'energy policy' which, as we remember, was a term little used before 1970, was itself one of the indicators of changes in the general interpretation of the energy policy field.

It was observed that the politicization of energy reflected changes in the economic and material conditions. But this merely prompts a new question: why and how did these conditions change? Firstly, we have observed that even though some sectors remained unchanged or followed stable trends, they were subject to a major re-interpretation by the newly emerged environmentally oriented political groups, and that fragments of this re-interpretation spread to the rest of the political groups. Secondly, changes in economic and material conditions such as the rate of economic growth, energy prices, accumulating pollution to name but a few examples, do not 'just happen'. These changes are not causeless: on the contrary, changes only come about by human action. The changing conditions of the economy, resource base etc. are themselves results of human activity including state energy policies. Figuratively speaking, both individuals and political groups are at any time confronted with a 'landscape', an existing physical and social reality. Even if they are not able to comprehend the social structure, it is nevertheless the basis of whatever they choose to do, whether they act to

change it or to preserve it. The sum of human activity brings about a new landscape, which is different from the earlier one, and that landscape now presents itself as a new set of conditions. Therefore an identification of a causal relationship between for example the price of energy and attempts to control the development of energy production politically does not explain why the whole energy policy field changes over time the way it has been shown to.

For any particular development in energy policy we may identify a number of possible causes. In this way we arrive at an interpretation of a chain of causes which link together changes at the levels of policy, political ideas, and economic and technological development. The problem is that these chains themselves seem to change over time. The logic involved in the development of energy policy in the 1950s and 1960s has been shown to be substantially different from that of the 1970s. This suggests that we should adopt, in addition to the perspective which allows for identifying causes 'transversly' i.e. between the economic and material conditions, the political ideas and the policy reactions within a period, a perspective which concentrates on the 'longitudinal' aspect: that change across time needs to be made the central object of our theoretical investigation. We shall suggest that the theory of social change advanced by Petersen (1985) in his major work on planning and social change represents such a perspective. But first we shall discuss the advantages of this perspective over alternative interpretations of social change when analyzing change in the energy policy field.

As we have seen, changes in the material and economic conditions can be interpreted as results of human activity. As to why the patterns of activity change, we shall have to investigate why individuals and groups change their patterns of behaviour. In other words, we shall focus on changes in motiviation, on the process by which

motivations change and are finally expressed as changes in e.g. the objectives of state energy policy.

We may now specify our problem further: Which process connects the ideas, interpretations, problem-identifications and policy proposals of one period to the changed state of the phenomena addressed by those interpretations in the subsequent period? And why do the interpretations themselves change?

We shall now briefly review a number of theoretical propositions which address one or more aspects of changes in the energy policy field to see if we may find useful contributions towards explaining the processes of change. A difficulty here is that many theoretical contributions address one specific aspect of the energy policy field as we have defined it We have chosen to divide these theories into two groups: Group 1: The theories within this group emphasize the relationship between two elements within the energy policy field: the influence of political groups on policy formulation or the efficiency in the implementation of energy policy; group 2: Theories within this group emphasize the historical dimension, analyzing the development of one or more of the above elements.

The first group of contributions is characterized by being oriented towards specific problems in energy policy at the time of writing. Starting by defining a set of problems, investigating their causes and drawing up guidelines for future action appears to be a rational recipe for improving policies. But this procedure cannot be adopted if we want to analyse the process of change which has taken place in the energy policy field. This is precisely due to the problem-orientation of these contributions. These contributions are, as a rule, <u>partial</u> and <u>ahistorical</u>, as we shall shortly demonstrate.

For example, Tietenberg (1976) conceptualized the energy

problem in terms of "the import vulnerability problem, the balance of payments problem, and the foreign policy problem" (p.36). As we have seen, however, these had not been the main dimensions of the energy problem in the 1950s and 1960s, when the problem addressed by most governments (which was not conceptualized as an energy problem) was one of providing sufficient fuel in the future. Ince (1982) identified the problems in British energy policy as a failure to adopt certain technologies (renewable energy technologies, but also combined heat and power and fluidized bed combustion). Again, this problem is specific to the historical context of the author, and can therefore not provide a starting point for an analysis of change in the field. Certainly the problems are seen as results of the circumstances and policies of the past, but the historical process, including the question of why problems are identified as policy problems is not the object of reflection. These theories are 'within a period': within a paradigm with its own guidelines for classifying social reality. The events of the past are therefore evaluated in the light of this paradigm, as when Tietenberg (1976) observes that the severity of the impact of the 1973 oil crisis upon the U.S. economy represented

> "(...) a classic case of the failure of piecemeal, sequential policy, because, while each policy had a certain logic behind it in terms of the limited objective it attempted to satisfy, taken as a whole, the package was rather devastating." (Tietenberg, 1976, p.13).

The quotation confirms the existence of a theoretical problem regarding the identification of political problems in a historical period. Tietenberg contends that the piecemeal, sequential policies (a description which is itself indicative of a post hoc evaluation, as those policies according to our investigation were originally thought to be as rational in relation to a long term objective of providing for a growth in energy demand) were based in a 'certain logic'. If such policies were generally thought

to provide solutions to the 'energy problems' as these were conceptualized in the 1950s and 1960s, how come that they could be seen to have failed in 1976? Apparently because new problems that were not foreseen had occurred which were at least in part the result of these policies e.g. leaving fuel choice to energy consumers led to a dependence on oil but the dependence only turned into a problem later, partly because economic growth could not be sustained, partly because of the activities of OPEC.

A similar criticism may be raised against the 'alternative' theories[1]. These point out that the past policies which assumed a positive correlation between growth in energy consumption, GDP growth and welfare have produced negative consequences, (for example, adverse effects on the environment) that the benefits from increased energy consumption have not been evenly distributed, and that the continuation of these political trends will eventually lead to resource depletion. As a contribution towards the solution of these problems the authors recommend the adoption of one particular version of 'the alternative energy strategy'. Such strategies assume that the problems which they address can be rationally solved by the adoption of a long-term state energy policy which actively supports a change from fossil fuels to renewable energy sources. But the assumptions of these theories are defined by a set of specific topical problems. Comparing, for instance, the alternative energy plan drawn up by Danish researchers in 1976[2] to that of 1983[3] (of which, incidentally, four of the co-authors were also co-authors in 1976), we find that the latter stresses employment and public investment to a larger degree than the first, which is in accord with the increasing severity of these problems, but raises the question of the validity of the theoretical foundation of these plans across time. Looking back, we remember that the optimism for nuclear power in the 1950s was of a similar character to the optimism within certain groups for wind-generated electricity today. This is an indication

that the theoretical contributions to 'a better state energy policy than that of the past' can contribute little to increasing our knowledge about the processes which have made the policies of the past unacceptable, as they are tied to the problems of a particular period. These contributions are subjected to contemporary policy values, i.e. policy-oriented[4]. But policy values depend themselves on historical circumstances. Therefore, policy oriented theories are not very suitable for an inquiry into historical processes.

Furthermore, the policy-oriented contributions are as a rule partial, not just in the sense of being partisan, or addressing specific parts or aspects of the energy policy field, but also in the sense that change is explained by referring to conditions or events exogenous to the theoretical framework. An example of partiality in this last sense, which also illustrates why we must refrain from explaining change across time if we adopt a partial framework, can be drawn from the work of Camilleri (1984) on the role of the capitalist state in the development of nuclear power in six countries. In the concluding chapter of this ambitious piece of work, Camilleri after having stated that one of the tasks of the state is that of legitimizing the activities of the nuclear industries, observes:

> "The preoccupation with legitimacy assumed a particular significance during the 1970s when nuclear energy became the subject of intense and widespread controversy." (p.180).

Viewed as an empirical statement, this is in agreement with what we have found above. But Camilleri uses this statement as an explanation. In this explanation, a major explanatory factor (public opinion) is introduced like deus ex machina to explain the increasing efforts of the state in the six countries to legitimize the nuclear programmes of each country. Remembering the questions which we asked above, we may note that we are back to the ques-

tion of why this controversy occurred at this specific time (and not at an earlier date). To Camilleri, changes in public opinion represents an important but inexplicable modification on the logic according to which the state supports the accumulation of capital in the nuclear industry.

In a similar way, theoretical contributions concerning the role of technology in social change and the significance of political groups in policy typically locate the cause of changes in their field of analysis outside the scope of their theory. Quite often these contributions start out by observing that the situation has changed, so that for example "technology is a word whose time has come" (Winner, 1977, p.4), or "The rise of the environmentalist movement is but one example of a growth in public interest which in various ways challenges economic individualism and the market ideology" (Cotgrove, 1982, p.v.). These developments are then explained by referring to changes at another level. For example, Andersen (1984) observes that a demand for analyses of the relations between technological change and economy has emerged as a result of structural crises, which have made it plain that the models of growth and regulation of the 1960s no longer suffice. Here the process of change once more becomes exogenous, in this case, located in 'structural crises'.

