NORTH AMERICAN RESEARCH ON PUBLIC ATTITUDES TO ENERGY RESOURCES AND CONSERVATION: A BIBLIOGRAPHIC ESSAY

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INTRODUCTION

The impacts of the oil embargo of 1973 and its aftermath have stimulated considerable interest among North American social scientists in questions concerning public perceptions of and attitudes towards energy resources and the diffusion and adoption of conservation practices by the general populace. After almost a decade of research, it is appropriate to review what has been accomplished to date, and use these findings as a benchmark against which to conduct and evaluate future research in this area.

Other reviews of the field are available, notably Farhar et al. (1980) and Olsen and Goodnight (1977), both of which argue that the failure of researchers to adopt a common conceptual framework severely limits the possibilities for comparing and generalizing results. The authors of the present review concur with this comment, but depart from previous reviewers in several distinct ways. First, we contend that much of the apparent inconsistency in results disappears when the body of research as a whole is organized within a single conceptual framework. Secondly, we believe that many of the residual inconsistencies can be explained, and occasionally resolved, if attention is paid to differences in the ways in which various researchers have chosen to operationalize abstract concepts, and if a more sophisticated approach to data analysis than the widespread dependence on two-variable relationships were to be adopted. Thirdly, the present review contains a broader range of sources than the essentially public opinion poll variety considered by Farhar et al. (1980) and is, of course, more up-to-date than that of Olsen and Goodnight (1977).

Our objectives in writing this review, therefore, are as follows: to organize and describe, within a single conceptual framework, the main findings from studies conducted in Canada and the United States; to discuss problems of consistency, conceptualization, and data analysis; and to indicate some perspectives on the policy implications of this type of research, even though
much of it may have been initiated purely for theoretical reasons.

As geographers, we have chosen to adopt a simple cognitive-behavioural model based on that developed by, and well-known to geographers and other social scientists (Saarinen, 1966, 1976). Our choice of this framework rests largely on our recognition of its value in our previous research on natural hazards and environmental quality (Foster, 1975; Jackson, 1974, 1981).

The literature cited herein is by no means exhaustive, due largely to the rapid expansion of efforts in this area and to the ongoing publication of new results, but the trends reported are sufficient to outline the scope and major results of research into energy perception and conservation practices. For further details and a more comprehensive range of sources, the reader is referred to several recent bibliographies, some of them containing detailed annotations, including Anderson and McDougall (1980), Cunningham and Lopreato (1977), Farhar et al. (1980), Frankena (1977a, 1977b), Joerges (1979), and Olsen and Goodnight (1977). In addition, the Banff Conference on Consumer Behaviour and Energy Use gives extensive coverage to international studies (Anderson et al., 1980).

ENERGY RESOURCES, POLICIES, AND SOCIAL SCIENCE RESEARCH

Reduced to its bare essentials, the "energy crisis" poses two interrelated sets of problems: the increasing scarcity, security, and cost of petroleum stemming from dwindling supplies coupled with escalating consumption; and impacts on environmental quality associated with the development of alternatives and the exploitation of conventional resources (e.g. acid rain, radio-active wastes, strip-mining, marine and terrestrial oil spills). The need has therefore arisen to develop new strategies to achieve a sustainable balance between supply and demand (Gander and Belaire, 1978), while at the same time minimising adverse effects on social and environmental systems (Government of Canada, 1976, 1980), and shielding both Canada and the United States from the political and economic uncertainties associated with world energy markets (Barker, 1981).

Such strategies include so-called "technical fixes" in the form of large-scale, centralized technologies directed towards increasing resource supplies, particularly of petroleum and natural gas, and alternatives such as nuclear power, coal, and the synthetic fuels. No longer, however, are such technical
fixes regarded as the sole means of achieving an energy balance (Government of Canada, 1980; Lovins, 1977; Schumacher, 1974). Complementary forms of adjustment, sometimes referred to as the "soft path" are also being widely advocated, including the development of alternatives such as renewable solar, wind, tidal, and geothermal power, novel, non-renewable sources such as the use of garbage for district heating, and a variety of conservation measures. How these technical fix and soft path strategies might fit together is shown in Figure 1, which depicts, purely for illustrative purposes, some interactions between the main elements of the Canadian Federal government's 1976 energy strategy (Government of Canada, 1976).

The term "conservation" has been assigned various meanings: for example, it may simply mean the improved efficiency of resource use without any corresponding changes in the absolute amount of resources consumed; alternatively it may imply a slowdown in the rate of growth of demand. More rigorous criteria for conservation might refer to a stabilization or absolute reduction in per capita and aggregate resource consumption. The objectives inherent in each definition can be achieved through a variety of strategies and actions, of both a technical and economic nature, including the application of retrofit, energy-efficient technologies in dwellings, improved efficiency in transportation, and changes in resource prices. Conservation ultimately may also involve some form of restraint or behavioural change based to some extent on changes in consumer attitudes. Indeed, given the notion that present lifestyles in Canada and the United States have developed on the basis of intensive levels of energy use, which they still require, it is difficult to escape the conclusion that changes in energy consumption will require some degree of modification of lifestyles, and vice versa (Schipper and Ketoff, 1980). This, however, is a contentious statement and the subject of widespread debate (e.g. Kahn et al., 1976; Lovins, 1977).

Planning for the complex range of actions designed to enhance energy conservation has been referred to as demand management (Grima, 1979). This concept recognizes that criteria over and above purely economic ones enter into the consumer's decision-making process with respect to energy consumption and conservation. It is now widely agreed among many politicians, academics, and administrators, therefore, that the articulation and implementation of a successful energy policy, which includes attempts to manage public demand for energy, requires (or at the very least assumes) an understanding of public
Figure 1  Elements of the Canadian Federal Energy Strategy (1976)
attitudes and behaviour (Jackson and Foster, 1980; McDougall et al., 1979). It is to these needs that the social science research summarized and discussed here has responded.

SUMMARY OF FINDINGS

An Organizational Framework

The studies summarized here lack a common theoretical perspective, yet it is still possible to identify major groups of findings, and the relationships between them, by adopting an organizing schema based on a conceptual framework familiar to social scientists and geographers in particular. The development of an entirely new conceptual framework is not necessary since, as Burdge and Field (1972) remarked in their discussion of the generality of concepts in social science, "social scientists are plagued with the notion that a new research topic demands a new theory. We forget that the core theory of each social science has applicability regardless of the behavior." Thus the study of emerging behaviour patterns such as new forms of energy perceptions, consumption, and conservation can be approached from the viewpoint of established concepts and procedures.

From the perspective of this review, the simplest and most convenient framework is a cognitive-behavioural model, based on the concept of bounded rationality, and developed from the objectives, hypotheses, and findings of geographic research on natural hazards (Burton et al., 1968, 1978; Kates, 1962; Slovic et al., 1974). This assertion, however, demands an explanation, and depends on the identification of several linkages between resource scarcity and environmental hazards.

Both resources and hazards are culturally or functionally defined. Physical and biological elements of the environment are "neutral stuff" which become resources only as a function of the value placed upon them by man (Hunker, 1964). As Chapman (1969) has argued, resources exist neither wholly in the physical environment nor wholly in the human system. Hazards may be conceived of as "negative resources" or "resistances," and, like resources, are created by the interaction of environmental and human systems (Burton et al., 1978).

