Energy policy: what it forgot and what it might yet recognise

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1 - SYNOPSIS

By focusing upon issues which energy policy typically forgets, we hope to stimulate broader debate about how energy related practices evolve and how they might be steered.

2 - ABSTRACT

The rationale for national energy policy varies from country to country and changes over time. Initially designed to manage supply or limit dependence on oil, contemporary energy policies often have explicitly environmental goals as well. Despite these shifts of orientation, the character and scope of energy policy making remains remarkably constant. Manipulation of prices, regulation of supply, accelerating the diffusion of energy efficient equipment and providing information: these remain the staple ingredients of policy analysis and practice. We argue that this kind of energy policy fails to capture wide ranging changes in the way that energy is used. By focusing on some of the things which energy policy forgets, we aim to create space for a broader debate about how energy related practices evolve and about how those might be steered.

Taking the escalating use of air conditioning as an example, we review missing features of current policy strategies. We reflect, first, on how policy focuses on individual consumers and their choices rather than on longer term changes in consumer expectation and demand. We argue that further blind spots are created by a second tendency to detach analysis of energy use from an understanding of the services it makes possible.

We speculate on the qualities of alternative policy strategies which genuinely engage with the provision of "services" like comfort, cleanliness and convenience and ask whether aspects of energy service consumption lie beyond the reach of policy as currently understood. Finally, we discuss the wider implications of taking a broader view of societal efforts to respond to the challenge of reducing CO2 emissions.

3 - INTRODUCTION

It is easy to slip into the habit of energy policy analysis and go along with the terms of reference which organise and frame such activity. The last few years have seen incremental developments in how energy policy incorporates theories and understandings of the social world and the dynamics of change and action. In particular, we have witnessed a fashion for more "integration" of economic, technological and social enquiry in the hope that this will lead to more robust and effective strategies better suited to cope with the social challenge of reducing CO2 emissions.

In this paper, we argue that much more radical changes are required if energy policy makers and energy researchers are to begin to grapple with the questions which really matter with respect to long term energy demand and environmental damage.

Instead of tinkering with the analysis and manipulation of factors thought to shape contemporary energy usage,

we argue that the real challenge lies in understanding the dynamics of consumption and rapid cultural change as manifested in concepts like comfort, cleanliness and convenience. To date, energy policy has "forgotten" to analyse the escalation of expectations and the co-evolution of social and technical systems implicated in the re-definition of normal practice and so of normal energy consumption. We suggest that this selective amnesia is in part explained by policy makers' and researchers' tacit reliance on a limited model of choice and change. Drawing on an historical account of the development of air conditioning, we identify ways of overcoming these restrictive conceptualisations and argue that it is both possible and necessary to re-define the scope of energy policy, and to re-configure the theories and models of social change on which it depends.

We begin by reviewing key features first of energy policy (taking a recent Norwegian policy document as an example) and then of policy relevant research (illustrated with reference to a Dutch research programme on sustainable homes). In both instances we reflect on the sorts of questions which dominate and the models of choice and change which underpin familiar yet arguably limited understandings of the "energy problem". It is important to say, at the outset, that we use these examples as a means of developing a more general argument. We do not isolate these cases because they are especially problematic or deserving of criticism but rather because they exemplify taken for granted features of energy policy making and research in many countries and contexts. Similarly, our discussion of air conditioning is important not for what we learn about events in the USA in the 1950s, but because the case of air conditioning, and the way we analyse it, illustrates a method and an approach which can be applied to the analysis of energy usage in many other circumstances and situations.

4 - ENERGY POLICY: QUESTIONS, ANSWERS AND INSTRUMENTS

Our interest in this paper is in how energy policy tackles consumption. How are consumers positioned, how is change conceptualised, what are posed as the elements of change, how are these taken into account, and what kinds of mechanisms are proposed as possible ways to reduce consumption? We use as an example a recent long-term, strategic energy policy analysis from Norway (NOU 1998). The analysis was commissioned by the Ministry of Oil and Energy. Its mandate was to "analyse and evaluate the energy and power situation in Norway forward towards 2020...The report should analyse different mechanisms which can strengthen production and limit consumption...Special weight should be given to what can be done to limit consumption...The main directions in the content and organisation of policy instruments should be a central element of the analysis." A task force was appointed to contribute to the analysis and writing of the report. It consisted of actors representing several government ministries, commercial organisations, the energy utilities, as well as several consultants and a representative from Friends of the Earth. The long term perspective, ambitious mandate and the task force were intended to make this policy document more innovative than your usual Ministerial White Paper.