This leads to, what we could call, the paradox of partial explanantion. On the one hand, theories concerning each of the above-mentioned fields (energy policy, technology and the role of groups in politics) tend to regard developments in the other fields as external, arbitrary, or even (as is the case of the role assigned to political groups in certain theories of energy policy[5]) irrelevant. On the other hand, there exists within each of these fields a large body of literature suggesting that the development of that particular field is of crucial importance to our knowledge about the world. The resulting

theoretical problem is almost topological: which phenomena and changes in phenomena are 'within' and which are 'without'? How are we to distinguish between factors which should be explained and those which are explanantory? It seems to depend on our stance. We may explain the formation of anti-nuclear groups by the increasingly evident adverse effects of nuclear power. But we have also seen that these effects to some extent are visible exactly because they have been interpreted and publicized by the anti-nuclear movement. Chains like this one can be established between the different levels of the energy policy field just like we have ourselves attempted in the previous chapters. Instead of just concentrating on one aspect, we have sought to establish connections across the whole field but so far, the analysis is still partial in the sense that it does not specify the process (or processes) underlying the changes which have been identified.

We might expect that theories explicitly addressing the historical development of energy policy could contribute greater insight into the process of change. Here we find discussions which involve considerations of the process involved, as when Lindberg (1977 II) discusses whether the 'present' situation in energy policy might be interpreted as a 'search phase' in which new interests challenge the existing institutions and practices. The implications of such an interpretation are however not elaborated any further. Poulsen (1978) represents a somewhat different perspective. Following Offe[6], he interprets changes in energy policy as a historical expression of "changing social demands on the steering capacity of the political and administrative system." (p.34). These changing demands stem from the existence of an "objective problematic condition" (p.11). This suggests, that action is conditional on the existence of problems. This leads us on to ask: under which circumstances is a specific set of conditions defined as an objective problematic condition? Poulsen does not approach this question short of referring to events

which caused policy changes, e.g. the 1974 oil crisis. Solomos (1980), in his ambitious and comprehensive thesis on the political economy of energy policy in Britain from 1960-1978, suggests like Camilleri (1984) that problems are defined by the needs of (energy) capital. Solomos analyzes the development of the entire energy policy field, yet again changes in energy policy are explained by factors exogenous to the theory, for example he notes that the need of the state to have regard to groups of 'economic agents' (presumably the trade unions and particular energy industries?) means that the state cannot adopt a unified policy in the interest of capitalism. Again we find that a perspective focusing on energy policy is insufficient for understanding the process of change underlying the historical development. We also find that these theories are firmly located within the problems of their own time: the historical analyses of energy policy is a phenomenon of the 1970s. These analyses seem themselves to be reactions to problems of their own time. They reflect the political problems related to energy supply emerging around 1970, and by doing so they impose the interpretation of problems of the 1970s on historical facts of earlier periods. But when the problems of one period are taken as the starting point, we cannot understand why the conditions now regarded problematic came to be regarded as problems.

In order to avoid the problem of partiality, we may turn to theories addressing problems related to social change in general rather than within one particular field.

At first glance, dialectical materialism seems to offer an answer to the search for a non-partial theory which addresses the dynamic inherent in society. But the problems indentified by Marxist theories through history have closely followed those defined by 'bourgeois' theory, which indicates that the understanding of the central dynamics of history is in fact limited. The new issues

emerging from the change in the energy policy field, e.g. energy as a policy problem, environmental degradation, resources problems, had not been expected or predicted by Marxist theory prior to their actual emergence as policy problems. This constitutes a problem insofar as Marxism makes claims to knowledge about the central levers of social change. Poulantzas (1968) for example, sets out to analyse the political superstructure of the state in the capitalist mode of production. Before embarking on the analysis, he observes that theory is always bearing on real, concrete processes, and that the aim of any process of thought is knowledge of the real objects. Nevertheless the analysis remains far removed from social reality and centres on the ability[7] of the political structure to contain class conflict and contribute to the maintenance of capitalist relations of production. Regarding the actual political situation, Poulantzas observes that

> "The state's various political functions (...) can only be grasped theoretically in their interrelation, i.e. inserted in the state's global political role." (Poulantzas, 1968, pp. 53-54).

According to Poulantzas, the global political role of the state is that of being the cohesive factor in the social formation, but that does not give us any clues as to why its concrete functions change across time, or what they may be like.

At the most concrete, Poulantzas is concerned about the legitimatory function of the capitalist state, i.e. its contribution to upholding the ideologies which ensure that class conflict is avoided. Now, both the role of the state in general and its legitimatory functions in particular were in the focus of Marxist theory at the time when Poulantzas wrote this[8]. Later, such analyses were largely given up, together with the very abstract structuralist approach, and since the mid-1970s, Marxist research has concentrated on more concrete issues. For example, the

'familiar' issues related to energy and the environment were made objects of Marxist analyses[9] which recognized and tried to incorporate into theory the emergence of new political actors beside the social classes. For example, Sandbach (1981) observes that:

> "The environmental lobby has recognized the implications for civil liberties of continuing the nuclear power programme (...), Anarchists and Marxists have also emphasized the possibilities of alternative technologies furthering the possibilities of workers' control as well as being less dangerous to the physical and social environment." (Sandbach, 1981, p. 127).

On the other hand, repercussions of the functionalist concept of the state are still present in these theories. For example, Sandbach immediately after the above observation suggests that the state serves the objective interests of capital, and so,

> "The environmental lobby has been deceived into the belief that the state is an impartial mediator in a pluralist society." (Sandbach, 1981, p. 128).

This leaves us with more questions than answers. Where does the self-preserving structure with its power to create false consciousness end and where does the true recognition begin? Why did the system ever allow the emergence of an environmental lobby? The Marxist framework in this case seems to provide categories which allow for an interpretation of the contemporary reality but the historical processes underlying changes in this reality remain inexplicable.

In addition to this, problems inherent in tracing policy forms back to the dynamics of the forces of production give rise to specific theoretical problems. A concrete demonstration of this point is Lindberg's (1977 I) observation that changes in energy policy exhibit striking similarities across different modes of production[10]. This in-

dicates that the relations of production may not be of any great importance in explaining the development of a policy field.

But this implies that Marxist perspectives applied to concrete policy fields end up as ahistoric reactions to topical problems unable to explain the social dynamic which have turned the author's own gaze towards exactly these problems.

Similar objections can be raised against adopting a liberal perspective. The history of liberalism shows liberal theories themselves as subject to 'vogues'. Liberal philosophies of historical development locate the dynamic of society firmly with individuals to the extent that the existence of social collectives is denied any significance in historical change:

> "This view (e.g. that social sciences study the behaviour of social wholes) must be rejected as naive. (...) the belief in the empirical existence of social wholes or collectives, which may be described as naive collectivism, has to be replaced by the demand that social phenomena, including collectives, should be analyzed in terms of individuals and their actions and relations." (Popper, 1963, p. 341).

This approach, for reasons symmetrical to those mentioned in relation to Marxist theories, is blind to society's shifting emphasis on the individual and the collective. Indeed, Petersen (1985) shows [12] that Liberal theories emerge in political debates at specific points in time as a reaction to social and economic problems in society and a political alternative to contemporary Socialist notions.

It would now seem that we are back to square one. We have demonstrated that theories which would seem to address social and historical change are themselves subject to change. Far from explaining why the political priorities of societies change, political and social scientific theo-

ries reflect these changes. If this observation is correct, it will also be the case with any theoretical propositions we ourselves are going to make. We can not detach ourselves from the history of which we are ourselves part. This would seem to land us in a relativist mire from which we cannot escape. At the same time, however, it provides us with an insight which could serve as a footing allowing us if not to escape the mire then to draw some lessons from being stuck in it.

We are referring here to the implications of the insight that social and political theory seems to reflect, always after the event, the development of new themes in social life and politics. Events described as crucial always seem to have originally come as a surprise to political scientists. Not only events like the oil crisis, but also more gradual developments like the restructuring of energy consumption that made the oil crisis possible, or the emergence of a popular opposition to nuclear power, were all unexpected. Could this indicate that the development of societies is <u>in principle</u> undiscoverable as Petersen (1985) suggests? Elster (1984) seems to make suggestions along these lines, when he observes, that

> "We have not - and will probably never get - the <u>theory about general social equilibrium</u> (including a theory of dynamic mechanisms) which would be necessary in order to speak with any certainty about the more comprehensive global net long-term equilibrium effects (of institutional changes, T.A.) (Elster, 1984, p.30).