Similar kinds of variables define resources and hazards: resources become relatively abundant or scarce not only as a result of the availability of materials in the physical environment, but also in relation to patterns of exploitation and conservation as affected by changes in perception (appraisal)
and economic, political, and technological conditions (O'Riordan, 1971). Similarly, the damage potential from hazards varies not only according to conditions of the physical environment such as event magnitude, but also according to population pressures in hazard zones, the degree of economic investment, perceptions of the hazard, and the adoption of damage-reducing adjustments which may be affected by political, economic, and technological factors (Burton et al., 1968, 1978; see Figure 2).

Resources are valuable and desirable, and hazards are the reverse; however, resource scarcity is conceptually similar to hazards in that both represent unacceptable breakdowns in man-environment relations. Both may result in temporary or permanent disruption of economic activities, declining incomes, changes in lifestyle, and even, in extreme cases, injury and death. Thus resource scarcity and natural hazards occur in part as a result of failures to achieve a harmonious balance between human activities and environmental constraints. In this sense, the adoption of energy conservation practices represents an adjustment to energy resource scarcity comparable to the adoption of damage-reducing adjustments to natural hazards. The role of perceptions and behaviour in resource and hazard systems is shown in Figure 3, in which the human use system is conceived of as a set of variable perceptions and decisions. The natural events or environmental system may be thought of as providing information which is subject to the perceptions and cognitive limitations of the people receiving it (Downs, 1970). People's responses to both resources and hazards are not determined by the environment per se but depend instead on how they perceive the environment. In turn the decisions which follow modify the environmental system.

Given common conceptual definitions of hazards and resources, the comparable potential impacts of hazards and resource scarcity on human activities, and the similar role that the adjustment process plays in alleviating resource and hazard problems, it is reasonable to propose that people will perceive and respond to hazards and energy resource scarcity in similar if not identical ways. Thus, from the point of view of research, the findings from hazard studies may be used to develop hypotheses about energy perceptions and conservation behaviour, an approach taken in a study conducted by one of the authors of this review (Jackson, 1980a). From the point of view of organizing findings from an array of studies, the groups of questions and variables examined on the basis of the cognitive-behavioural model in natural hazard research appear to
Figure 2 Resources and hazards from nature and man
(modified from Burton et al., 1978, p. 20)

Figure 3 Perceptions and behaviour in resource and hazard systems
provide the most useful organizational framework currently available.

For research on energy conservation, two main topics of interest correspond to those addressed in hazard research, namely perceptions of energy resources (which can be subdivided into issues such as belief in a crisis, perceived seriousness, concern over effects, and perceived responsibility), and conservation behaviour, which involves both the awareness and adoption of specific conservation practices or adjustments to energy resource problems. These, then, are the primary variables addressed here, together with the auxiliary issues of relationships between perceptions and behaviour, socio-economic variations in the dependent variables, attitudes to government energy policy, and the implications of perceived connections between energy resource development and environmental quality.

This approach has a number of advantages, perhaps the most important being the potential contribution to theoretical insight which results from a re-examination of established models, using new data with respect to new behaviours. In this sense the present review represents a broadening of the cognitive-behavioural tradition in geography in the same way that the extension of hazard research to phenomena such as drought and earthquakes represented a wider testing of hypotheses originally developed, rather narrowly, with respect to flood hazard (Jackson, 1981; Slovic et al., 1974). Further, if perceptions and behaviours towards energy scarcity and natural hazards are similar, then it may be possible to draw inferences in a broad social context, comparable to those discussed for hazards in general by Burton et al. (1978) and White and Haas (1975), and for earthquake hazard specifically by Jackson and Burton (1978) and Jackson (1981).

On the other hand, the use of the cognitive-behavioural model demands the study of people's perceptions, which in turn usually requires a questionnaire approach to data collection. Consequently the type of behaviour described tends to be reported rather than observed directly. The limitations of such data are well-known and need not be re-iterated here; the reader should be aware, however, that studies based primarily on direct measures of energy consumption and conservation are generally excluded from this paper, because of their inability to consider respondents' perceptions of energy issues. Furthermore, the strictest level of comparability between studies is not possible because, as Farhar et al. (1980) rightly observe, this would require item replication. General comparisons between data-sets are possible, however, and
the issue of consistency is discussed at a later stage in this review.

Summary of Findings

1. Perceptions of energy issues

   At the most basic level, there were indications by the late 1970's that the North American public was growing increasingly more knowledgeable about the general nature of the energy problem (Olsen and Goodnight, 1977). Even so, only half the respondents in one U.S. national survey knew their country to be an energy importer (Resources for the Future, 1978). About 40 per cent of a limited Canadian sample incorrectly believed that exports of petroleum exceeded imports, and a further 9 per cent were uncertain (Brady, 1980).

   Two widely diverging sets of public perceptions and beliefs appear to have emerged in response to energy disruptions and, in particular, to rising prices. Many people believe that no real physical shortage of energy resources exists, and there are sizeable elements of the public who attribute increasing costs and disruptions in supply to poor planning, government ineptness, economic manipulation by the multi-national oil companies, and even a government-industry conspiracy. For these people, the "energy crisis" is perceived as more contrived than real (Bartell, 1974; Brady, 1980; Bultena, 1976; Cunningham and Lopreato, 1977; Foster and Jacobs, 1980; Gottlieb, 1974; Gottlieb and Matre, 1976; Milstein, 1976; Murray et al., 1974; Perlman and Warren, 1975; Resources for the Future, 1978; Talarzyk and Omura, 1975). At the very least, many of these people believe that the energy supply companies have taken advantage of the situation by holding back production and hoarding fuel in order to increase profits (Cunningham and Lopreato, 1977; Doering et al., 1974).

   On the other hand, there is also evidence of widespread concern about several aspects of the energy situation: between a quarter and a half of various U.S. samples have stated their belief that the world will run out of fuels at some time in the future (Bultena, 1976; Gottlieb, 1974; Thompson and MacTavish, 1976), and figures varying from about 20 to 60 per cent have been quoted for the proportion of people believing that the United States faces a long-term energy problem (Barnaby and Reizenstein, 1974; Bartell, 1974; Cunningham and Lopreato, 1977; Murray et al., 1974; Stearns, 1975; Warren, 1974; Warren and Clifford, 1975; Zuiches, 1976). Members of these groups also tend to recognize wasteful energy practices by consumers as being responsible, at least in part, for the emergence of the energy problem (Cunningham and
Similarly, studies conducted within Ontario and in Canada as a whole report between 30 and 70 per cent of the population evaluating the current energy situation as "very serious", depending on the form of the question used (Douglin and Greer-Wootten, 1980; Gallup Poll, 1980; Jacobs and Foster, 1980). Even in energy-rich Alberta, 40 per cent of an urban sample evaluated provincial energy problems as "very serious" or "somewhat serious" (Jackson, 1980a).

The main fears expressed by those people concerned about energy seem to be related to impacts on disposable income and lifestyle (Doering et al., 1974; Resources for the Future, 1978; Talarzyk and Omura, 1975), either because of the increasing fuel costs which are expected, or because of the expense and behavioural adjustment which are perceived to be inherent in many conservation practices (see below). These findings suggest that criticisms of the commonly-accepted correlation between energy development and economic growth (Lovins, 1977) have not yet become widely diffused among the public, and may in part help to explain some important characteristics of conservation patterns to be discussed later.