The report is organised into three main topics: energy supply, energy demand, and the workings of the electricity market. Demand and market issues are discussed under the title "Trends and factors which will influence future energy consumption", then in several chapters on policy measures aimed at reducing consumption.

4.1. Trends and factors

In the discussion of trends, the report points out that Norway has the 3rd highest per capita stationary consumption of energy in the world behind Canada and Finland and notes that energy consumption is growing rapidly overall. Two sectors are pointed to as particularly problematic: the public service sector and residential sector, both of which have had about a 47% growth in the period from 1976 - 1996. Weighed against a future in which dramatic reductions in energy use will be required, this makes strategic policy analysis all the more important.

The section "Factors which determine energy demand" is divided into subsections the titles of which give an idea of what the authors consider to be important in understanding consumption: "climate", "demographics", "technical developments", "economic growth", and "energy prices." After commenting on Norway's cold climate and the special demands it makes on space heating, the section on demographics focuses on the problem created by a dramatic increase in one person households, the number of which has more than doubled since 1950. This development is of concern because a one person dwelling uses about 1.5 times the per person energy use of a 2 person dwelling and double that of 3 and 4 person households. There is a discussion of how this trend is

likely to continue due to the ageing of the population. The section is rounded off with a peculiar digression into teenage energy habits. These are posed as problematic because teens shower longer, bathe more often, eat at irregular hours, wash and dry clothes more often, use more appliances like video, tv games, personal computers and stereos. This is apparently included to show that the authors are aware of the importance of the "behavioural dimension", though the teenage "problem" is not taken up again in the discussion of policy measures.

The section titled "technological developments", centres around two trends which together determine future home energy use: the continued diffusion of household appliances, and continued improvements in their energy efficiency. In the period 1976 - 1996, overall appliance energy efficiency increased by around 15%, and thermal efficiency (windows and insulation) by 40%. Energy consumption nonetheless grew by 60%. In the "economic growth" section which follows, consumption is represented as an inevitable outcome of technical and economic trends. The construction of ever larger houses is, for instance, simplistically linked to growth in GNP.

4.2. Strategies and approaches

Discussion of policy strategies focuses on economics, and the concept of "energiøkonomisering (enøk)", market barriers, technologies, and regulation.

The NOU mandate is unusual in the Norwegian policy context in that it is to find ways to "limit consumption" with no qualifying statement about economic justifiability. This gave the task force more leeway to distance itself from the usual debate about discount rates and whether measures, incentives and programs are economically justifiable. Even so, the reason that a section is devoted to "enøk" is because Norwegian energy policy does not promote all energy reductions, but rather those which are also economically justified. As the NOU authors write, "enøk" is understood to be energy efficiency which is "profitable".

If enøk has been one cornerstone of Norwegian energy policy, the other has been creating an efficient electricity market after the deregulation of 1991. Energy efficiency policy has boiled down to an effort to eliminate well known "market barriers", such as lack of information and failure of prices to reflect environmental externalities..

In the analysis of barriers there is a reference to another issue, namely the existence of "other than energy" investments and costs which prevent energy consumers from making rational energy decisions. This is another way of saying that life gets in the way of energy policy. Shove (1999) and Wilhite and Shove (1998) have pointed out the irony in considering everyday life as a barrier and suggested that such simplistic assumptions about consumption behaviour are themselves a barrier to achieving reductions in energy use.

The section on "energy prices" considers the advantages and disadvantages of different pricing regimes including CO2 and other energy surcharges. This is followed by a lengthy analysis showing that in Norway, energy consumption has been virtually price inelastic over both the long and the short term. In other words, changes in levels of energy consumption between 1976 and 1996 are shown to be almost totally independent of price, ironic given an energy policy that has been so fixated on price, markets and economic mechanisms.

Under the heading "new technology", the technical enøk potential is the focus of a lengthy appliance by appliance review, which examines the efficiency of existing, available and future technologies in each end-use sector. The discussion is interspersed with occasional references to the need for information and changes in attitude to facilitate this process. In a separate section, attention is given to future developments in information technology and its implications for energy consumption. A scenario approach is taken, with no clear conclusions about likely technology paths or their energy consequences.