Elster's aim, however, is not so much to investigate why this must be so, as it is to suggest a relevant and just policy model in the light of this conclusion. We shall return to the question of the relationship between social and political theory and social and political practice, including the scope for alternative policy suggestions. But before we do so, we need a theory which would explain why the real developments keep surprising those who claim

to possess knowledge about the levers of social change. We need a theory which would not try to circumvent the observed unpredictablity of social change but instead take it as its starting point. In other words, we need to ask: if the development of societies is undiscoverable in advance, can we explain why this is the case?

The perspective suggested by Petersen (1985) implies that any action, including social and political theorizing, can be understood as a reaction. Therefore we should seek to explain the process that defines the relationship between a given social reality and the reactions which either uphold it or change it. Above we observed that the actual socio-political development take even theorists who claim insight into change by surprise, that social and political science may be interpreted as reactions to problems in a society's established way of handling its affairs, and that a major preoccupation of political theory is that of prescribing future strategies either for particular political groups or for the state. This seems to support Petersen's (1985) suggestion that societies develop through a process which we may tentatively liken to that of 'trial and error'. If society progressed by a trial and error process, this would explain why policy is always reactive, e.g. why attempts at long term, comprehensive energy planning were not initiated in any nation until the emergence of an 'energy problem'.

As a theoretical suggestion, this is yet a mere skeleton and raises more questions than it answers. We need to look carefully into the assumptions and implications of adopting a perspective along these lines. We need to answer questions like: which factors contribute to periodic development which we have identified within the energy policy field? What constitutes 'error'? How are 'errors' identified and by whom? What is the relationship between 'errors' and the 'trials' which are adopted? What is the relationship between the activities of individuals and

groups and the aggregated results of these activities?

At this point of investigation, in order to focus the investigation into these issues, we find it warranted to present our hypothesis concerning these questions.

6.2 Elements of a Trial and Error Theory of Social Change.

The following section builds on the ideas and theories put forward by Petersen in his book on planning and social change as well as in our discussions about these matters. Above we suggested, that viewing social change in terms of a process of trial and error might prove a fruitful approach. More specifically, we want to put forward the following hypotheses:

1) The process underlying changes in the energy policy field contains elements of trial and error. Within this framework, changing attitudes of different groups may be interpreted as reactions to conditions which only gradually come to be experienced as negative compared with the expectations against which they are measured. This applies to one-off events like the sudden rise in oil prices of 1973/74 as well as to the experience of environmental pollution and other effects of technology.

2) The interacting external effects of technologies as well as inconsistencies between behaviour at the micro-level and the experienced results at the macro-level imply that attempts at purposive state control of the energy policy field, e.g. in relation to the application of particular energy technologies, will lead to counterfinal and in principle unforeseeable results.

These hypotheses call for a closer specification and explanation. What do we mean by trial and error?

Let us consider in some detail a very simple example of a process of trial and error: An old lady takes her home-grown vegetables to a market once a week. How does she fix the price of each particular sort? Probably, she will look around for someone selling the same type of product, and her experience will tell her to fix the price close to their prices. If, however, she is the only one wanting to sell, say, leeks, that day, she cannot use that method, in which case she will probably rely on experience: what was the price like last year? The precise calculations which she makes, consciously or unconsciously, before fixing a price is not so important to us as is the observation that she does not fix the price arbitrarily, but uses her experience. The same holds true even if she would want to market an entirely novel product, an exotic fruit never seen in the market before. She would still rely on experience regarding the level of prices commanded by other types of fruit as well as experience-based estimates of the willingness of customers to pay extra for novel and exotic-looking fruits. She may, however, overestimate the latter, or she may just in general be a greedy old woman trying to squeeze customers. In this event, she may experience 'error', i.e. failure to sell at the fixed price. She may decide to try and wait for some time, but if she consistently fails to sell her produce, she will probably embark upon a new 'trial' e.g. she will lower the price. This she will do until she experiences a satisfactory sale, i.e. a sale which is satisfactory measured by her expectations. Note that this process does not ensure that an economic optimum will ever be reached, as the yardstick of error as well as satisfaction is the expectations which exist prior to each trial.

From this simple example, we may draw a few observations: We have assumed that the person who markets a good relies for as long as possible on behaving stereotypically. Only when this results in an error, i.e. when the guidelines provided by the market and the seller's experience is not

sufficient information to fix a price which will attract buyers, will she embark on a new 'trial', a new price, until a harmony between expectations and results is achieved.

This indicates that a process of trial and error involves two different types of behaviour: a stereotypical pattern, which is upheld for as long as the person experiences harmony between expectations and results, and a searching behaviour which has two phases: 1) recognition of failure of the stereotypical behaviour to achieve harmony between expectations and results; 2) attempts to remedy this situation by adopting a new rule (a price). In the case that this is successful, it may turn into a new stereotype, which will then be adhered to until new problems are encountered.

Still, the example only bears on individual behaviour. If, as we have suggested, a similar process is discernible at the level of society, we shall have to investigate whether it is warranted to interpret social behaviour in similar categories.

Let us first assume that groups in society as well as individuals may develop stereotypical behaviour. Is it possible to find any evidence to support this assumption? Firstly, we may observe, that the mere identification of a group <u>qua</u> group demands that the group is bound together either by formal rules or by common values and norms reflected in a common pattern of reactions. We may think of the anti-nuclear groups which, as we saw in chapter three, have developed a set of shared values on the basis of a shared reaction to nuclear power. Along these lines, Cotgrove (1982) suggests that values are relevant to situations, i.e. that individuals have different scales of value operating in different areas of their life. If political groups are formed by individuals who share the experience of particular problems, this would make sense.

Within this framework, the working class in a Marxian sense may well be conceptually defined as a class (the class in itself), but it would only have an impact on society as a political group in the situations when it was recognized as such by its members (the class for itself), and not merely by theorists.

If individuals come together to form groups out of a shared wish to do something about a particular set of problems, they may experience that belonging to a group enhances their ability to influence those problems. If the group can be seen as successful, or at least potentially successful, in countering the particular problem or providing a convincing vision of an alternative state of things, this reaction may be strengthened. A stereotypical behaviour will be developed. For example, a stereotypical reaction within grass root groups toward the emergence of new problems consists in mounting campaigns which follow set rules, e.g. selling badges and stickers to raise money, arranging demonstrations etc. Taking the analysis one step further, we may assume that such interpersonal stereotypes are developed also between the members of a society. We need only think of language to make sure that this is indeed the case; but is it the case of other types of activities as well? The notion of social conditioning implies that interpersonal stereotypes do exist: that society is bound together by behaviour which is guided by a set of shared norms and generally established methods for handling specific types of problems. We need only consider a fragment of our own daily routines to accept the plausibility of this suggestion. The original motives for accepting a particular pattern of reactions need not be part of the conscious mind of each individual for her to behave stereotypically. For as long as behaviour in accordance with norms, rules and accepted methods bring about satisfactory results, there is no need for the individual to inquire into her own motives: she unquestioningly accepts that certain behaviour is 'the done thing'.

Having explained what can be understood by 'stereotypical behaviour' in the context of society, we move to the next step in the process: that of change. If societies tend to develop stereotypical behaviour, how do we explain the emergence of problems and crises in societies? We have suggested that we shall have to look for some sort of error; but how are we to understand 'error' in a social context? Following the example of individual trial and error, error would denote conditions experienced as unsafisfactory in relation to previous expectations. We need therefore to explain what kind of problems may develop in societies, and why these come to be regarded as problems, deficiencies or unsatisfactory conditions.

Whilst we have concluded that the development of interpersonal stereotypes is a precondition for social integration, we have not implied that this integration is ever achieved in full. The notion of stereotypical behaviour does not imply that conflicts cease to exist. Conflicts between different groups in society may for example arise if these groups make claims to the same resource, and in this case conflict resolution mechanisms may themselves turn into stereotypes. For example , in the 1950s and 1960s, the stereotypical solution to conflicts between the working class and capital was compromise, negotiation and wage rises.

Also there seems to be evidence that stereotypical behaviour at the level of society <u>per se</u> may be a source of error. 'Stereotypical' does not mean static: indeed, stereotypical behaviour may result in the highly dynamic development of certain parameters of society. Consider, for example, the population growth in the third world resulting from the stereotypical reproduction patterns which derive their original rationality from the need to ensure someone to look after the parents in their old age, but which, given altered conditions, produce highly irrational results. Likewise, the stereotypical political patterns of

the industrialized nations in the 1950s and 1960s derived their rationality from the aim of maintaining economic growth. Later, however, economic growth was identified as a source of social problems.