Most significantly, there is consistent evidence that energy resource problems have failed to assume a dominant position in the minds of most of the public (Gottlieb and Matre, 1976; McDougall et al., 1979; Morrison and Gladhart, 1976; Murray et al., 1974; Resources for the Future, 1978). Jacobs and Foster (1980), for example, found energy ranking fourth behind inflation, taxation, and pollution in a list of problems of concern to Toronto residents. Similarly, a sample of Albertans ranked energy last out of a list of seven provincial issues and seventh out of a list of nine national problems (Jackson, 1980a). An interesting aspect of this latter study was an increase in concern by scale: while 40 per cent of the Albertan sample rated provincial energy problems as "very" or "somewhat serious", national energy problems were so rated by 69 per cent, and those at the world scale by 87 per cent. These findings, which are supported by results from a study conducted in Iowa (Bultena, 1976), may indicate some degree of denial, but this interpretation requires checking in subsequent studies.

In their perceptions of the seriousness of energy issues, people distinguish between various categories of resource. In Alberta, Jackson (1980a) found 40 per cent concerned about supplies of gasoline, 30 and 29 per cent concerned about natural gas and electricity respectively, but only 13 per cent were concerned about coal. Similar findings were reported for Ontario by
Foster and Jacobs (1980), with home heating oil and gasoline taking precedence, followed by natural gas and electricity, and lastly by wood, coal, and propane. In the southwestern United States, 60 per cent agreed that American supplies of natural gas and oil were dwindling, compared with only 21 per cent believing the same about coal (Cunningham and Lopreato, 1977).

Distinctions are also made between the anticipated and preferred structure of energy resource use in the future. Brady, for example, found that Ontario residents expected to see nuclear power most used in the year 2000, followed by hydro-electricity, solar energy, and natural gas; they would most prefer, however, solar energy, then hydro-electricity, nuclear power, and energy generation from wastes. Similarly in Alberta, hydro-electricity ranked first in expectations, followed by natural gas, solar energy, and coal, whereas the rank order of preferences was for solar energy, hydro-electricity, generation from wastes, and natural gas (Brady, 1980). Results from several U.S. studies consistent with these findings are summarized by Farharet al. (1980), who detect a general pattern of preferences for renewable energy resources.

In summary, reasonably consistent information has begun to emerge from a wide range of Canadian and American studies on several aspects of the public's perceptions of energy issues, including knowledge and awareness, perceived seriousness, and beliefs and preferences about future resources and supplies. While the findings do not necessarily indicate uniformity of knowledge and perceptions among the public, there is evidence of widespread concern about energy and signs that attitudes have begun to be translated into an awareness of the need to conserve, and to some extent into the actual adoption of conservation practices among some segments of the public.

Two important issues demand some further discussion, however. The first concerns the difficulty of estimating how perceptions and beliefs have changed over time, especially when most of the studies from which inferences are drawn were "one-shot" and localized, and few contain identical questionnaire items. Obviously, the most important and clearcut changes occurred following the "oil crisis" of 1973. As Olsen and Goodnight observed in 1977, "considering that only five years ago (1972) virtually no-one saw energy availability as a problem, and that most people supported the prevailing national goal of continued energy growth, research findings suggest that a rather rapid and extensive shift has occurred in American public opinion towards awareness of the energy
problem" (Olsen and Goodnight, 1977, p. 16). Other than this, clear trends over time are difficult to discern: for example, a recently-published Canadian national opinion poll reported the number of respondents believing there would be "no real shortage of energy in the next five years" as 51 per cent in 1976, 48 per cent in 1977, 55 per cent in 1978, 43 per cent in 1979, and 52 per cent in 1980 (Gallup Poll, 1980). It is difficult to know whether these figures reflect real changes, or result from random statistical fluctuations (Wilson, 1979). It may, however, be best to conclude at this stage that public attitudes are relatively volatile, changing quickly in response to new events and information (Keller and McDougall, 1980; Sadler, 1980). Certainly, Keller and McDougall's (1980) recommendation for longitudinal studies is to be heeded if any worthwhile conclusions are to be drawn.

Secondly, relatively little is known about the factors which might explain why people hold the beliefs and preferences described in the preceding paragraphs: in a general sense there has been more emphasis on perceptions as independent rather than as dependent variables. Farhar et al. (1980), have summarized five possible hypotheses suggesting that belief in an energy crisis is a function of: a) attribution of the energy problem to the declining availability of fossil fuels rather than to sociopolitical and economic causes; b) negative energy-related impacts experienced or anticipated; c) awareness of energy facts and issues; d) environmental concern; and e) exposure to credible information sources with high levels of factual knowledge. Hypotheses such as these need exploration in future research.

Another useful avenue of research might be to assess the role of more fundamental and general attitudes as sources of energy-specific perceptions and beliefs. It is interesting to note, for example, that the two widely-diverging sets of perceptions identified above correspond to general orientations to energy resource development described by Russell (1980) as the "expansionist view" and the "limited world view," which summarize multidimensional complexes of beliefs about nature, technology, and the quality of life. It is not unlikely then, that energy-specific perceptions merely exemplify and symbolize a more deep-seated set of values towards lifestyle, a hypothesis which is currently under investigation (Jackson, 1982).

2. Conservation behaviour

In a series of nationwide Canadian surveys, Keller and McDougall (1980)
found that, on average, people rate the importance of individual efforts to conserve energy as "somewhat important" to "very important." In a U.S. national study, respondents ranked conservation as high as third on a list of options to solve energy problems, as the "fastest" solution, and, along with solar energy, the cheapest (Union Carbide, 1980). While such generally positive attitudes to conservation have been identified in several other studies (Burdge et al., 1976; Grier, 1976; Murray et al., 1974; Talarzyk and Omura, 1975), there may at the same time be more lip-service than real enthusiasm among the public for personal conservation efforts. It is worth noting, however, that few if any studies have explicitly addressed the question of what constitutes conservation in the public mind, but there does seem to be a perception among many that conservation involves sacrifice, which becomes manifested in a reluctance to conserve unless the need is real and the responsibility is shared by all.

As a result, habitual, ingrained patterns of energy consumption may be resistant to change (Sadler, 1980), and the apparent high levels of concern about energy and support for the concept of conservation have yet to be translated into widespread "significant" conservation behaviour. As Olsen and Goodnight (1977) have observed, while the 1973 oil embargo resulted in some form of behavioural adjustment among most of the public, this was generally action requiring relatively little in the way of expense or inconvenience, and which does not radically alter lifestyles.

Thus various U.S. studies have reported figures ranging from about 60 to 90 per cent of respondents making adjustments to home heating and lighting practices, as well as to the use of the automobile for shopping and recreation (Bartell, 1974; Bultena, 1976; Cunningham and Lopreato, 1977; Curtin, 1975; Gottlieb, 1974; Grier, 1976; Perlman and Warren, 1975; Stearns, 1975; Warkov, 1976; Warren, 1974; Warren and Clifford, 1975). These findings have largely been substantiated in Canadian research (Brady, 1980; Douglin and Greer-Wootten, 1980; Foster and Jacobs, 1980; Jackson, 1980a; Keller and McDougall, 1980), and specific differences in reported percentages are probably due less to variations in perceptions and attitudes than they are to spatial variations in factors such as building practices, climate, demographic characteristics, and costs of various kinds of fuel (Claxton et al., 1980; McDougall et al., 1981).