Analysis of "administrative mechanisms" deals with laws and regulations. There is, for example, consideration of rebate programs (which are concluded to not be economically efficient due to free riders), voluntary agreements, NUTEK-type market transformations, and labelling. Energy efficiency standards are discussed, but mainly in the context of which will be imposed due to Norway's EFTA agreement with the European Union. Building codes also feature, as do planning measures to encourage new residential development in areas with district heating or industries with overflow heat.

Again underlining the need for information, advice and training, the section titled "competence building" is mainly directed at end-users. A significant organisational restructuring has taken place in Norway over the past

decade the effect of which has been to take responsibility for providing information and advice from the energy utilities and give it to regional centres partially funded by a wires surcharge. This change and the functioning of the new centres comes in for further scrutiny.

Summarising the approach and orientation of this lengthy policy document: it discusses the factors behind energy consumption and policy approaches to achieving "enøk". The common thread is that change will come about by focusing policies on the end use market for energy and on the "end user". In other words, a well functioning market with a well informed end user is key to generating changes in consumption. Economic instruments and information are also keys to facilitating the diffusion of ever more efficient technologies. Other broader issues are addressed in the "factors" section, but missing in the instruments discussion. For example, the single most important contribution to spiralling stationary energy use in Norway, the dramatic increase in the size of dwellings, is conceived of as an inevitable outcome of economic development. This prohibits further social analysis of changing expectations of home, space, and comfort. In fact, social perspectives on consumption are virtually non-existent in the report, or rather assumed to be addressed in scattered references to the attitudes, knowledge and behaviour of the end user.

This orientation to energy policy embodies a particular theory of social change, that is, it makes certain assumptions about how the world works and what can be done to make it operate differently. Policy documents such as this one, typically identify actions which policy makers can take, and which are expected to change peoples' practices. The relevance of specific "policy instruments" (the provision of information, the introduction of new regulations or of financial penalties and or incentives) might be debated but their role, as tools and devices for engendering social change, is rarely questioned. In other words, conventional policy approaches perpetuate a view of the world in which policy makers and policy instruments really do have the capacity to steer the course of events for the better. To be more explicit, energy policy making generally rests on a somewhat mechanistic model of how energy is used, of what "factors" affect that process, and of how those might be adjusted to produce a different result. This model of change highlights certain issues, questions and processes and puts others into the shade with practical implications for the organisation and character of policy relevant research. Critically, it determines the framing of research agendas, the flow of funding, and the kinds of expertise drawn into the debate. In the following section we show how research questions mirror policy preoccupations and argue that these mutually reinforcing links between research and policy perspectives have the unintended effect of marginalising alternative conceptualisations both of the problem and of possible responses.

5 - ENERGY POLICY AND ENERGY RESEARCH

In this section we reflect on the tacit theories of social change which underpin programmes of policy related energy research. We take as an example the case of a recent Dutch research initiative on sustainable household consumption (HOMES), part of a larger programme of work sponsored by the Dutch National Foundation for Scientific Research (NWO). This is a relevant case to consider for the programme has the double aim of applying, but also developing, concepts, approaches and methodologies for the integrated diagnosis and analysis of household metabolism - that is for the analysis of the demand for and supply of natural resources, including energy. The programme is unusual in seeking to include multiple disciplinary perspectives but is at the same time conventional in its representation of social change and policy.

By treating the home as a kind of organism with its own distinctive pattern of inputs and outputs, the Dutch researchers investigated the role of economic, psychological, cultural, and technical factors in determining the scale and flow of resources and materials through households, and the nature of the constraints involved. Pursuit of such "factor analysis" led the team down a number of different paths. Three were especially relevant for the HOMES programme.

5.1. Demographic factors

The number of households and the age composition of the population make a difference to total energy consumption. Demographic analysis therefore allowed researchers to describe and even anticipate future energy use. As in the Norwegian case, increase in the number of single person households proved to be a significant trend. Such insights are interesting, but what is their policy relevance? Demographic analysis appears to be

worthwhile not because policy makers expect to change long term demographic trends, or determine who lives with whom, but because these define the context within which other policy initiatives are designed and implemented.

5.2. Economic and technological factors

Analysis of the costs of energy and the development and diffusion of energy related technologies promises to show how opportunities for energy consumption are organised at the household level. Providing observers make assumptions about the rates at which new technologies penetrate society (for example, technologies such as central heating, fridge freezers, or air conditioning systems), and providing they also make assumptions about the costs of acquiring and using such devices, they can generate plausible scenarios regarding future energy demand. This kind of research allows policy makers to imagine, and even test, the likely impact of policy intervention: for instance in estimating the impact of technological regulation, new standards, or the manipulation of prices. In this case, the economic underpinning of policy assumptions (which parallel those in the Norwegian case discussed above) translates, directly, into a corresponding programme of economic research.