We can point to a number of mechanisms which each may contribute to this apparent tendency of stereotypical behaviour to produce counterfinal results. The phenomenon of crowding provides an illustration. An activity, e.g. visiting a small Greek island, may be a pleasant experience for the first tourists who experience an original, unspoilt natural and cultural environment. Yet, as this experience is made available to the majority by the tourist industry, its preconditions cease to exist: the invading mass tourism annihilates the original society and creates its own culture. In this case, activities originating in an intention to spread a benefit to a wider group leads to the destruction of the original benefit.

Crowding, or the disjunction between the results of a given activity pursued by a small number of people and the results of the same activity if pursued by everyone, has been identified by several authors as an important impediment to social rationality. Hirsch (1977) shows that in periods of economic growth effects of this kind arise in liberal economies, even with the aid of specific correctives by state intervention. Examining cases like suburbanisation, public transport, and the use of landscapes for leisure purposes, Hirsch finds that the piecemeal choice made by each individual is not, under conditions of economic growth, a valid guide to what individuals would choose if they could see the results of their choices along with other peoples' choices:

> "Since the piecemeal choices between the opportunities that are available through market choices at any given time involve unintended and at times undesired repercussions, choice in the small does not provide choice in the large." (Hirsch, 1977, p.18).

Hirsch locates the source of counterfinal results of social action within the state-modified liberal paradigm and the politics that go along with it. We may, however, find indications to show that other political stereotypes would produce counterfinal results as well. Elster (1984) sums up four distinctions significantly influencing the relationship between the purpose of social change and the results: 1) local versus global effects; 2) partial effects vs. net effects; 3) short term vs. long term effects; and 3) transitional effects vs. equilibirum effects. Out of these, the first two distinctions have particular significance when we consider the effects of stereotypical patterns of reactions at the level of society. We have argued that such behaviour is developed because it initially appears to be efficient in solving the most pertinent problems of society. But Elster argues that it is not valid to infer from the success or failure of a small scale institutional change any conclusions regarding the effects of introducing the change at the large scale. Elster refers here to the example of socialist communes which, he argues, have been successful because they were able to profit from the technology developed by the surrounding capitalist society. These prerequisites are closely connected to the isolated character of the experiment and would disappear if the change was adopted at a large scale.

The distinction between partial effects and net effects is based on the observation that any change may occur in a number of stages. When we evaluate the change afterwards, it is in terms of the net effects. These may, however, bear little relationship to the partial effects which we wanted to obtain by initiating the change. According to Elster, the point of this observation is that even if one (and one may also be a social institution like a Department of Energy or a political group trying to influence energy policy) possesses precise and correct knowledge about a causal relation, this is of little relevance if one

does not recognize the different effects that may arise from the action which one initiates to reach the intended result, and which may cancel this out. This argument requires the assumption that any action bears with it a multitude of consequences which cannot be analysed beforehand because of the immense complexitity of social systems, which means that individual activities, group activities and state activities interact in space and time. Popper (1963) cites as an example of these 'unintended consequences of intentional human action' the man who wishes to buy a house in a certain district and thereby unwittingly contributes to raising house prices in that area, while Freeman (1977) uses the example of car-ownership:

> "The individual who buys a car did not and could not have worked out the long-term consequences for the urban environment of millions of similar decisions. Nor indeed did the suppliers. Yet the social costs may well be so great that they negate the private benefit to most consumers (...) (Freeman, 1977, p. 82).

The relationship between different kinds of effects and their implications can be illustrated if we think of throwing pebbles into a pond. If more than one pebble is thrown, the interference of the waves soon makes it extremely difficult to predict how the banks will be affected by the waves. Now it may be objected that that is exactly what science and social science is for: in the case of the pebbles, although the wave patterns seem very complex, a theory of waves will enable us to predict the interference patterns and the final impact on the banks. Likewise, Popper (1973) proposes that the main task of social science is to trace the unintended consequences of intentional human actions. But as the argument presented above seems to suggest, this may be in principle impossible. Consider again the example of pebble-throwing: while we are busy throwing pebbles and analyzing wave-patterns, the pebbles pile up in the pond, causing it to flood. This consequence might have been foreseen had we looked for it,

but we were not. We were too absorbed being in the partial and immediately visible disturbance of the bank resulting from the waves.

If the energy policy field has developed by trial and error, then we would expect to find periods of stereotypical behaviour here, too. And indeed, we have observed that the energy policy field for a number of years from 1950 up to the late 1960s was dominated by a consensus view, and that this phenomenon was not restricted to single nations or even to capitalist economies. We have during this period identified the stereotypical behaviour of different groups in society. We may mention e.g. the general propensity to solve diverse problems by increasing the consumption of energy (think e.g. of kitchen utensils solving the problem of time-consuming housework at the level of households or the introduction of labour-saving machinery in a period of decreasing unemployment in the firms); the tendency of the energy industries to concentrate and rationalize operations; and the recognition that the possibility of a future energy gap necessitated state investments in new and efficient means of energy production. These patterns of reaction were reflected in the generally accepted dogma, itself a stereotype, that growth in energy consumption was a necessary precondition for as well as a necessary result of economic growth. This dogma was instantly verifiable and was supported by actual social activities. This would explain why it became almost universally accepted to the degree that it was a self-evident policy assumption and also throws light on the fact that it was accepted throughout the industrialized world including socialist nations, as shown by Lindberg (1977). This fact has not been explained convincingly by established theories addressing the energy policy field, whether the dogma has been seen as a result of insufficient theoretical knowledge, or as an expression of an ideology determined by the inherent tendency to accumulation in the energy industry.

As we have seen above, there is some reason to think that the adoption across society of any type of stereotypical behaviour will lead to negative and unintended results, and the description of the development of the energy policy field seems to confirm this. We have recorded the results of the policies of the 1950s and 1960s as they were interpreted by particular political groups, and seen that a number of problems were identified, e.g. increasing environmental pollution or dependence on single fuels. We must assume that these effects were the unintended results of the stereotypical behaviour of the consensus period.

We indicated earlier that the idenfication of 'error' was conditional upon expectations against which an achieved result could be measured. As observed in the example of individual trial and error behaviour, the fixing of an original price, as well as the incentive to change the price, was derived from a set of expectations regarding the sales. We may trace this expectation back to an objective (not necessary conscious) of earning money, and perhaps even further back to an original goal of self-preservation. But where do objectives originate? Petersen (1985) suggests that objectives and values arise out of a tension between expectations and experience. This tension could also be termed 'need', but note that it is not need in any objective, original, or absolute sense of the word. Discussions of need in such terms seem to us to be less fruitful, as they tend to distract us from the fact that need is an experienced condition. Therefore it would be more correct to say that new objectives can only arise when individuals or groups experience conditions as intolerable or unbearable measured by their expectations, and at the same time are convinced that these conditions are not necessary, i.e. they could be different. We shall therefore examine closer the suggestion that social change arises out of experienced need, and that the experience of need is itself conditional upon the ability to visualize

absence of the condition which is experienced as negative.