In contrast, the more "significant" forms of conservation behaviour have been less widely adopted. For adjustments involving such factors as expense
and structural changes (e.g. insulation and storm windows) the reported figures of adoption in both U.S. and Canadian studies tend to be much lower than those for the "minimal" types described above. In particular there appears to have been a general unwillingness to make major adjustments in automobile use, especially for the journey to work, by turning to car-pooling, walking or mass transit, although there has been an identifiable trend towards smaller cars (Bultena, 1976; Gottlieb and Matre, 1976; Hyland et al., 1975).

An area which has received little attention to date in terms of conservation practices is that associated with leisure and recreation. In two surveys in widely differing communities in British Columbia, Foster and Kuhn (1981, 1982) found that leisure and recreation were activities most resistant to modification to effect energy conservation. Given the essentially discretionary nature of recreation behaviour this result is surprising. Explanations, which are currently under investigation, include research into the knowledge that the public has concerning energy consumption for various recreational activities, and the importance of leisure to lifestyle. Foster and Kuhn's findings, together with those of Ritchie and Claxton (1981) on the same general topic, emphasize the importance of relationships among energy consumption, energy conservation, and lifestyles. This in turn suggests that conservation behaviour and its correlates are only partially understandable as a series of discrete if interrelated variables, and represent a complex of multi-dimensional perceptions, attitudes, and behaviours (Stiles and Schwartz, 1980).

In an early statement of the bounded rationality concept as the basis of a cognitive-behavioural model for natural hazard research, White (1961) argued that variations in the adoption of adjustments may be explained with reference to a "practical range of choice," i.e. those adjustments of which people are aware. Similarly, explanations of conservation behaviour are usefully amplified by reviewing the perceived as well as the actual range of choice. This kind of information may also help in the development of pertinent information programmes based on improving awareness of the practical range of choice, the identification of barriers or obstacles to the adoption of conservation practices, and subsequently to the institution of various forms of behaviour modification.

Given the high levels of adoption of "minimal" conservation practices, it is obvious that most people are aware of at least some way to conserve energy. For example, 85 per cent of an Albertan sample were able to list at
least one conservation practice, although the data also showed that few people were aware of the full range of choice and no adjustment was uniformly known by all members of the sample (Jackson, 1980a). Data such as these, however, show that awareness is a necessary but not sufficient precondition for the adoption of conservation practices. In the Edmonton-Calgary study it was found that the mean number of adjustments adopted by the sample was significantly less than the average number listed. Also, well over half the sample adopted fewer adjustments than they were able to list, and the proportion adopting specific adjustments compared with those listing them ranged from a high of about 80 per cent in the case of the "minimal" class, to a low of 32 per cent in the case of car-pooling and 45 per cent in the case of insulation (Jackson, 1980a).

Data of this kind can be displayed graphically. In Figure 4, for example, the size and shape of the space between the "adoption" and "awareness" lines corresponds to the remaining variation in the adoption of conservation adjustments unexplained by awareness, and may provide some clues as to the relative importance of other barriers to adoption. These barriers have been suggested as cost and inconvenience, and their identification is important in order to select appropriate incentives, such as tax adjustments, subsidies, pricing policies and rationing, as well as information and education programmes (Claxton and Anderson, 1980; Foster and Sewell, 1980; Gollinet et al., 1976; Gottlieb, 1974; Keller and McDougall, 1980; Zuiches, 1976). These are called for because, as Foster and Jacobs observe, "voluntary action is unlikely; individuals are unlikely to make sacrifices without the assurance that others will do the same" (Foster and Jacobs, 1980, p. 67). Based on an Ontario sample, these authors suggest that most people believe that if energy conservation is to become ubiquitous it must be imposed "from above."

3. Associations between perceptions and conservation behaviour

The identification and interpretation of associations between various indicators of perceptions of energy problems and the adoption of conservation practices offers one of the potentially most fruitful directions for understanding and explaining behaviour. As one would expect, several energy studies have identified strong correlations between energy resource perceptions and conservation, i.e. the people expressing higher levels of concern about energy availability and cost exhibit a greater propensity for developing new energy-
Figure 4 The "awareness-adoption gap"
(Source: Jackson, 1980a, table 5, p.125)
conserving behaviours (Allen et al., 1980; Brady, 1980; Doner, 1975; Foster and Jacobs, 1980; Gottlieb and Matre, 1976; Hogan, 1976; Thompson and MacTavish, 1976). Jackson (1980a), for example, found that the mean number of conservation practices perceived by respondents dismissing Canadian national energy problems as "not at all serious" was 2.54, compared with significantly higher figures of 3.51 among those replying "not too" or "somewhat serious" and 3.94 among the "very serious" group; the mean number of adjustments adopted increased significantly from 1.39 to 2.43 and 2.93 among the three groups respectively. In a similar vein, Keller and McDougall (1980) found 83 per cent of "concerned" respondents turning off lights and appliances, compared with 70 per cent of the "unconcerned" group; comparable figures for "lowering the thermostat" were 75 per cent and 42 per cent; for "using less hot water" 40 per cent and 18 per cent; and for "driving less" 44 per cent and 27 per cent.

For several reasons, however, findings such as these must be treated and interpreted carefully. First, some studies have failed to identify associations between perceptions and behaviour (Morrison, 1975; Morrison and Gladhart, 1976; Warren, 1974; Warren and Clifford, 1975). Jackson found that the perceived seriousness of energy issues acted as a poor predictor of the adoption of specific conservation practices, and that responses to attitude statements were related neither to specific practices nor to the range of adjustments perceived and adopted (Jackson, 1980a, 1980b). To some extent inconsistencies such as these may be due to variations in the indicators which are used to measure the concept of "conservation behaviour": this is an issue to which we shall return below.

Second are the residuals which are often overlooked when searching for associations between variables. Although the majority of people may act in a manner consistent with perceptions, some anomalies remain: why, for example, do a proportion of the apparently "unconcerned" adopt some form of conservation practice? And why do some of the "concerned" fail to develop energy-conserving behaviours? The first case is relatively easy to rationalize, given the assumption that conservation behaviour may in part represent a response to stimuli other than concern. For example, the adoption of insulation may result as much from a desire to upgrade the home in keeping with peer pressure (Jacobs and Foster, 1980) or to improve comfort conditions as it is a response to perceptions of an energy crisis; and changes in habitual behaviour or driving practices may occur because of life-cycle changes (Zimmerman, 1980) or as economy measures...
rather than because of a belief in the reality of an energy crisis. The second case is rather more puzzling, and a number of possible explanations may have some bearing. Severe barriers to the adoption of adjustments may not be fully recognized in the "cognitive" approach. For example, factors such as expense may intervene in the relationship between attitudes and behaviour. It is also possible that many people do not evaluate individual behaviour as contributing a solution to the problems about which they express concern.

In essence, the above discussion represents a specific example of the general problem of identifying associations between perceptions and behaviour, a well-known issue which has plagued social science and has been discussed elsewhere (O'Riordan, 1973). Although correlations have been identified in much of the energy perceptions literature, some contradictory results are evident, and the presence of residuals suggests that more thorough and sophisticated frameworks of explanation and analysis are required. Behaviour cannot be predicted on the basis of perceptions alone, and it would certainly be incorrect to infer specific perceptions and beliefs from overt behaviour.