5.3. Lifestyle factors

As the architects of the Dutch Sustainable Homes programme recognised, household choices are not simply determined by demographic, technological or economic factors. Scrutiny and modelling of so called "lifestyle choices" promised to offer deeper insights into the underlying causes of behavioural change. Taking the household as the unit of analysis such enquiry sought to explain differences between peoples' energy consuming practices. In the Dutch study the analysis was pushed on a stage further such that lifestyle, as a determining factor, was itself seen to be determined by a host of other sub-factors, including psychological, economic, and technical considerations. In research terms, the challenge was to generate better social-psychological understanding of end-consumers and their choices in order to give policy instruments a sharper edge.

Calls for more integrated research inspire genuine efforts to encourage closer inter-disciplinary interaction within the research community. In terms of conventional factor analysis the aim of adding together psychological, economic, technical and demographic data so as to compile an ever more complete picture makes good sense. In adopting this approach, the metabolism model invokes a theory of change in which new practices emerge through the interaction of identifiable factors, some of which are thought to be amenable to modification through the policy making process.

6 - RESEARCH AND POLICY: A SHARED PARADIGM

These examples of policy and research selected from Norway and the Netherlands both underline the conceptual importance of factors as drivers of change. In addition, they adopt a strikingly similar approach in terms of the basic units of analysis and underlying models of choice and agency. In this section we reflect on these commonalities of approach.

6.1. Consumer Choice

A first point to highlight is the individualistic focus on choice. This is paralleled by the search for critical factors, and key policy buttons which can be pressed, or levers pulled to steer peoples' choices in a particular direction. In short, the view embodied in the Norwegian policy document, as in many others, is that one of the key avenues for change, and one of the areas in which policy expects to exert some influence, is in encouraging consumers to opt for "good" rather than "bad" lifestyles. If consumer demand can be galvanised in these ways, the assumption is that other key features, including the practices and actions of utilities, manufacturers, and suppliers, will fall into place. End consumers are therefore given a pivotal position in research as in policy.

6.2. Consumer Demand

A second related point concerns the representation of needs, opportunities, abilities and technologies. The key step here is the backgrounding of how consumer demand is itself generated. In the Dutch study, as in much policy related research, generic conventions of appropriate behaviour disappear from view, as does the part which manufacturers and utilities play in constructing consumers' "needs". In the Norwegian case, increase in the size of houses was for example, attributed to the economy in general, not to the practices of planners or builders.

We argue later that this black boxing of the dynamics of demand effectively disables policy analysis, diverting attention away from the questions which really matter and focusing it instead on subsidiary and peripheral issues.

6.3. Household and nation as units of analysis

Third, we observe the ease with which the transition is made from the individual consumer or household, as the basic unit of analysis, to the level of national energy consumption - as the aggregation of individual practices. Reliance on these two units of analysis excludes that middle territory occupied by corporate players, non-governmental organisations, and even governments themselves as relevant and significant actors in the energy world. This is more than a methodological omission for, as we argue later, it reflects a much deeper aversion to meso-level theories of social and technological change.

The Norwegian policy document and the Dutch research programme share a remarkably uniform framing of the energy problem. Both focus on individual choice, on factors affecting individual choice, and the potential of policy tools (economic, educational, regulatory) to shift both factors and choices. In setting the two alongside each other, we hope to have shown how policy models generate research priorities, and how these have the effect of reinforcing, rather than challenging, underlying theories of change.

In the next section, we offer an account of how air conditioning systems have become embedded in normal life. This description is not set out in terms of an analysis of technical, economic or psychological factors. Nor does it revolve around moments of individual choice. As such it illustrates the possibility of a significantly different way of analysing energy demand. Having developed an alternative narrative we then reflect on the assumptions embedded in our own account, and the implications of the approach we develop for the framing of policy relevant questions and the conduct of policy relevant research. This leads us to argue that the scope of policy analysis will have to be broadened, and informed by more sophisticated theories of social and technical change, if it is to have any chance of conceptualising let alone influencing the future of energy demand.