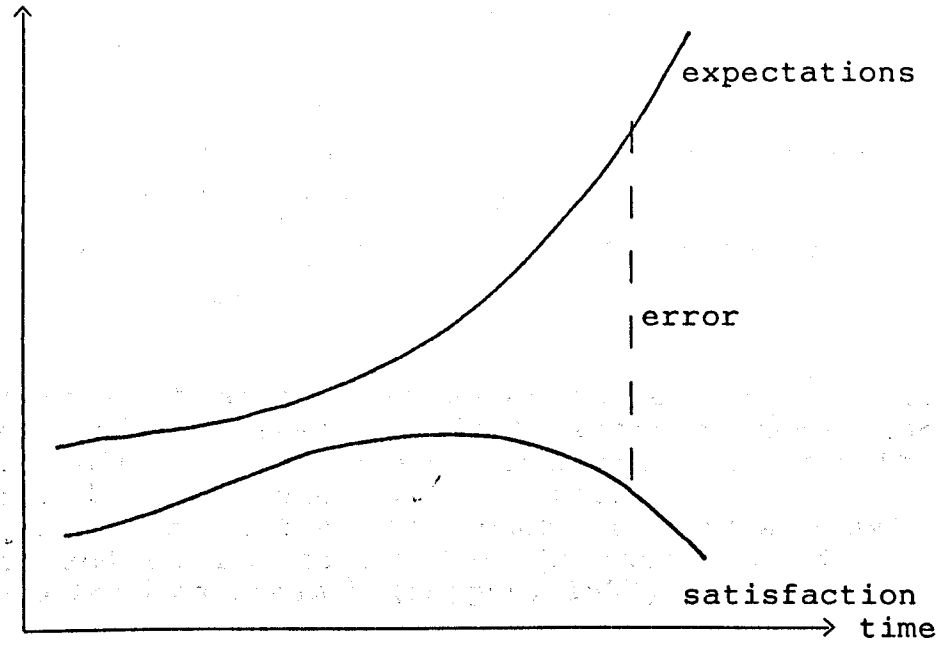
Petersen (1985) suggests that groups and societies may also in this way 'recognize problems'. Evidently, in the final analysis it is always individuals who recognize problems; social collectives are not endowed with senses. But when, as we have seen a group can developed its own pattern of reaction, this involves also the group (or society) developing ideas, norms and values. We shall suggest, that these goals are themselves subject to a process of trial and error. In order to explain this suggestion, let us assume that a particular group recognizes a problem in society, i.e. a set of conditions which are thought to be unsatisfactory. The group seeks an explanation of the emergence of this problem. To find this explanation they may consult theorists, either comtemporary authors or researchers sympathetic to the cause of the group, or historical theories which seem to offer relevant interpretations of policies and actions of the previous period and explanations of why they have failed to achieve the ideal which served as justification. As an example of such criticism we need only think of the emergence in the 1970s of a widespread criticism of GNP as an indication of welfare[13]. At the more general level we have seen that the relevance of economic growth as a social objective was subjected to increasingly harsh attacks by political groups. Parallel to this, theories emerged to explain why economic growth and growth in energy consumption failed to contribute to generalized social welfare whilst at the same time creating problems especially in relation to the natural environment.

We suggest that these events indicate social recognition of 'error' i.e. the extensive recognition that the actual results of social actions have increasingly departed from the ideal which once served as justification for these actions. We have suggested that the political groups within society may be seen as an embodiment or an impression

on the social structure of the problems recognized by individuals in previous periods. Hence we may interpret e.g. the organisation of the working class as a result of problems created in the process of industrialization. This also gives us a clue as to why new groups appear in society as an indication of 'error'. As long as the errors experienced by individuals in relation to expectations can be contained within the politicial structure, there is no motive for forming new groups. Therefore we may assume that small 'errors', isolated cases of unexpected problems (like e.g. the Windscale fire) may be 'patched up' within the existing social structure. When these problems become persistent we would expect the formation of new groups as the existing political groups are rooted in the sterotypical behaviour and the world-views of earlier periods. The general problem of the recognition of 'error' is illustrated in fig. 6.1.

The diagram is intended as a visual representation of an idea; we do not want to suggest that any of the depicted categories are measurable. The argument which we seek to illustrate in this way goes as follows: if our assumptions regarding the role of ideals are correct, the expectations created by the successfull application of a certain (stereotypical) behaviour will tend to exceed the actual results. This does not need to give rise to the identification of an error in the system. As long as the level of satisfaction (always, we remember, defined in relation to the ideal) continues to rise, the world-views, values and objectives can be upheld; they seem to produce positive results, and can be expected to do so in the future. This will in its turn cause the level of expectation to rise further. At some point in time, however, we have suggested, that the results of the actions which are in accordance with the methods prescribed by the shared ideal will fail to satisfy the expectations. An 'error' is recognized.

Fig. 6.1 The Development of 'Errors'.



Initially, as we have suggested, and as our empirical analysis corroborates, 'error' is recognized by particular groups in society. In order to explain how errors come to be universally recognized, it is necessary to investigate in more depth the concept of social myth. Until now, we have spoken of the objectives and values of groups and society as if they were given. We have suggested that they are subject to trial and error, but have not specified the phases of this process. Petersen (1985) suggests that the experience of tension between expectations and results leads to widespread recognition of the myth-character of the world-views which gave rise to the expectations, and he concludes that both the laissez-faire paradigm and the paradigm of controlling and planning the future has revealed themselves as myths. This 'myth-crisis' will then give rise to a search for new explanations and new interpretations. In this phase (where 'error' is recognized), a number of different myths will compete, until finally one is adopted as the 'dominant myth which gives rise to a new

trial. And once this has happened, the myth is no longer seen as such. It is adopted exactly because it provides hope that the promises it holds can be redeemed. Myths, then, are social ideals. The obvious example of a myth is the notion of a utopia, a society which is 'nowhere' and in which all evils experienced in a historical present time can be seen to be overcome. But also socio-economic paradigms or political theories may be viewed as potential candidates for social myths. This is brought out by Popper, when he observes:

> "The course of history is never shaped by theoretical constructions, however excellent, although some schemes might, admittedly, exert some influence, along with many other less rational (...) factors. (...) All social engineering, no matter how much it prides itself on realism and on its scientific character, is doomed to remain a Utopian dream." (Popper, 1957, p. 47).

It should be noticed that Popper was mainly concerned with showing that 'historicism' (read Marxism) was a pseudo-science. His own suggestion for 'piecemeal social engineering' does not, as we can see today, escape the above consideration, and the reason for this is to be found in the argument itself. Even though, as Popper correctly observes, there is by necessity a distance between theory and reality, this does not imply that the course of history is not shaped by historical constructions. Although the application of theories do not yield the intended results, they do yield other results; even though the social conditions do not bear the intended imprint of the myth guiding the behaviour of its members, they nevertheless bear an imprint on this myth, even if this is not instantly recognizable as such.

This suggests that any theoretical construction bearing on society might serve as a myth. According to our theory, however, to become the lodestar of society the myth should in some way be connected to those conditions of the previous period that were regarded as negative by

creating a distance to these conditions. This requirement echoes Goodwin and Taylor's (1982) 'prerequisites for a thoroughly constructive or reconstructive political theory':

> "1) a conception of society as an artefact (unlike Nature) capable of being purposefully altered by man himself;
>
> 2) the conviction that progress, qua improvement is possible;
>
> 3) an analysis of socio-political life which is free from fatalism, the que sera, sera attitude which negates from the outset human attempts at change, and also free from reliqious deference (....)." (Goodwin and Taylor, 1982, pp. 23-24).

This suggests that political theories can never be 'true', that they are always relative to the historical situation which has prompted their formulation. This is explained by Goodwin and Taylor as a result of "the fact that our quotidian politics is, in theory, about finding ways to utopia and, in practice, about compromise between entrenched interests" (Goodwin and Taylor, 1982, p.35). This observation bears specifically on utopias; but as Goodwin and Taylor themselves observe, utopias are only one kind of myth:

> "The devices just described (idealization of the past and criticism of the present; justification of the present reference to a hypothetical past; justification of the present by reference to a hypothetical present; constructive criticism of the present via and ideal alternative; inversion of the present for critical purposes; and justification of the present by reference to a worse future, T.A.) can be viewed as ways of removing current social restraints and culture-specific elements (...) In this respect, the Golden Age, the state of nature, utopia and the rest can be designated the salient myths of political theory since, like myths, they attempt to portray eternal verities about human nature and ideals, in an imaginary or symbolic form." (Goodwin and Taylor, 1982, p. 27).

But having observed this, Goodwin and Taylor introduce another concept, the 'constructive political theory'[14].

This seems to suggest a distinction between theories which describe conditions which are not realizable (utopias or myths), and theories which are constructive in the sense that they may serve as guidance for action to change society. But this distinction is only possible as seen from a particular point in time. Here, now, the 'Golden age' theories or Laissez Faire have been revealed as myths, because the promises they held were not redeemed. For the original protagonists of these theories, they were constructive political theories.

Now we can see how one myth may be replaced by a new. If a group in society recognizes an error which reveals the myth-character of the traditional world-views and paradigms, it will seek to create for itself a new ideal: a potential myth. We would therefore expect that as the number of errors grow (as we have said that they will), still more propositions will appear which puts the old myth into doubt and puts forward alternative solutions to the experienced problems. These completing myths enter into a process of trial and error. We may say that they are tested out, not in a 'just' or 'rational' way, but nevertheless the test will eventually show which proposal can be generally accepted as the new myth.

We may see the politicization of energy as one aspect of a recognition of error. The proposals for alternative energy strategies then becomes understandable as contributions to a new myth, each representing a negation of that aspect of the present which a particular group experiences as most problematic. Renewable resources to replace exhaustible resources, when resource depletion is seen to threaten future energy supplies and the environment; decentralized provision of energy to overcome alienation of the energy consumer vis-á-vis the centralized efficient industry; 'soft' technologies to replace 'hard' technologies; all these are examples of interpreting the results of the 1950s and 1960s as problems and posing the solutions in

terms of negations.