At a more fundamental level, there is also doubt about the extent to which both perceptions and behaviours can be explained with reference to attitudes. There are several reasons for this. As in hazard research, where individuals often underestimate the way in which their behaviour contributes to hazard potential and therefore do not adopt physical adjustments, people likely underestimate energy consumption and feel little need to conserve. Indeed, Foster and Kuhn (1982) report that people significantly underestimate energy consumption for different leisure and recreation activities. Further, as suggested by McDougall et al. (1981) is the possibility that attitudes have little effect because most consumption is perceived as or is non-discretionary. Another possibility, which these authors also recognize, is that the apparent lack of attitude-behaviour relationships may be a function of the methods utilized to establish attitudinal dimensions: these usually consist of empirical methodologies such as factor or cluster analysis. An alternative approach based on conceptually-derived dimensions needs to be explored. In this regard, a conceptual typology such as the polarization, referred to above, between technocentric-expansionist views and the ecocentric-limited world position (O'Riordan, 1976, 1981; Russell, 1979), which recognizes attitudinal dimensions such as nature, technology and the quality of life, may prove to be a fruitful avenue of research (Jackson, 1982).
Clearly, a broader range of hypotheses than has thus far been examined is required. Farhar et al. (1980), for example, suggest that the adoption of energy conservation practices may be a function not only of concern about energy, but also of: a) the perceived effectiveness of conservation; b) concern about any risks involved; c) assessment of the relative advantages of conserving; and d) the availability of the necessary information and equipment. Robinson (personal communication) argues that behaviour also depends on the public's evaluation of governmental policy and the energy industry's response.

4. The effects of socio-economic variables

Socio-economic variables such as income, education, occupational status, age, family size, family structure, life cycle, and sex represent another important set of factors which have been widely examined as sources of variation in both perceptions of energy issues and conservation behaviour. Income is worth examining in some detail, since it is the variable most often examined and most frequently cited as associated with attitudes and behaviour, not surprisingly because price constitutes the most obvious signal of changing energy availability.

As far as energy consumption is concerned there are, as one would expect, positive relationships between income and the amount of gasoline, natural gas, oil, electricity, and other fuels used by consumers (Grier, 1976; McDougall et al., 1981; Newman and Day, 1975; Warkov, 1976).

In the case of perceptions, the most commonly reported relationships are also positive and linear such that, for example, belief in an energy crisis increases in frequency among successively higher income categories (Cunningham and Lopreato, 1977; Douglin and Greer-Wooten, 1980; Gottlieb and Matre, 1976; Perlman and Warren, 1975; Thompson and MacTavish, 1976; Warren and Clifford, 1975). There have, however, been three kinds of exceptions to these general trends: some researchers report a greater frequency of concern among the lower income groups (Gollin et al., 1976; Jackson, 1980a; Keller and McDougall, 1980), others a curvilinear relationship, with levels of concern being highest in the middle-income categories (Kilkeary, 1975; Warren, 1974) while still a third group report income categories as failing to distinguish between perceptions (Murray et al., 1974; Talarzyk and Omura, 1975; White, 1975).

The most commonly-reported relationship between income and conservation behaviour is curvilinear (Grier, 1976; Kilkeary, 1975; Walker and Draper, 1975;
Warren, 1974). Jacobs and Foster (1980), for example, found an income threshold in the adoption of "significant" conservation practices such as insulation and weatherstripping, such that adoption increased from the lowest to the upper-middle income groups but declined thereafter. Most of these authors conclude that the lower income groups, who are already relatively low consumers of energy, have the least latitude to adjust consumption, nor can they afford to invest in costly conservation practices such as insulation. The highest income groups, among whom energy costs represent a comparatively smaller proportion of the family budget, can afford to pay higher prices and therefore continue to consume at established levels. The middle-income groups, however, cannot afford not to conserve, yet command sufficient financial resources to invest in adjustments which may take several years to pay off. These findings are substantiated in a study of energy consumption in Canadian households (McDougall et al., 1979). There have again, however, been exceptions to these general trends: some researchers report positive linear relationships between income and conservation (Perlman and Warren, 1975; Talarzyk and Omura, 1975), others negative associations (Cunningham and Lopreato, 1977; Gottlieb, 1974; Gottlieb and Matre, 1976), and others no income differences in conservation behaviour (Curtin, 1975; Hogan, 1976).

These apparently contradictory findings regarding the income variable illustrate the difficulties surrounding the identification and interpretation of socio-economic variations in energy perceptions and conservation behaviours. They may be partially resolved, however, with reference to the process of conceptualization and approaches to data analysis, two issues which are relevant to all aspects of survey research in this subject-area, and which are discussed below.

5. Other themes in research

The preceding overview has described findings regarding the most common themes in research on energy perceptions and conservation behaviour, and which correspond closely to the kinds of questions asked in natural hazard research. In addition to these, one or more studies have examined other, more specific aspects, including perceptions of solar energy (Berkowitz, 1980; Foster and Sewell, 1980; LaBay and Kinnear, 1980; Warkov, 1980) and nuclear power (Barrados, 1980), exposure to media, access to information, and the evaluation of conservation advertising campaigns (Barnaby and Reizenstein, 1975; CanWest
Survey Research Corp., 1980; Douglin and Greer-Wootten, 1980; Foster and Jacobs, 1980; Kushler and Jeppesen, 1980), evaluation of conservation programs (Corney et al., 1980; Dyer, 1980; Heberlein et al., 1980; McNeill and Hutton, 1980), experience with disruptions in supply (Kilkeary, 1975), and perceived responsibility for causing energy problems (Brady, 1980; Hummel et al., 1978).

One further issue which has received some attention and which is worthy of more consideration than those listed immediately above is the question of how people view tradeoffs between energy development and environmental quality. Foster and Jacobs (1980) examined two aspects of this critical issue: the extent to which people are prepared to sacrifice environmental quality to energy development; and the ways in which desirable goals in environmental quality should shape decisions about energy development. Foster and Jacobs found that the majority of the respondents in their Ontario sample recognized the inherent environmental impacts associated with energy development, but believed that strategies are available and should be chosen which maintain acceptable levels of environmental quality, without reducing per capita energy consumption or negatively affecting accustomed lifestyles. In this regard, respondents tended to call for the reduction of waste and inefficiency in present energy uses, the development of renewable resources and low-impact technologies, and the limiting of exports of resources from Canada. Foster and Jacobs concluded, however, that in the final analysis most people believe that "where a decision must be made between environmental quality and the provision of adequate supplies, the former will have to be sacrificed" (Foster and Jacobs, 1980, p. 71). This conclusion has been confirmed by Stiles and Schwarz (1980) with Prince Edward Island respondents.

Farhar et al. (1980), however, report the public to be polarized on this issue: a substantial majority favour environmental protection but, while environmental quality is widely viewed as an important energy policy goal (Bultena, 1976), the majority favour relaxing various forms of environmental control in order to secure larger energy supplies at a lower cost than would be possible as a result of such controls (Angell and Associates, 1975; Doering et al., 1974). Indeed, some studies report substantial numbers of people blaming the actions of environmentalists as a partial cause of the "energy crisis" (Gottlieb and Matre, 1976; Hummel et al., 1978). There was also some evidence in the studies surveyed by Farhar et al. (1980) for the hypothesis that attitudes towards energy-specific development versus environmental quality
were related to more fundamental orientations to resources and conservation. Clearly, this issue represents one aspect of a more complex series of attitudinal dimension concerning nature, technology, and the quality of life, the effects of which on energy perceptions and behaviour are poorly understood, and which therefore require exploration in future research.