7 - EXPLAINING AIR CONDITIONING

Air conditioning is a phenomenon of the 20th century, and as far as use in residences is concerned, of the past 40 years or so. There were only 1000 air conditioning units sold in the US in 1950, 24 million units were in use by 1970 and today, the penetration in homes in the US (excluding the north-western states and New England) is in excess of 80%. Japan followed a similar trajectory, from 3 air conditioners per 100 households in 1960 to 150 in 1990 (Wilhite et al. 1996b). China, India, the Latin American countries and other developing countries with warm seasons are following suit. Home air conditioning is creeping into southern European countries and automobile air conditioning is rapidly becoming standard for cars as far north as Norway, where 50% of new vehicles sold in 1997 had air conditioners. The implications for energy consumption are overwhelming.

It is incumbent on energy policy, and on energy researchers, to understand the nature of these rapid changes, first for the sake of developing an informed policy on space cooling, but also because they raise the larger question of whether energy policy as constituted today is equipped to deal with this and other changes in comfort and convenience.

The brief history we outline below highlights important points not adequately acknowledged in energy policy, despite their profound energy and environmental consequences. More than that, it illustrates a totally different way of conceptualising choice and change, the place of policy and the character of policy relevant research. Amongst other things, the story of air conditioning suggests that:

- the nature of the change is more a story of push by commercial actors than of pull by consumers. Aspiring manufacturers had to construct uses and users for their new technologies: it was not a question of simply meeting demand.
- air conditioning has affected the entire fabric of everyday life in the home. Analysis of the diffusion of single devices or appliances fails to capture their positioning within a suite of interdependent routines, practices and co-requisite technologies.
- it has led to changes in the design and construction of homes which in turn perpetuate the need for air conditioning in order to achieve indoor comfort. This reminds us of the need to develop analytic tools

which capture the co-determination of expectations, conventions and technologies.
- it shows how the usual energy policy focus on the end-technology and the end-user are completely inadequate to make significant reductions in the energy used for space cooling. In short, it points to the need for a radical expansion of the scope and reach of energy policy.

In her fascinating book "Air Conditioning America: Engineers and the controlled environment, 1900-1960", Gail Cooper (1998) details the ways in which artificial cooling has become taken for granted in offices and residences in much of the United States. Air conditioning was originally developed for manufacturing industries, where control of indoor climate and air quality would lead to more efficient production. The purpose was as much to control humidity and to keep air clear of dust and particles as it was to control temperature. By the mid-1920's, air conditioning was used in industries like textiles, tobacco and various food processing sectors.

The general public got its first taste of air conditioning at the movie theatre. In the 1920's and 30's, theatre management saw air conditioning as a way of attracting people in hot summer months, and comfort began to be packaged as part of the movie experience. By 1938, 15,000 of the 16,251 theatres in the United States were air conditioned (Cooper 1998:82).

7.1. Inventing comfort

It is interesting to note that theatres, bars and restaurants had difficulty in those early days in determining what "comfortable" really meant. In the 1920's and 30's, service establishments were usually cooled to between 73 and 78 F and to a relative humidity around 70%. In the homes of those few wealthy families to acquire air conditioning, comfortable conditions were considered to lie in the temperature range between 76 and 78 F, with a relative humidity of 75%. The first American Society for Heating and Ventilation Engineers guidelines published in 1925 were for 78 F and 50% relative humidity. This illustrates how there is no "natural" comfort level for artificial cooling (nor for heating for that matter), but rather that the levels we now take to be normal took a while to stabilise around a commonly accepted figure.

The conventional rather than natural characteristics of "comfort" are further demonstrated by the fact that building operators in the United States now view 68 - 70 F to be an appropriate indoor summer temperature, and many service establishments set temperatures as low as 65 F, a level which sometimes causes visiting Europeans to don sweaters in response.

To continue with our historical account, manufacturers began to see the commercial potential for residential air conditioning in the 1930's. General Electric's attitude was typical, as revealed in this quotation (Business Week 1932): "air conditioning may be the industry which will take the place of the automobile industry of 1922 in bringing back prosperity." Westinghouse and other manufacturers engaged in huge media campaigns extolling the virtues of air conditioners. The commercial potential was also spotted by the electricity industry in the late 30's. Cooper relates that the National Electric Light Association picked a symbolic "all domestic" football team for 1932, along with the opinion that "for tackles on our all-electric team, the coach might well pick Health Appliances and Air-Conditioning to open up new holes . . . In them is amazing potential power for gaining the service goal (Greenwood 1932)". We see here a developing alliance between manufacturers, utilities and the media, each positioning themselves, one with respect to another, so as to define and build new commercial possibilities.