Having said that a new myth emerges out of negations of the negative results of the previous period does not imply that we can predict the content of the new myth before it has been established. As Goodwin and Taylor observe, there is no such thing as the opposite of a social institution. So we must imagine that to each problem, several 'negations' exist, i.e. imagined conditions where the specific problem would be overcome.

A new myth would therefore be established if trials on the basis of a certain theoretical proposition ('the adoption of renewable energy will be a benefit to the economy, the environment and democracy') could be generally interpreted as successful. The myth would then serve as the basis of a new trial. Within such a trial social action would increasingly be brought to correspond to the myth, new stereotypes would be created, and eventually this will give rise to new problems.

We may now interpret the development of the energy policy field during the period 1950-1980 in terms of a process of trial and error. We have already discussed the 'calm' period stretching from 1950 to about 1969. We may now see the period from 1969 to about 1978 as a period in which the expectations of economic growth, including the idea that growth in energy consumption contributed to economic growth and welfare, were increasingly recognized as a myth In this light, the oil crisis[15] only accelerated this deeper crisis. The adoption of new instruments and methods in energy policy can now be interpreted as partial trials, as can the emergence of renewable energy experiments. Although we cannot yet clearly see the contours of the myth that may replace that of the 1950s and 1960s, the analysis has shown the contours of some propositions which seem to be generally accepted, and which may therefore be seen as potential elements of a new myth: economic efficiency in

energy production and use, e.g. energy conservation should be encouraged, and dependence on energy imports should be avoided. There also seems to be a tendency to prefer more decentralized solutions. These propositions seem to be generally accepted, although it is still early days to assess whether they will in the final analysis contribute to a myth which will command the active support of the whole of society.

If the energy policy field, together with the rest of society, develops through processes of trial and error, we can also understand why both similarities and differences can be identified looking at the development of the energy policy fields of two different nations. Different conditions at any point in time will lead to different interpretations, different negations, different myths and therefore different trials. But at the same time, some problems are common to more than one country. The development of the international economy has, as we have seen, had a profound impact on the scope for energy consumption, and other types of international events, like the oil crises, have had a similar impact in the two countries. Furthermore, the internationalisation of information dissemination means that individuals or groups of different countries increasingly have access to the same information and explanations when looking for solutions to a myth-crisis. This implies that a proposal can be adopted as the basis of trials in different countries, irrespective of its origin, as long as it seems to provide a credible alternative to the myth in crisis.

The theory of trial and error seems to us to provide a consistent framework for analysing social change. But a problem remains: if, as we think, theories about society are themselves subject to this process of trial and error, they are either reflections of the dominant myths of a consensus period or negations of earlier theories attempting to explain why the earlier interpretations gave rise

to problems and prescribe solutions to these problems. But if this is the case, why have we discovered this process? The theory tells us that we are bound to reflect our position in time and space; but at the same time the theory puts forward statements about the nature of the process. This seeming paradox is resolved if we remember that the theory is being formulated in a period of rapid change. Having lived through a period which has displayed a marked shift in priorities in the social sciences, it has prompted the initial question: which process is guiding the introduction of new issues, interpretations and methods into our field? Looking to the policy field, we found that the question was important not only in relation to the development of theories about society but also to those ideas about society embodied as policies and political conflicts. Secondly, in accordance with the theory, we make no claim to having arrived at a final truth. We are only trying to make sense out of history as seen from our particular point in time.

We have still to discuss the implications for the future of the theory of trial and error. This we shall do in the following section, which addresses the consequences of adopting a chronologically relativist view of social change.

6.3 Consequences in Theory - Consequences for Theory.

Looking at the energy policy field today, we find that it is populated by decision-makers and would-be decision-makers each trying to impress their version of the most desirable future onto reality. What are the consequences of the theory of trial and error for those attempts? We may elicit two types of consequences: 1) consequences of the trial and error theory for the (real) development of the energy policy field and 2) consequences of the trial and error theory for future attempts to change the energy policy field.

Of course these two are deeply interconnected. We must emphasize that the trial and error theory bears on our knowledge about historical processes, and therefore on our knowledge about the processes involved in changing the energy policy field. The immediate consequences of the theory are therefore not of the same status as the consequences of a theoretical advance in physics for space-travel. The theory does not immediately contribute to a change of the future configuration of energy sources, for example, it tells us how such configurations are likely to come about. If changes happen through trial and error, then a new configuration emerges out of the old, but not in the sense that it can be predicted:

> "(...) the new myth and the new society is a possible, but not necessary, result of the old society. The change has happened through thinking and active beings reacting to conditions, creating new myths and experimenting with new solutions." (Petersen, 1985, p. 26.).

A consequence of the theory is that a revitalisation of old myths is likely to fail, because these myths have been revealed as such. The 1970s crisis in energy supply involved a gradual realization that a market-dominated energy supply had produced negative consequences. As a solution, state regulation was increasingly tried out. But

in other spheres, negative effects of increased state regulation was already emerging, creating a crisis for the myth of 'the planned society'. We will therefore expect that proposals which involve increased state control are unlikely to be realized. Likewise, we do not expect proposals for market control of the energy sector to be realized in the immediate future. The organisation which will eventually emerge will probably involve both elements of state control and elements of decentralisation and, probably, regard to the environment on the one hand and economic efficiency on the other will be important elements.

The consequences of the theory of trial and error for the attempts to change the energy policy field follows in part from what has been said above. The theory suggests that the goals and values which inspire social change are out of the reach of theory. These goals and values are generated in the process of social change by people, individuals, and groups who react to their surroundings. Realizing that the results of social change are unforeseeable may give rise simultaneously to hope and disappointment. Disappointment may stem from the shattering of a conviction that the future may be known, hope from the promise that little is determined. From these observations, and from the observations of the previous paragraph, we may conclude that the probability that the 'alternative energy strategies' will be realized is small. They demand a presently unacceptable level of state control and planning. Faced with the evidence of the failures of past generations of energy planners to foresee the problems of the future, the scenario-makers proceed within the myth of the planned society, and are therefore likely to fail.

This is indirectly supported by one of the more thoughtful scenario-makers, Chapman (1975). He observes that the 'scenario' approach to policy suffers from serious drawbacks. A crucial assumption of scenarios is consistency of policy over time, and this rarely holds. In addition, the

uncertainties associated with future fuel supplies, technological change etc. lead Chapman to conclude that possible variations in the future results of policies may lead to the peculiarity, that under some conditions there might be no difference between the outcomes of policies which represent different objectives. On this count alone, energy scenarios should not be accepted at face value. But there are additional problems which are related to the status of these 'strategies'. As 'strategies' of one group of individuals (although, as we saw in chapter three, usually masquerading as 'the national interest' or 'a socialist approach to energy policy'[16]), they are only myths: proposals for strategies which could be adopted by society. Everyone is free to create his own utopia, but nobody is free to realize it.

As we have seen, elements of such strategies may be incorporated into the dominant myth through group actions. In the present situation, however, this does not increase the chance that any one strategy could be adopted as a unifying theory. On the contrary, we have seen indications that fragments from these strategies are reflected in group ideas and that the imprint left on the actual energy structure, which is highly state controlled, reflects the degree to which the political groups are able to command a political majority on pursuing particular elements of the strategies (think e.g. of state subsidies for windmachines). This degree, we have suggested, is intimately connected with the perceived failure of existing systems. In this way, the pure theoretical context withers away, and the real results are born in the impure context defined by the experienced successes and failures of the existing institutions and practices.

Finally, we can point to a specific set of problems which arise from the assumptions about state control inherent in most proposals for a version of the alternative energy future. Often it is uncritically assumed that the

alternative future can be brought about by changing the assumptions of state energy policy, and most often this would mean a greater emphasis on collective rationality. A multitude of collective rationales are proposed, ranging from the need to avoid a climatic disaster[17], over the need to avoid pursuing "an energy policy which is unashamedly geared to the interests of capital" (Spence, 1984), to Lindberg's three (1977 III) 'policy principles': 1) "Energy conservation and a phased transition toward a more labour-intensive economy should become primary goals of national policy". 2) "The development of renewable, nonpolluting, relatively low-technology, and decentralized sources of energy supply should receive priority over fossil fules and nuclear fusion"; 3) "The transition to an energy-efficient economy based on renewable resources will require that the industrial nations develop a positive unexploitative international strategy" (Lindberg, 1977 III, pp. 364-366).