CONSISTENCY, CONCEPTUALIZATION,
AND DATA ANALYSIS

It is clear from the preceding overview that several consistent sets of general findings have emerged from the studies of energy perceptions and conservation behaviour conducted thus far. Most notable among these are the polarization of public perceptions related to a belief in and concern about the "energy crisis", and the widespread adoption of "minimal" types of conservation adjustment while the more "significant" practices have yet to be adopted by large numbers of the public. Within these general findings, some relatively minor inconsistencies were identified, especially in terms of differences in percentage responses to specific comparable questions. No doubt variations of this kind may be attributed largely to the circumstances and characteristics of the surveys in which the data were collected. These include location, scale, timing, sample size, structure, and bias, and, most important, variation in the form of questions, which has prevented the strictest degree of comparability between studies.

Above and beyond such relatively minor differences, however, several serious inconsistencies remain, including the contradictory and therefore inconclusive evidence about the effects of income variations on perceptions of energy issues and on conservation behaviour. As described above, positive, negative, curvilinear, or no associations between income and these dependent variables have been reported. Similar inconsistencies were identified in relationships between energy perceptions and conservation behaviour.

An obvious question, then, is the extent to which apparently contradictory findings are a true reflection of the real world, namely that socio-economic factors, perceptions, and behaviours are at best only loosely related. A detailed examination of the findings, however, suggests that in many cases quite different indicators have been used to describe and measure what appear, on a superficial level, to be the same concepts. It can be argued, therefore,
that much of the apparent inconsistency in results disappears when it is recognized that many of the studies described in the preceding pages have in reality examined different dimensions of public energy perceptions and behaviour. Furthermore, some contradictions may be resolved if a more sophisticated approach to data analysis than has commonly been used were to be adopted.

When social scientists investigate behaviour, they face two tasks which have serious implications for the data subsequently collected, the interpretation of those data and, most importantly, the inferences and generalizations which may ultimately be drawn. These tasks involve the process of conceptualization, whereby ideas about the phenomena under investigation are expressed in a rigorous form; and operationalization, or the choice and definition of specific indicators for the measurement of the abstract concepts. Given the inherent subjective elements of these processes, it is only to be expected that independent researchers utilize varying measures of multidimensional concepts and, as a result, draw apparently contradictory conclusions.

The abstract concept "perceptions of an energy crisis", for example, suggests several possible specific meanings and may therefore be operationalized in a variety of ways. An illustrative but by no means complete list from the published literature is as follows:

- perceived seriousness of the cost of gasoline;
- perceived seriousness of the cost of home heating fuel;
- degree of concern about the cost of energy and specific resources in relation to other current social, economic, and political problems;
- perceived seriousness of shortages of energy in general and of specific resources;
- anticipated dates of shortages for specific types of energy resource;
- past impacts of shortages;
- anticipated impacts of shortages;
- past impacts of price increases;
- anticipated impacts of price increases.

Since the precise indicator chosen in a given study is an important determinant of the nature of the response, it is reasonable to believe that the independent choice of indicators on the part of different researchers is at least partly responsible for what appear to be, at first sight, contradictory results. Certainly, evidence from studies which have simultaneously examined alternative indicators of the same general concept bears out this conclusion.
In a Canadian nation-wide study, McDougall et al. (1979) found that the cost of energy ranked second on a list of public concerns, whereas energy shortages ranked only fifth. A study in Victoria found that energy cost ranked fourth and energy shortages eighth out of ten public concerns (Foster and Kuhn, 1982). Similarly, when Albertans were questioned on their concerns about energy, only 39 per cent described possible provincial energy shortages as very serious or somewhat serious; but the level of "concern about energy" increased to 69 per cent of the sample when the same respondents were asked to consider energy shortages at the national level (Jackson, 1980a). The problem, illustrated by these examples, thus becomes one of choosing an appropriate measure of "concern about energy" (or any other abstract concept), since this choice affects the analysis of relationships among variables within a specific study, the degree to which inferences may be compared between studies, and ultimately the possibility for more fundamental generalizations from a body of research.

Comparable problems surround the choice of an appropriate definition and measure of "energy conservation behaviour", especially when it is recognized that the process of classification is in part a subjective response by the researcher to the problem of collapsing vast amounts of raw data into a form manageable for further analysis. The following are examples of the ways in which researchers have approached this task:

- perceived importance of individual efforts to conserve energy;
- frequency of the adoption of specific practices;
- grouping to various levels of abstraction, e.g. structural, habitual, transportation;
- "minimal" vs. "significant" conservation practices;
- range, as measured by the number of conservation practices perceived and/or adopted.

These methods vary from the relatively concrete to the relatively abstract, and each, therefore, has a number of advantages and limitations related to the understanding of patterns of conservation behaviour. The focus on specific practices, for example, has the advantage of being the most detailed and therefore the least abstract representation of real and specific behaviours; but unless the list is exhaustive, some important conservation actions may be omitted. Also, specific practices may be adopted insufficiently frequently to permit statistical analysis of the data. The "range" index gives a measure, albeit a crude one, of the extent to which individuals are aware of and have adopted
conservation practices. Its use is limited, however, since its derivation is based on an assumption of equal value and interchangeability of all forms of conservation behaviour and obscures important differences in terms of cost, the effort involved, and perceived and real energy savings. The point, of course, is the same as that made earlier in the discussion of perception indicators, namely that the measure independently chosen by the researcher to suit immediate analytical and inferential needs has serious implications for further analysis and for the comparability of results.

The presence of interrelationships among energy perceptions, conservation behaviour, and socio-economic variables in many of the studies summarized above, reverse relationships in others, and their absence in yet another group, are also matters of considerable concern. It is reasonable to conclude, however, that such contradictions stem, at least in part, from variations in the processes of conceptualization and operationalization. A few examples should suffice to establish the validity of this conclusion.

As far as the effects of the income variable are concerned, Cunningham and Lopreato (1977), for example, report that when questions were couched in fairly general terms (belief in an energy crisis and the real depletion of energy resource materials), then the high income groups most frequently expressed concern. When the questions implied specific impacts on disposable income and lifestyles, then it was the lower income groups who seemed to be the most concerned. Similarly, while Jackson (1980a) found that socio-economic variables acted as poor predictors of behaviour when the indicator chosen was specific conservation adjustments perceived and adopted, significant socio-economic differences became apparent when these practices were grouped, and the alternative indicator of the "range" of practices perceived and adopted was used.

Contradictory generalizations about the effects of age might initially be drawn from studies reported by Curtin (1975) and Gottlieb (1974). Curtin found that it was relatively young people who made the most significant reductions in energy use, whereas adjustments to home heating and cooling practices were made most often among the middle-aged. Gottlieb found that older people had the greatest propensity to alter their driving habits. The contradiction is thus resolved when it is recognized that different specific behaviours were under examination.

The presence or absence of relationships between perceptions and behaviour may equally be affected by choices made in the process of operationalization.
Warren and Clifford (1975), for example, found that belief in an energy crisis had no effect on conservation behaviour; but differences in energy savings appeared when sub-groups were defined on the basis of the extent to which they had personally been affected by energy shortages.

The preceding discussion implies that there can be no single or most appropriate measure of "concern about energy" or "conservation behaviour." Furthermore, attempts to operationalize these concepts in various ways may mean that, in reality, significantly different perceptions and behaviours are investigated. A great deal of care should therefore be taken in generalizing back from specific indicators to abstract concepts; at the same time, apparent contradictions in results should not be accepted at face value.

