Towards a Philosophy and Practice of Energy Policy Making

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Public policy formation in the energy sector is dominated by liberalism and the assumption that the primary aim of policy is the correction of market failure. Such a policy framework does not sufficiently account for the interconnectedness of the energy system and the role it has in determining characteristics of society and the environment. The author proposes an alternative approach to public policy that is objective in content and process. Content is objective if its truth conditions are independent of what humans happen to believe or want. The policy process is objective if it is designed to eliminate ignorance, bias and error. This leads the author to propose that policy formation should be based on "backcasting" from possible objectives. He concludes that such a policy framework is more effective in a complex world which is itself evolving in response to human decisions and that it reinforces our capacity for participative democracy.

L'élaboration de politiques dans le secteur de l'énergie est dominée par le libéralisme et la supposition que le but principal d'une politique est de rectifier les échecs du marché. Une politique ainsi structurée ne rend pas suffisamment compte des liaisons étroites qui existent à l'intérieur du système de l'énergie et du rôle qu'elles jouent dans la définition des caractéristiques de la société et de l'écologie. L'auteur propose une approche alternative aux politiques, une approche objective dans son contenu et dans son procédé. Le contenu est objectif si les conditions de vérité sont indépendantes de ce que les êtres humains peuvent croire ou désirer. Le procédé est objectif s'il est conçu dans le but d'éliminer l'ignorance, la partialité et les erreurs. Cela amène l'auteur à suggérer que l'élaboration de politiques se base sur des "postvisions" (backcasting) à partir d'objectifs possibles. Il conclut qu'une politique ainsi structurée est plus efficace dans un monde complexe dont l'évolution même se fait en réaction à des décisions humaines et qu'une politique de ce genre renforce notre aptitude pour une démocratie de participation.

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Editor's Note: This paper is based on an address given at McMaster University on October 25, 1988. The opening section, which provided background for the author's central argument, has been summarized by ESR's editors. The main body of the address has been abridged and edited.

I. Backdrop: Liberalism

The formulation and analysis of energy policy is carried on within a shared cultural-political tradition characterised as liberalism.[1] In its extreme form liberalism is characterised by the notion that, for all matters other than religion and ethics, the perfect free market is an ideal institution for human relations in that it is economically efficient and uncoercive. A society with a functioning perfect free market would have need of government only for external affairs and for the policing of the market itself.

Because the conditions required to establish a perfect free market do not strictly obtain anywhere, governments in actual societies are given the additional role of correcting market imperfections. Arguments for government interven-

1 / For some background on this, see, for example, Hooker and van Hulst (1980) and Hooker (1983) and (1987, chapter 7) and the manifold references there to those on whom I have relied.

tion that go beyond the correction of market failure must appeal to justice, ethics, collective social goals, or religion, which transcend the pursuit of individual interests. While liberals prefer to minimise all such interventions, governments in Western societies are also influenced by religious and various other traditions.

As a result of being formulated in a framework dominated by liberal thought, public policy tends to have the following characteristics.

Policies are **commodity-centred**, focusing narrowly on individual energy industries, rather than on the overall energy system. As a result there are large gaps. For instance, despite the fact that passive solar energy has an important role in the system (for plant growth, building heating, drying, etc.), it gets little attention because it is unpriced in the market. Little consideration is given in government policy to those energy commodities that are available but not marketed at the moment. Too little attention is paid to the long-term economic effects of an integrated energy policy (e.g., for urban structure and building design, technological infrastructure and the like).

Market incentives are favoured as policy tools. Governments specify policies in terms of pricing, taxation, tariff and other market-based structures. They tend to neglect policy tools that do not operate through market incentives; for example, support for research and demonstration of new energy technologies, the setting of building standards, environmental quality codes, lifestyle education, and so on.

Liberal policies are **expert-active, client-passive**. In the private sector, firms design products; the consumer decides only whether or not to buy them. Similarly, when government institutions are designed to fine tune the market, they are designed by experts; the public who are going to enjoy the results of the policy are not closely consulted. Such consultation is done through the political process, not through the policy analysis process.[2]

Because of the emphasis on tuning markets, policies tend to be **reactive, short-term** and **non-directional**.

While the author described these features of liberal policy making in order to contrast them with those of a preferred policy framework, he pointed out that he does not reject liberal public policy in an overall sense. Many aspects of it are desirable in appropriate circumstances; because public value-based decisions are coercive, government intervention should be reduced wherever possible; waste is always undesirable. The real problem is to encompass the best of the liberal approach within a broader perspective: one that allows for a society to be conceived of as an interrelated system that is structurally influenced by government policies and within which collective decisions, as well as individualism, are valued.