But the mere fragmentation of political groups indicates that appeals to the collective rationality may at present be at the best inefficient. Furthermore the idea (itself, we may observe, a myth) that the state should execute the collective will through an energy policy in the interest of society does not at present fulfill one of the requirements of a would-be myth: it must be able to elicit action. The alternative energy strategies show a desirable end state, but what do we do, living in a world of coal-fired electricity, to get ourselves there? The calls for state action seem a highly inefficient way to promote a proposal for a new myth. Hence we find ourselves in an absurd situation that while great parts of the populations of both Britain and Denmark in theory agree that something ought to be done about energy supply structure, at the same time these are the people who uphold the structure by the stereotypical behaviour which is guided by the rejected myths of state regulated economic growth. A new myth has yet to be found.

6.4 Conclusions

We find it warranted to conclude that the changes in the energy policy field contain elements of a process of trial and error, in which individuals and groups react to conditions which are experienced as intolerable against the background of their expectations by actively trying to influence those conditions and by producing visions of a future condition in which the experienced tension is dissolved.

In the present situation of an ongoing battle between would-be myths for achieving the right to interpret the world, a possible task appears for a critical social science: to contribute towards ascertaining that the proposals which are brought forward do not just represent retrogressions to earlier conditions. We must criticize attempts to restore credibility to the myth of free-market rationality as well as attempts to propose a return to a preindustrial stage. These myths have been left behind because amongst other things they produced unacceptable results. We may investigate the assumptions of new proposals in order to see whether they address the above-mentioned problems. If we sympathize with particular political groups, instead of providing theories to show that the practice of that particular group is eventually in the true interest of society, we might instead investigate the practice of the group in the context of the policy field in which it is operating and seek to identify the trends which under the present situation work for the strategy of the group and which worked against it.

NOTES FOR CHAPTER 6

1. See e.g. Chapman (1975); Leach et. al. (1979); Bacon and Valentine (1981); Flood (1983).

2. Blegaa et. al. (1976).

3. Hvelplund et. al. (1983).

4. For example, Tietenberg (1976) observes that policy-makers need to minimize negative outcomes of energy policy in order to ensure being re-elected. But the complexity of the issues involved in energy policy decisionmaking necessitates that theoretical analysis is brought to bear on these issues

   "(...) to collect the relevant, available information and systematize it so that it provides the quantity and quality of information needed to reach a decision within the constraints imposed on the analysis." (Tietenberg, 1976, p.5).

   Addressing energy problems from a politically different point of view, Ince (1982) also defines the role of theory as a means to political ends:

   "The aim of studies of this kind is not only to persuade the Department of Energy or other official bodies to change their minds and abandon their plans for a nuclear future. Instead, it is to point out to the trade union members, local authorities, and the general public that well-researched alternatives to established energy thinking exists and may even offer them more than the present official plans." (Ince, 1982, p. 189).

   Also the articles in Lawrence (ed.) (1979) as well as a number of the contributions in Lindberg (ed.) (1977), although more critical, essentially adopt this rationale.

5. See e.g. Lindberg (1977 II) pp. 336-338; Tietenberg (1976).

6. Offe, C.: Strukturproblemerne des Kapitalistischen Staates. Frankfurt am Main, 1973.

7. We use the word 'ability' on purpose, as there is recurring evidence in Poulantzas analysis that the social structure is thought to be endowed with the purpose of sustaining the capitalist mode of production. According to Poulantzas, the function of the state specifies it as:

   "(...) the cohesive factor (which) necessitates its specific intervention in that instance which maintains the determinant role of a formation, namely the economic" (Poulantzas, 1968, p. 55).

   This inherent functionalism becomes even clearer when the role of ideology is considered and Poulantzas states that the juridical and ideological structures, which are themselves determined in the last instance by the structure of the labour process, conceal from the agents of production the fact that their relations are class relations (p.130).

8. Alternative Marxist interpretations of the state and the questions related to legitimizing capitalist relations of production all stemming from the late 1960s and early 1970s can be found in Habermas (1973); Offe (1972); Altvater (1972); Lapple (1973); Miliband (1969).

9. See e.g. Lindberg (1977) and Camilleri (1984) on energy policy; Sandbach (1981) on technology and environmentalism.

10. Lindberg's analysis is based in studies of inter alia Hungary, India and the U.S.

11. See e.g. Popper (1957, 1963); Hayek (1943). For a discussion of the political commitments of the philosophers belonging to the Vienna Circle, see Ravetz (1984).

12. See Petersen (1985), pp. XXV-XXXI and p. 15-17.

13. See e.g. Hirsch (1977); Hvelplund (1980) addresses the relationship between GNP and energy policy and concludes that the emphasis on GDP growth in the economic theories underlying energy policy leads to highly irrational results in a situation of environmental degradation and deteriorating social conditions for large fractions of the population.

14. This includes a demand that the myth must prescribe a plausible development taking the present state of affairs into account. As Chapman (1975) observes: "No matter how much choosing you do you cannot change the laws of thermodynamics, nor can you choose to make the OPEC countries reduce the price of oil, nor can you choose the UK to have a warmer climate.

15. If we regard the global social system, the oil crisis may itself be explained in terms of trial and error. Analyzing only a limited geographical area evidently specifies certain events as exogenous. The theory of trial and error, however, in emphasizing unpredictability of social change is not invalidated by the occurrence of 'one-off events' as are determinist theories.

16. See e.g. Ince (1981) or Spence (1984)

17. Chapman (1975).

7. LEARNING FROM THE PAST?

The present piece of work centres on change in the energy policy field. The aim of the study was to describe and compare the historical development of the energy field in the 1950-1980 period in the United Kingdom and Denmark in order to establish which factors had contributed to changes in the field and to establish a framework for evaluating current conflicts in the field. This aim sprang from earlier work on Danish energy policy, which had indicated that the objectives, issues and methods of energy policy had undergone changes that could not be reduced to the impacts of variations in fuel prices and other resource related conditions. It was observed that these changes were accompanied by the emergence of new political groups trying to influence the agenda of state energy policy as well as changes in the energy political attitudes of existing groups.

Against the background of these observations of the Danish energy policy field we formulated eight hypotheses about change in the energy policy field.

The hypotheses specified the factors that were expected to influence energy policy and the relations between these factors. In addition, it was suggested that the process of change could not be understood solely from analyses of these factors or the relations between them, but demanded a framework for understanding social change in general, and it was suggested, that the 'trial-and-error-theory of social change developed by Petersen (1985) represented such a framework.

The first hypothesis concerned the nature of change during the period of analysis. We suggested that within this period, a politicization of energy had taken place in the industrialized World, and therefore in Britain as well as Denmark. This was founded in observations of the Danish

energy policy field, where we had observed a politicization characterized by the emergence of new groups attempting to influence state energy policy as well as by increasingly intense political conflicts over energy related issues. We then suggested that changes in the energy policy field were directly influenced by the activities of political groups. We observed that the groups presently attempting to influence state energy policy included the political parties, trade unions, industries within and outside the energy sector and different types of interest groups, e.g. anti-nuclear groups. We therefore suggested that we would expect to find the objectives and attitudes of those groups reflected in energy policy.

Next, we wanted to establish the importance of changes in the material conditions in the energy policy field. We suggested that the emergence of new groups and changed attitudes of existing groups reflected changes in conditions related to the provision of energy, such as access to energy resources, changes in the relative prices of energy sources as well as rises in the prices of energy relative to income.

In particular, we suggested that the emergence of new groups reflected reactions to negative experiences of the effects of particular energy technologies, especially nuclear power. We suggested that these negative experiences were mainly related to effects on the environment, on social conditions, and on quality of life.

The major changes in the energy policy field and in the relations between the abovementioned factors, we suggested, was parallel in Britain. This would be the case if, as we assumed, the economic conditions and energy technologies have to a large degree been common to the industrialized world.

Whereas these hypotheses described a static model of cau-

sal relations between the material conditions in the energy policy field, the political groups reacting to these conditions and the objectives, issues and methods of state energy policy, the last two hypotheses concerned the process of change itself. Following Petersen (1985) we proposed that this process of change contains elements of trial and error. Finally we suggested that attempts at purposive, long term planning for the energy sector will lead to counterfinal results whose nature is in principle unforeseeable. This hypothese was partly a consequence of the suggestion that the process of change in the policy field contains elements of trial and error, partly it assumed that we should be able to point to inconsistencies between micro behaviour and macro results which would contribute to unpredictability in the development of the field.