7.2. Social and technical innovation

As is often the case, the scope for innovation was itself structured by existing technologies and practices. The first type of air conditioner to penetrate the household market was the room air conditioner, cleverly designed to be a self-contained unit which did not have to be accompanied by any major changes in the home or home services. The earliest room air conditioners were sold in the late 1930's, but were not bought in significant numbers until the late 1940's. By the 1950's the first central air conditioners were in production. The main market was in new home construction, since retrofitting an existing home was expensive and complicated.

According to Cooper, there was initial resistance in the residential market, especially to central cooling, due to the significant changes entailed for everyday life. Windows had to be kept closed, shutting out sounds and smells from the outdoors. People realised that routines like sitting and dining in the garden or on the porch in the warm afternoons, changing to light clothing, and other pastimes like strolling in the woods or taking a swim, would change. Nonetheless, the sale of window air conditioners grew rapidly in the 1950's, accompanied

by intense advertising pressure from manufacturers and utilities. In addition, many of the popular home magazines like "Better Homes and Gardens" and "House Beautiful" began associating air conditioning with the modern home. "House Beautiful" actually established an "Air conditioning and Climate Control Editor" who wrote regular pieces on the virtues of air conditioning. Sales went from 1000 units in 1945 to 193,000 in 1950 and 6,5 million in 1960. It is estimated that by 1960, one eighth of all US dwellings had air conditioners.

Central air conditioning came more slowly, but created, and demanded, deeper changes in the fabric of home design and construction. Standard home designs began to incorporate windows, ventilation, and duct systems adapted to central air conditioning. Even lending organisations like the California Savings and Loan encouraged central air conditioning. By 1957, CS and L required all homes priced higher than $20,000 to be set up to accommodate central air. By 1970 42% of all homes in Dallas and Austin and 40% in Washington, D. C. had central air.

Something which had been considered as an indulgence in 1930 had become a "natural" aspect of home comfort by 1970. The case as laid out by Cooper shows clearly that this change was not consumer driven, but rather was a complex process in which engineers, manufacturers, energy utilities, media and the service industry played major roles. The air conditioning story is one of the co-evolution of supply and demand, a story in which key actors do make a difference, but also a story in which "a certain nonmalleability characterises technology, not because actors have insufficient power or resources to get what they want but because technological developments have, in a sense, rules of their own" (Rip and Kemp 1998: 352). Just as theatre goers and manufacturers played a part in the collective negotiation of comfort, so the possibility of introducing new air conditioning technologies depended, in no small measure, on the social and technical organisation of new and existing buildings.

Along the way, the very nature of comfort was re-defined, a change which has had enormous impacts on home culture and on the environment. In the case of air conditioning, the result is a revised concept of space comfort which is now being held up to the rest of the world and is leading to similarly profound changes in lifestyles, energy use and environmental consequences around the globe.

8 - RE-CONCEPTUALISING CHOICE AND CHANGE

Our quick review of the development of air conditioning in the US highlights questions and processes which are central to the understanding of energy consumption but which are almost always invisible when framed in terms of conventional policy analysis. We have, for instance, been forced to reflect on the ways in which demand is created and on how household technologies such as the window, the veranda, and the porch, interlock and form networks or regimes of social as well as technical practice. We have also seen how alternative systems, requiring ducts, sealed windows, fans, and the re-design of the building fabric itself, go hand in hand with different styles of clothing, with new routines, and with other patterns of social interaction. All this suggests the need for an analysis which reaches over the heads of individual consumers and which captures if not their lack of choice, then at least their part in the co-determination of systems which are already structured by the social and technical contexts in which they are developed and situated.

In this respect, the case of air conditioning prompts us to reflect on the units of energy policy analysis. It would be difficult to capture the sweep of social transformation associated with the introduction of air conditioning through an analysis of the beliefs and practices of individual households. In fact concentration on household choice, without reference to the cultural contexts in which preferences and expectations evolve, is certain to miss critical elements of the bigger picture. Similarly, aggregation of household choice at the national level promises to reveal the energy consequences of relevant social and technical change, but not the dynamics of that process. Likewise, demographic analysis begs as many questions as it answers, again failing to offer much purchase on the long term transformation of energy consumption.