Another issue appropriately examined at this point concerns the need for multi-variate as opposed to bi-variate analyses of interrelationships among perceptions, attitudes, behaviour, socio-economic factors, and other pertinent variables. This is not to argue that multi-variate analysis has been entirely absent from the research described here: it is simply that a rather more sophisticated approach to the data is necessary than has been widely used. Multi-variate analysis can help to resolve apparent inconsistencies both within and between studies, and ultimately can contribute to a more complete explanation and understanding of the behaviours under investigation.

There are, of course, many reasons for wishing to conduct multi-variate analyses, each of which has been described at great length by Rosenberg (1969) in his detailed account of the elaboration model. Those which concern us most are the following:

- to test the reality or spuriousness of an original two-variable relationship because the "independent" variable may itself be dependent on or interrelated with one or more additional independent variables;
- to test for the conjoint influence of two or more variables on the dependent variable;
- to assess the relative strength of two or more variables as predictors of the dependent variable;
- to test for conditional relationships, i.e. to identify the specific conditions under which a relationship between two variables occurs.

A few examples created to illustrate salient points but indicative of a variety of real cases in the literature should suffice to demonstrate the need
for and the benefits of multi-variate analysis. It has been commonly found, for example, that younger people express a deeper level of concern than older people about energy problems, as do the better educated compared with the less well educated. Since, however, younger people tend on average to have more years of formal education than older people, the question arises as to the role or education in the relationship between age and perception. By utilizing some form of statistical control it is necessary, therefore, to examine the effects of age on perception while holding the education variable constant. Expressed in another way, the age-perception relationship must be examined under all conditions or categories of education. If the original relationship disappears, then it is considered to be "spurious" and is attributed instead to the education variable. On the other hand, the original relationship may be maintained, in which case it is considered to be "real." This simple example is representative of a multitude of possible interrelationships among all the socio-economic and other variables. It does serve to illustrate the point that inconsistencies in findings in the studies previously described may be due, at least in part, to a widespread failure to isolate the effects of specific variables and consequently the acceptance of the presence or absence of relationships at face value.

If, in the example described above, the original relationship is maintained and a reverse procedure shows that the effects of the control variable are also real, then it may be concluded that the two "independent" variables exert a conjoint influence on the dependent variable. One advantage of this procedure is the opportunity thus provided for producing composite or multi-dimensional rather than fragmented profiles of a sample according to a dependent variable. It may also be useful to assess the relative strength of two or more variables as predictors of the dependent variable, for which a variety of statistical techniques is available and which need not concern us here.

Rather more problematical and ultimately more important is the case of conditional relationships. It is often necessary to test for such relationships because of the apparently puzzling or counter-intuitive effects of variables when these are examined only at the simple level of bi-variate analysis. Knowing precisely what conditions lead to the emergence of a relationship (or even, alternatively, to its suppression), will also contribute to a deeper understanding of behaviour.

It was noted earlier, for example, that concern over energy issues tends to increase with income (a hypothetical case being shown in Figure 5A), and that
perceptions and conservation behaviour are similarly positively related (Figure 5B). On the evidence of these two relationships it would be reasonable to postulate a third positive relationship, namely between income and conservation; but the most commonly-reported relationship for the latter is curvilinear (Figure 5C). In cases such as this, the second relationship (perceptions and behaviour) should be examined under various income conditions, i.e. the effects of the income variable should be controlled during statistical analysis (Figure 6). In this hypothetical example, conservation behaviour is shown to be affected by both income and perceptions simultaneously, and the unexpected relationship between income and conservation is clearly described and explained, namely that it is modified by the intervening variable "energy concerns." Thus the precise conditions contributing to behaviour are more clearly specified than if the effects of each variable were to be examined in isolation from each other. Furthermore, the results of this and more complex levels of analysis in which additional variables are introduced may subsequently be used to develop models of perceptions, behaviours, and related variables.

Clearly, then, there are considerable advantages to the multi-variate analysis of survey data on the public's perceptions of energy issues and their conservation behaviour. Unfortunately, these advantages have been inadequately recognized in the literature, a fact which may help to account for the lack of agreement as to the effects of certain variables as predictors of perceptions and behaviours. This is surprising, because while the approach to analysis may be relatively sophisticated, the statistical techniques required are not. On the other hand, it should be recognized that the type of analysis advocated here may require very large and expensive samples, especially if non-parametric techniques associated with the multi-level crosstabulation analysis of nominal or ordinal data are to be utilized.

In summary, we more attention to be paid to processes of conceptualization, the operationalization of abstract concepts, and approaches to data analysis, the opportunities for the comparison of research findings and the development of generalizations would be enhanced. At the same time, a recognition of these issues as possible sources of variation between independently-conducted research studies suggests that the body of research published to date is less inconsistent and contradictory than it may appear at first sight.
Figure 5 Relationships between income, energy concerns and conservation behaviour

Figure 6 Relationships between energy concerns and conservation behaviour, controlling for income effects
POLICY PERSPECTIVES

While many of the studies reviewed in this paper were initiated primarily for academic and pedagogical reasons, the results are not without practical consequences. The fact that increasing amounts of funds are being expended by government agencies, public utilities, interest groups and energy companies on these types of studies attests to such a conclusion. Indeed, it is often difficult to dissociate the theoretical from the practical: much theoretical work has resulted in conclusions and recommendations which have been incorporated into public policy, while specific policy-oriented surveys have drawn, at least implicitly, on concepts and theories developed by the social sciences.

It is worth reiterating here that the "energy crisis" has evoked responses which recognize that technical solutions, which have traditionally permitted society's demands for increasing supplies to be met, are no longer appropriate. The finite nature of non-renewable sources of energy has placed limitations on the success that a one-dimensional policy of technological expansion can be expected to achieve. A critical examination of a reliance on a "technical fix" approach indicates that social adjustments are important and necessary, and are often less expensive in the long run than engineering responses. A balanced energy program must stress conservation by all levels of society.

It has been noted that today "energy decisions are issues of political economy rather than the application of technology. Such choices are ultimately matters of social preference" (Sadler, 1980, pp. 175-176). It is this realization that social processes are fundamental to energy policy-making, and to the success of policies especially in terms of conservation strategies, that has evoked such an interest in public awareness, perception, attitude and behaviour studies. Indeed a failure to evaluate and anticipate these factors has been responsible for the preclusion of certain options in the past and resulted in the failure of myriad public programs.

In the most general sense, questionnaire surveys can help provide a realistic basis for the formulation and evaluation of policies and programs which are directed towards achieving a sustainable energy balance acceptable to the consuming public. Paine and Naumes (1974) have identified six distinct stages which enter into the policy making process and the research studies under consideration in this review can, and have, contributed to all of these stages (Table 1).
### TABLE 1
POLICY STAGES AND ENERGY-RELATED RESEARCH

<table>
<thead>
<tr>
<th>STAGES</th>
<th>EXAMPLES OF RESEARCH</th>
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<tbody>
<tr>
<td>POLICY</td>
<td></td>
</tr>
<tr>
<td>1. PROBLEM IDENTIFICATION</td>
<td>• Identify public level of concern with respect to energy</td>
</tr>
<tr>
<td>2. POLICY DEFINITION</td>
<td>• Identify public attitudes towards energy conservation</td>
</tr>
<tr>
<td>3. IMPACT ANALYSIS AND POLICY SELECTION</td>
<td>• Identify public knowledge of potential energy-conserving behaviour, general reaction and resistance to policy alternatives, and current energy-conserving behaviours</td>
</tr>
<tr>
<td>PROGRAM</td>
<td></td>
</tr>
<tr>
<td>4. PROGRAM DEVELOPMENT</td>
<td>• Identify the types of programs perceived as useful in assisting in energy conservation</td>
</tr>
<tr>
<td>5. PROGRAM IMPLEMENTATION</td>
<td>• Identify groups likely to be receptive to energy conservation initiatives</td>
</tr>
<tr>
<td>6. PROGRAM EVALUATION</td>
<td>• Identify public who react to program</td>
</tr>
</tbody>
</table>

Source: based on Evans et al., 1979; Paine and Naumes (1974).