In chapter one we presented these hypotheses and discussed the principles and methods for a research aimed at 'testing' the hypotheses. The nature of the hypotheses meant that they could not be confirmed or refuted in the usual scientific sense. We concluded, however, that a analysis emphasizing a chronological perspective as well as a cross-national comparison, would allow us to evaluate the plausibility of our suggestions and consequently of the proposed theoretical framework. Therefore, the analysis was widened out to include Britain in addition to Denmark. The period of investigation was set from 1950-1980 which was thought sufficient for allowing us to evaluate the preconditions of the changes which have brought about the present conditions of the energy policy field, yet clearly delimited.

Chapter two described changes in the objectives, issues and methods of state energy policy in the two countries during the period. In order to examine the hypotheses about the origin of such changes we first had to locate and describe these changes. We identified four sub-periods

characterized by different approaches by the states to energy. In both countries, the 1950s was marked by fragmented and market-oriented fuel policies aiming to support and further economic growth in the energy industries as well as in general. This type of policies was continued through most of the 1960s, but we saw, particularly in Britain, that the fragmented approach increasingly created problems. Unforeseen competition between different fuels created political difficulties, and (in particular in Britain) the nuclear technology, although heavily subsidized, was increasingly recognized to demand for its safe operation very strict controls.

The period from about 1969 in Britain and about 1972 in Denmark was marked by the emergence of state energy policy institutions and of a number of new methods and procedures to ensure a coordinated development in the energy policy field. This process was accelerated by the oil price rises following the OPEC embargo in 1973. Finally, towards the end of the 1970s, there were signs in both countries of accumulating differences in accommodating a wide spectrum of objectives in state energy policy. This was evident in a rapidly increasing number of issues considered by energy policy agencies. Amongst these issues, cost was the most important.

After identifying the nature of the changes in state energy policy, we turned in chapter three to the political groups, for each class of groups we described changes in the groups' energy political attitudes as well as the activities which it undertook to influence state energy policy. We found that this description supported our hypothesis of a politicization of energy around 1970. We found that the intensification of state initiatives in the energy sector had been preceded by increasing activities by the political parties as well as by the emergence of new environmentally orientated groups. We also found that the adoption of new types of issues in state energy policy re-

flected campaigns from specific groups emphasizing the importance of that particular issue. Each of the new issues of the 1970s: the environment, employment, advantages of small versus large scale operations, safety of operations, had its own constituency. Finally we observed that the politicization was also evident in a multiplication of groups each advancing their own version of a future energy policy serving the national interest.

The proposals of the groups were shown to contain elements of solutions to problems identified by each particular group as pressing. Seen in this light, the energy policy recommendations can be understood as attempts to show that the present conditions, including the future that would follow if no changes were made, is not necessary. The proposals can be understood as reactions to the conditions experienced by the members of the groups. As we had suggested, these conditions were related to, on the one hand prices of and access to energy, on the other the effects of energy technologies: the problems identified by the groups were mainly related to, on the one hand macroeconomic effects of energy policy, on the other hand effects, real and potential, on the environment, including future resource availability. In addition, technology seemed to pose a separate set of problems. Some of the environmental groups interpreted the whole range of problems as results of the development of a particular type of technology, 'hard' technology, symbolized by nuclear power, and their proposals centered around the idea that better, less polluting, less centralized, technologies ought to be furthered.

In chapter four, we looked for changes in the national economies, in the trends of energy supply and consumption, and in the resource base and found support for the suggestion that the reactions of the groups reflected changes in the material conditions. We found that the embryonic energy planning of the late 1960s sprang from a

wish to counter balance-of-payments problems which beginning to look like a constraint on economic growth.

The account made it clear that resource availibility does not represent a determining factor. Resource availability was seen to depend on technology, and the introduction of new resources was seen to have depended on whether the traditional resources gave rise to problems, and whether the new resource was thought to represent a solution to these problems. We also saw that the particular problems that the groups identified and reacted to in the 1970s were the unpredicted results of decisions of the 1950s and 1960s. We observed that some of the conditions, that were thought undesirable in the 1970s, e.g. dependence on electricity and oil, were not themselves unpredictable in the 1950s -on the contrary they were both predicted and intended - it was the interpretation of these conditions as unwanted that was not predicted. In other cases, the problem was unpredictable, yet still a result of the policies of the 1950s and 1960s. The OPEC embargo was only possible because of policies emphasizing growth in energy consumption and free competition between fuels. The different impact that the embargo had in Britain and Denmark also supports this observation. Britain had subsidized its nationalized coal industry, while Denmark having no local industries demanding protection, had not placed any restrictions on the use of oil. As a consequence, the shift to new methods on energy production was much more radical in Denmark than in Britain, where the traditional production of coal was upheld, giving rise to problems later when the problem related to oil had vanished.

We had suggested, that the emergence of new groups and the change of attitudes of the existing groups also reflected reactions to the group members' experiences of the effects of energy technologies, and chapter two had supported this suggestion. In chapter five we inquired into the problems

identified in relation to technology by political agencies in order to evaluate the significance of this factor. We concluded that a considerable shift could be observed regarding the experience of effects of technologies, and that this shift occurred about 1970. Before that time, technological change was generally expected to yield mainly positive results, and the natural sciences were by all political groups interpreted as a progressive factor in society. This reaction of the early 1970s suggested that 'laissez'faire-technology' had led to the accumulation of results which were generally interpreted as negative. The reports from Denmark, Britain and the OECD pointed to the extra burdens put upon the states to counter environmental problems arising as the external effects of particular technologies, frequently citing nuclear power as an example, and observed that an efficient use of public finances was difficult as long as the formulation of technological objectives was left to scientists and the industry. Looking at a number of theoretical proposals for avoiding the negative effects of technologies, ranging from recommendations for Technology Assessment to utopian designs emphasizing small-scale, decentralized technology developed with regard to the environment, we concluded that elements of these theories corresponded to elements of the world-views of the political groups.

In chapter six we tried to pull together the observations of the previous chapters. We had suggested that the process underlying changes in the energy policy field contained elements of trial and error, and that the nature of the process meant that attempts at purposive, long-term state control of the energy sector would lead to counter-final results of an unforeseeable nature.

After specifying the phases of a process of trial and error, we concluded that our observations supported such a hypothesis. Following Petersen, we suggested that periods of stereotypical behaviour would lead to the accumulation

of a tension between expectations and experienced conditions for fractions of society. At first, individuals, groups and political agencies would seek to dissolve the tension by applying 'more of the same', i.e. by reacting streotypically. But if the tension developed, at some point it would be recognized as 'error', and the world-views of the previous period together with the paradigms, theories and methods going with it would be revealed as a myth. A search would then start for new theories, methods and objectives which would make up an image of a future in which the particular set of problems creating the tension did not exist. This search would be accompanied by action aimed at solving the same problems. Eventually out of the competing myths, one would become the dominant myth of society, and consequentially would no longer be interpreted as a myth. The new myth would lead to the adoption of new types of stereotypical behaviour and new theories would be developed within the new paradigms belonging to the new myth.

Our account of the development of the energy policy field displays phases which fit well with the phases of the process as described above. We concluded that whereas theories addressing state energy policy as well as theories of social change were located within the myth of one particular period and thence incapable of understanding the process of which the myth is an element, Petersen's theory offers a comprehensive understanding of the relationship between beliefs (including values and theories) and experience in creating change.

In addition, we concluded that our observations supported the hypotheses that purposive, long term state energy policy would lead to counterfinal and unforeseeable results. We reached this conclusion partly as an implication of the trial and error hypotheses, partly because of the observation that such a policy would demand a presently unacceptable extent of state control, and partly as a

consequence of a discrepancy between micro-behaviour and the aggregated results of this behaviour.

On the basis of these conclusions we finally evaluated some of today's proposals for future energy policy, and concluded that whereas we cannot predict the objectives and issues of future energy policies, we expect certain issues to be prominent for some time to come. Among these issues, we suggest that the cost-efficiency of energy production and consumption and the environmental impact of energy technologies will be important.

Whereas we are satisfied that we have fulfilled the aim of this thesis, we do want to point to a number of issues which have arisen along the way and which need further investigation. It is evident that the trial-and-error theory is not predictive. On the contrary, the theory states that, social change is in principle unpredictable. In other words, a non-determinist theory of change. Therefore we shall not make any policy recommendations on the basis of our account. This does not mean that the adoption of this framework should not be of any wider consequence. The framework still needs support and refinement. For example, we think that the process whereby one particular myth is adopted as a dominant myth is as yet insufficiently explained. Likewise, we think that the relationship between material or technological inertia and the changes which are brought about by the myth-creating activities of political groups ought to be discussed in more depth. Therefore we would recommend that social science research emphasizes projects involving work across specialization and topics and across time in order to achieve knowledge about the process itself as well as about the present tendencies.

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