As part of the quest for such a policy analysis, it is useful to consider the current literature. In a primarily individualist market society, two concerns dominate the analysis of policy: (1) an evaluation of the efficiency of government policies in the light of their market-tuning objectives; and (2) an attempt to understand the interest groups who create the demand for policies and the process by which they affect the decisions of government.

In a framework that goes beyond liberalism, energy policy must involve distinctive **content** that is not treated in these two areas of the policy analysis literature. Neither does the literature treat the distinctive aspects of the **process** upon which energy policy should be based within this broader perspective. Thus, the central objective of the author's address was to offer, against a liberal background, an approach to the **content** of public policies and an approach to the **process** of policy making that will move beyond the confines of the liberal approach in a responsible manner.

II. Energy Policy Content

Let us remind ourselves of the standard struc-

2 / Examples of literature on this point are Midttun and Baumgartner (1987) and references; for Canada especially see, Bott *et al* (1984), Hooker and Robinson (1987), Robinson *et al* (1977), Hooker *et al* (1980) and their references.

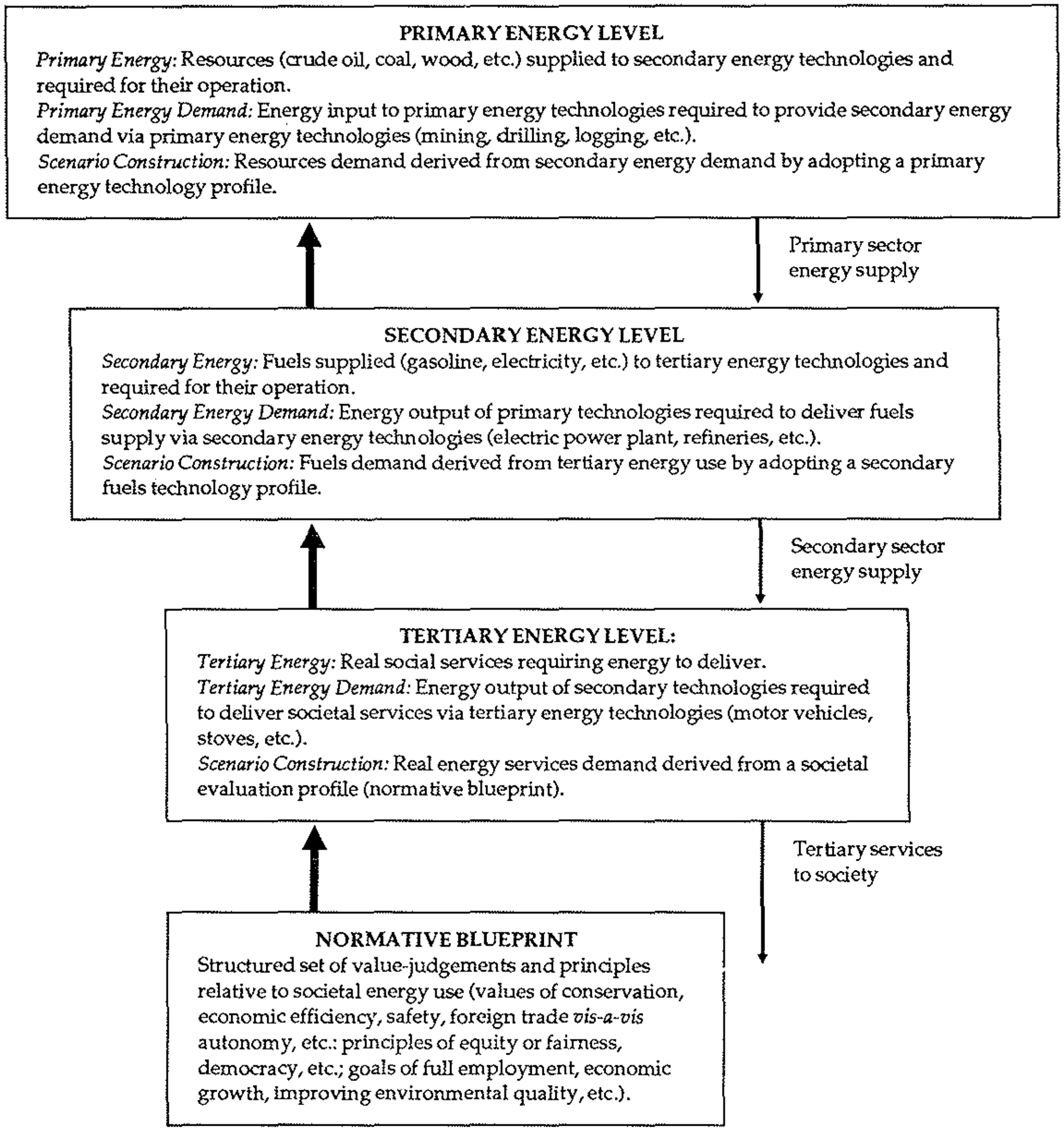

Figure 1: Societal Energy Structures.
Downward arrows indicate the flow of energy services. Upward arrows indicate first the influence of values and then the demands for services on each level of the energy system.

ture of energy use in an industrial economy. The energy flow structure (Figure 1) can conveniently be divided into production (primary level), distribution/transformation (secondary level) and consumption (tertiary level). Primary energy demand is the direct demand on the environment for resources — the actual amounts of coal mined, oil extracted and so on, measured by their energy values.

From the entropic perspective we should be measuring this use of resources by the negative entropy values associated with the demands referred to above and we should be assessing energy use in terms of second law efficiency; that is, efficiency in the use of negative entropy or available work. First law efficiency — efficiency measured simply in terms of the quantity of energy — is normally used. It suffices for economic decisions in relation to an energy commodity, but not among energy forms. Our western societies are about 25% first-law-efficient; that is, their energy using devices eject as waste on average about three-quarters of the energy fed into them. But our societies are only about 2% second law efficient; that is, they destroy or eject as waste about 98% of all the ordered structure or useable energy available to them.

Secondary energy demand is the amount of energy demanded of the primary level by the devices in homes, factories and so on which use the primary energy to do things: washing, motoring, heating and so on. Tertiary demand is only indirectly a demand for energy, it is the energy actually used to produce the services wanted by consumers (i.e., the cooked eggs on the breakfast plate, not the coal used to cook them). Tertiary energy use is the energy supplied by — rather than to — the secondary-level devices and actually delivered in goods and services.