In describing and analysing the evolution of air conditioning we and others have drawn on a mixture of intellectual resources: cultural studies, political economy, science and technology studies, and history. This does involve a form of integration and the building up a complex and layered picture but the process of enquiry is not one of adding discrete dimensions - such as the psychological, the technical or the economic - in order to

arrive at a more complete picture of the "factors" at play.

Borrowing from the work of Hughes (1986), we have hinted at the "seamless web" of technological development, and suggested that many different elements - in his case, artefacts, entrepreneurs, networks, banks, regulations and users - join together and, like him, we imply "that the evolution of technology and the evolution of society cannot be separated" (Rip and Kemp 1998: 337). In other words, it is not simply a matter of adding more factors, or of piling social dimensions on top of technical analyses. The point is, rather, to re-think the models of change with which we work. Critical to this is a recognition of the process of co-determination and the reality that, as Rip and Kemp also observe, "important new technologies transform the system from which they emerge".

This is not to suggest there is no room for human agency or even for government or policy intervention. There clearly are moments of flux and points at which lines of social and technological development take one but not another path. In Gail Cooper's account, individual engineers and companies have decisive parts to play at critical junctures in the historical development of air conditioning. At these moments it might make sense to revert to more familiar forms of policy analysis or at least to reflect on momentary yet situationally specific balances of power and influence. Specific events may for instance, reflect the relative power of the utilities at a particular point in time, the need to sell more electricity, the relationship between appliance manufacturers and building designers, and so on. One could even design research to inspect the history of air conditioning in terms of consumers' psychological propensities, needs, abilities, and opportunities, and the current state of play in terms of technology and economics. Whether it makes sense to describe the proliferation of air conditioning solely in terms of consumer choice is, however, highly doubtful.

If we were wedded to the analysis of "factors" we might search through the paragraphs above in order to identify critical variables such as the interests of the engineering profession, the relationship between the cost of stand alone air conditioning units and their diffusion, the combination of "need" and "opportunity". With only a little more effort we might retrospectively construct a plausible flow diagram of factors determining the course of air conditioning. But what would be gained from such an exercise? For the reasons outlined above, the lesson is that policy related research which involves the systematic de-lamination followed by the systematic integration of technical, social, economic or psychological factors is likely, perhaps even bound, to miss the boat. In the light of our discussion of air conditioning, the question is this: what do analyses of demographic trends, estimates of future prices and technologies, catalogues of non-technical barriers, or evaluations of the impact of information and regulation really have to offer when the policy challenge is to somehow influence cultural transformation in the meaning of comfort?

9 - WHAT ENERGY RESEARCH AND POLICY MIGHT YET RECOGNISE

If it is to affect energy consumption by more than a few percentage points, energy policy needs to adopt a broader and a more sophisticated theory of social and technical change. In a policy framework which addresses the longer term and which demands deeper changes, it is the wide sweep of social practice which counts, not the colour of an energy label, the technical efficiency of one rather than another air conditioning unit, or the preferences of individual consumers.

Though plausible, this line of argument brings us face to face with a rather awkward question. Can national policy makers really make much difference? For example, can they do anything to halt the spread of air conditioning, the re-definition of comfort, or the apparent escalation of normal standards of cleanliness. As suggested above, expectations of space cooling are now deeply rooted, at least in American culture. So much so that even an energy policy fixed on the re-configuration of cultural energy services (Wilhite et al. 1996a) could only hope to make a difference in the long term.

We appear to be reaching some rather negative conclusions. In the course of this paper we have, for instance, argued that:

- the impact of energy policy is usually limited and always situationally specific: policy makers often suffer from an illusion of agency
- energy policy should not be seen as something which is external to, or which bears down upon, the practices of energy use: it is instead already implicated in those practices
- a narrow focus on consumer choice ignores the manufacturing of demand, the structuring of choice, the inertia of deeply entrenched infrastructures and the part which governments and commercial organisations themselves play at all levels.

Rather than seeing these as negative insights, we finish by identifying positive possibilities for energy policy and for the re-direction of policy relevant energy research.