In the first stage, that of problem identification, surveys are needed to measure aspects of the energy problem such as the level of public concern, which indicates the social priority and urgency attached to the issue. Concern is a very necessary prerequisite to the successful implementation of certain energy policies. The second stage involves policy definition, and research which can identify public attitudes towards such items as energy conservation is important. The holding of certain attitudes is more likely to favour certain policies over others. The third stage consists of impact analysis and policy selection. Required studies include the identification of current energy conserving behaviour and awareness and knowledge of other potential conservation adjustments. In addition, barriers or resistances to changes need to be identified if an expansion in the adoption of conservation behaviour is to be effected.
The next two stages involve program development and implementation. Information requirements in these stages include, for example, the identification of the types of programs which are perceived by the public as being useful in assisting energy conservation, and the identification of target groups which are likely to be receptive to program initiatives. In the final stage, program evaluation surveys are needed to identify the public who reacted to individual programs. On the basis of this information, new programs or "fine tuning" of existing ones can be formulated.

While this framework giving distinct policy stages is suggestive of how questionnaire surveys can contribute to energy policy making, in reality most studies are limited and tend to be specific rather than strategic in nature. In a thorough review of the use of questionnaire surveys in energy policy making Sadler (1980) makes several important, yet disturbing observations. In the first instance, questions are asked, the implications of which have received little thought by the public. This is especially important in complex issues such as those involved in energy policy. Such opinions are likely to be inconsistent, at best unstable, and there is generally a poor correlation between measured attitude and actual behaviour. Second, surveys tend to pay little attention to situational factors which may affect responses. Third, questions are often generalized and hypothetical in nature and assume the public is well informed about complex interrelationships. Fourth, responses to questionnaires are often conformist, meeting with accepted norms which bear little or no relationship to actual behaviour. Sadler concludes: "In short, questionnaires are prone to elicit public preferences and attitudes that may be accurate but are only marginally relevant for predicting behavioural responses which have significance for policy" (Sadler, 1980, p. 186). While such strong criticism is perhaps justified in some instances, it should be emphasized that the primary purpose of much of the research under Sadler's scrutiny was initiated for reasons other than policy making. Rather, policy implications of the research were merely implicit, rather than explicit.

Nevertheless, there is evidence that such criticism has been heeded and research is now following a more rigorous path as far as policy perspectives are concerned. This is perhaps best demonstrated by research funded by the Consumer Research and Evaluation Branch of Consumer and Corporate Affairs Canada. Earlier questionnaire and research projects have been modified to fit a more strategic mode, as suggested by the framework presented in Table 1.
CONCLUSIONS

In many respects, North American energy perception and conservation research stands now where natural hazard research and recreation research stood ten or fifteen years ago. The formative stages are now complete, and the results from fragmented studies are beginning to take shape as a coherent body of findings. The essential dimensions of perceptions, attitudes, preferences and behaviour have been identified and described, typologies of behaviour have begun to be developed, some basic understanding of the influences of perceptions, attitudes and preferences on behaviour has been attained, and there is evidence of socio-economic differences in energy consumption and conservation. It is now appropriate to broaden the research effort, and in this regard three main avenues for future research may be suggested. These are: replication elsewhere; the assessment of relationships between energy consumption, conservation and other behaviours; and the influence of fundamental attitudes and lifestyle on energy-oriented behaviour.

The kind of research described in this review would appear to offer definite opportunities for replication outside North America, as well as within regions of Canada and the U.S. which have thus far received relatively little attention (eg. Quebec, the Atlantic Provinces). Allowances must of course be made for basic differences in the structure and amount of energy use reflected in factors such as climate and settlement and transportation patterns. Generally speaking, conservation behaviour must be placed within a broad social, environmental, and economic context, given marked differences in per capita energy use, energy prices, and the structure and availability of energy resources between different countries, and to a lesser extent between regions of North America. Actions perceived as severe sacrifices in a high energy-using society may be commonplace elsewhere; such differences should be viewed as part of a cultural mosaic which not only affects energy conservation but also may themselves be interpreted as surrogate measures of variables related to energy attitudes and behaviours. This caution aside, a clear precedent exists for applying established concepts, hypotheses and methods in novel situations as evidenced by the spatial and cultural diversity in localized studies of response to natural hazards (White, 1974).
Another potentially useful direction for future research would be the examination of relationships between energy perceptions and conservation on the one hand, and other forms of behaviour of interest to geographers on the other hand. These may or may not be overtly energy-consuming behaviours. One example which appears to be receiving current attention is the connection between energy consumption and recreation behaviour, and future research might follow the models developed by Foster and Kuhn (1981; 1982) and Ritchie and Claxton (1981).

Finally, there are some indications from research currently being conducted (Jackson, 1982) that an examination of fundamental attitudes might not only serve to explain specific energy-oriented perceptions, attitudes and behaviours but might also provide a useful set of indicators of lifestyle. In this regard, the "expansionist-limited world views" framework described by Russell (1979) and the "technocentric-ecocentric mode" framework described by O'Riordan (1976), which reflect conflicting philosophies about energy and other resources, may offer valuable insights for the organization and understanding of energy perceptions and behaviours. These frameworks provide useful summaries of fundamental beliefs about nature, technology, and the quality of life, and are currently being manifested in attitudes, behaviours, and strategies towards energy resources (eg. "hard paths" vs. "soft paths"). For example, ecocentric or limited world views characterize the perceptions, attitudes and behaviour of sizeable elements of the public, expressed in beliefs that the world is running out of resources, the identification of wasteful consumption practices as partly responsible, the call for the development of renewable energy resources, and concerns about the impacts of energy development on environmental quality. On the other hand, the call for highly-centralized strategies of energy management, based in part on a faith in technology, the notion that conservation will involve sacrifice, and the belief that environmental quality will ultimately have to be compromised to energy development, all imply a continued adherence to at least a modified expansionist-technocentric view. And those who entirely dismiss the existence or potential seriousness of energy problems certainly belong in the expansionist camp.

In this review we have attempted to demonstrate that the results of North American research into the public's perceptions of and response to energy issues is characterized by an acceptable degree of consistency when viewed
from the perspective of a single conceptual framework, and that much of the remaining inconsistency disappears when differences in conceptualization are recognized. As a result, the studies summarized here can be used as a baseline against which to conduct and evaluate future comparable research, and the findings can play an important role in the development and implementation of strategies of demand management. Much work remains to be done, and geographers can take advantage of this opportunity, contributing their own special insights. Emerging energy perceptions and behaviour, especially when viewed from the cross-cultural perspective, will provide geographers with exciting avenues for the further exploration of concepts and theories in the cognitive-behavioural tradition of geographic research.
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