Energy plays a ubiquitous role in our society. Every process, every piece of work or play, requires an energy flow. We should not think of the energy structure of society in isolation from its effect on the whole industrial and social structure. So, for example, the architectural designs of buildings reflect both a certain approach to energy use and, in turn, determine the pattern and level of heating and cooling demand. The design of our transportation system not only directly affects the energy demand profile, but also the spatial design of cities, which energy policy also influences and is influenced by. Industrial structure has an enormous impact on the structure of primary and secondary energy demand. Aluminium production demands enormous quantities of electricity; if, on the other hand, you are primarily processing steel and plastics then the demand will be for coal. In turn, a different mix of electric power production and direct coal use will mean that different technologies are supported in the society, different export industries become competitive, different regions of the society become wealthy, or subject to pollution, and so on. The consequences reverberate through the economy.

Thus, when you are thinking about an energy policy, it is appropriate to think about a "slice" of the whole society.[3] The energy flow structure is one aspect of the entire design of the society, not only its technologies but also its occupational structure, its lifestyles, the lot. Thus one should approach energy policy from a systems design point of view. One should think of **energy policy as the design of the entropic flow subsystem of an entire society.**

Notice that from this perspective it is logical to begin an analysis at the tertiary demand level — just the opposite to our current supply-oriented approaches. Our model commences with the formation of tertiary energy demands, by describing the kinds of goods and services required; then from that and the preferred designs of technologies which will supply those particular demands, the secondary energy demand can be constructed. And here you want a feedback loop, since those technologies themselves have to be built, and the resulting industrial structure to do so will itself require energy (and itself will have

3/ The metaphor of a "slice of society" in relation to energy policy is useful because the argument presented here applies to any major policy area. Analyzing transportation policy would require a different slice, cultural policy another one, and so on.

to be built, requiring still more energy, etc.). Inverting secondary technology operating efficiencies now yields the required primary level output. Here again these demands must be corrected to allow for the manufacture of the technology, requiring a second feedback loop. And now the resulting primary demand profile must be weighed against the distribution of natural resources available plus those not available that the society is willing and able to buy from elsewhere. Any mismatches here are fed back down through the primary and secondary redesign loops — a third feedback loop. In this way one can build up an operating model of the energy structure of the society as a system.[4]