To begin with, we need to unpack the term "energy policy". As we have seen, "energy policy" usually refers to policies and initiatives, at the national level, involving the manipulation of prices, regulation and information and targeted on technical efficiency or the choices of end-users/consumers. In practice policies which make a difference to energy consumption come in many more forms. For instance, the increase in single person households is in part related to state policy with respect to family life (taxation, welfare etc.). Similarly, policy in the field of employment and education has important, if indirect implications for how people spend their time, for what they do, and so for what energy they consume. Developing this theme, policy is not only made at the national level: local governments, businesses and employers all adopt policies and practices which have a bearing on energy use, for instance, in terms of the temporal structure of the working day, the provision of child care, the management of energy services and so on. This way of thinking alerts us to the proliferation of "other energy policies", not designed or recognised as such, but which nonetheless have the effect of configuring expectations of normal practice and the delivery and management of the services which energy makes possible. Strategic thinking about how energy intensive areas of everyday life are organised and structured promises to identify new opportunities and avenues for intervention. In other words to understand or influence energy consumption it is probably necessary to abandon the focus on energy and concentrate instead on the practices which require its use, and on the way in which energy services are organised and managed.

A second equally positive route involves a more thoughtful approach to technological development. Looking back, the history of air conditioning appears to be a history of an unstoppable process. Yet there have been, and continue to be, critical moments or turning points in the trajectory of technological development: that is moments at which events might take another course. Identification of those moments, in real time, might allow policy makers - and again we should include the full range of policy players- to favour one rather than another line of development. Equally, favoured lines of development reflect the preferences and priorities of those involved. Taking a step back, policy makers may be able to structure these contexts of choice so as to indirectly influence the outcome. Deliberate efforts to stimulate technological developments, along with strategies to create protected environments in which new ideas might at least get a foothold illustrate these possibilities (see for

example, ideas of strategic niche management as discussed by Schot, Hoogma and Elzen 1994). A more complex understanding of technological change, in terms of the seamless web, suggests the existence of more rather than less points of co-determination. For sure this view suggests that policy makers lack the uni-directional power they aspire to, but at the same time it implies there are multiple interests at stake, and so multiple dynamics on which one can play. To give just one example, anxieties about health and the relinquishing of control over the indoor environment represent potentially important forces in countering the spread of air conditioning (Kerr 1997). Recognition of the multiple dimensions of "energy problems opens up new if subtle possibilities for policy influence and policy involvement.

Re-orientation of policy along these lines has equally far reaching implications for the energy research agenda. The following examples merely hint at the possibilities.

Accepting the arguments developed above, the understanding of present and future energy use depends on understanding how conventions and practices evolve over time and within and between cultures. Anthropological research on lighting (Wilhite et. al. 1996a) and detailed sociological investigation of the habits and routines of laundry (Kaufmann 1998) points the way forward here as do historical studies including Cooper's work on air conditioning or Shove and Southerton's review of how the freezer became normal (Shove and Southerton 1998).

Such enquiry requires understanding of peoples' diverse experiences of energy use, and the ideas and practices which go along with it. As we have already noted, people don't use energy but instead relate to the services it makes possible: lighting, cooking, washing, cleaning etc. Taking a cue from daily life it might make sense to organise energy research around headings such as comfort, cleanliness and convenience. These macro level concepts have the real advantage of moving us away from the focus on individual consumers and instead providing a vocabulary with which to represent those long term, wide ranging developments which really count in terms of future energy demand.

Likewise, it is important to understand more about technological change and the relationship between existing infrastructures, anticipations of future possibilities, the tracks of path dependency and the moments of flux which characterise the careers not only of individual devices but of whole families or systems of taken-for-granted energy consuming technologies. Again new vocabularies are required to capture not simply the diffusion of isolated gadgets, but the national and international structuring of technological regimes. Such a strategy might, for instance, focus on the future of the kitchen or the bathroom (both "hot spots" of energy use) and the infrastructures and practices implied in their design and use. Again the challenge is to pitch research in such a way as to reveal rather than obscure the limits and possibilities afforded by this broad social view of change.

In this paper we have argued that conventional framings of energy policy and research fail to give much purchase on the dynamics of energy demand. New ideas and new approaches to policy making are required if there is to be any hope of reducing energy consumption on the scale required. As others have argued, it is essential to add a measure of social understanding to otherwise limited technical or economic perspectives. We argue that this alone is not enough and that what is required is a more radical overhauling of research and policy paradigms. The tacit theories of change on which conventional agendas depend inevitably focus attention on some questions and not others. Peering into the shadows of energy research and policy we have discerned the outlines of alternative theories and policy perspectives. By concentrating on what energy policy forgot we have been able to say something about what it might yet recognise.

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