The above construction specifies a content to energy policy which is conceptually independent of the economic market. *A fortiori* policy formation within it does not revolve around market fine tuning, nor is it primarily concerned with economic efficiency goals construed more generally. Rather, energy policy specifies the design of an entire societal subsystem and that goes well beyond narrowly defined economic competencies. Energy designs shape and are shaped by urban design and lifestyles (e.g., by environmental quality standards, by population distribution and kinds of work roles, by health and safety standards and so on). Even within the economic sphere, energy use design is a key factor in the long term development of industrial infrastructure. (For example, support for a wind electric grid in some suitable region means tooling up to produce reliable small motors, to improve battery storage and so on, and these in turn have many other industrial applications.) What we really need then, for an energy policy, is a coherent systems design to the energy flow structure of a society. This gives a coherent content to energy policy, in contrast to ephemeral attempts to fine tune markets.

The relationship of policies of this kind to the economic market still needs to be specified. Strictly, this cannot be done in any detail until the role of value judgements in setting energy flow design is considered. However, a position can be stated here in outline. The market is to be used as the institutional device for implementing energy policy wherever the costs of its limitations — including both its functional imperfections and the social character of its outcomes *vis-a-vis* justice, national security, etc. — are outweighed by the benefits its use bestows, in terms of both economic efficiency and freedom from coercion by government. The extent of reliance on market mechanisms thus turns on the particular character of the policy field involved (e.g., contrast timber pricing to oil pricing), and on the value judgements made by the society in respect to that policy field. To this latter issue I now turn.

There are no such things as value-neutral designs. Every design is the choice of certain relationships and the rejection of others and every such choice has a group of value judgements underlying it. Our society is an artifact, an "art-in-fact", a set of values realised as facts. For example, the value placed on human life in Ontario by the transportation system is around $300,000, give or take $50,000. One calculates a value of this sort from a risk-benefit analysis. It reveals the way in which people typically trade off time and convenience against, for example, the increased risk of being in a motorcar accident as compared with the risk of train and bus travel, as well as the way in which they trade off safety features in cars against reductions in their buying price, and so on. The road system is not labelled with that value of life; there are no signs on the highway saying "Value of Life: $300,000." Nevertheless, that value judgement is built into the design of the transportation system. It is realised in the thickness of the door sheathing on cars, the safety systems built into them in the event of a collision, the width of roads, the number of police patrolling them, and so on. While it is a common mistake to think that value judgements are abstract and private to individuals, the most important value judgements a society makes are concretely realised in the public designs of the society itself.

Our description of the design process can now be completed by recognizing that an energy flow

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4/ For detailed analyses see Robinson *et al* (1983/4), Robinson (1982); Bott *et al* (1984); for an overview see Crosley and Hooker (1987) and Hooker (1987).

system design must realise the public values of the society involved. This leads me to the notion of a normative blueprint. A normative blueprint for an energy flow design takes the systems structure, locates every design choice point and identifies the values relevant to it.

The most obvious choice points are located at the tertiary level, where a society decides which services to demand and in what priority order. What is more important to us? Safe transportation or more hospitals? Far-flung residential suburbs or city centre life? Cheaper housing heated and cooled or more expensive passive solar buildings? Freedom from foreign energy dependence or cheaper fuel?

The secondary energy design level also exhibits plenty of choices; for example, should home temperature maintenance be achieved by electric radiators, gas furnace, fuel stove or passive solar plus clothing? Finally, at the primary level, value judgements concerning occupational safety (cf. coal versus nuclear versus solar technologies), environmental quality (cf. uranium mine tailings versus damming rivers), foreign dependence and the like become massive indeed. And there are still judgements concerning industrial democracy, work role satisfaction, concentration of wealth and the like to be considered. In sum, we go through the whole structure of a society's energy system in order to clarify and record all of the relevant values in the energy normative blueprint. I have placed the normative blueprint at the base of Figure 1 to indicate how fundamental it is to all three design levels.

Within a pluralistic society there will be support for many different normative blueprints. Even within a single blueprint there will be conflicts among values. These will have to be resolved by compromise, by trading off values against each other. It would be nice, for example, to have a safe road transportation system and to have it cheaply, so as to afford more health care for the aged, but that may not be possible. It would be nice to have plentiful electricity but no miners' black lung or radiation risk, but that may not be possible. So we need a further set of values, ones that specify which of our more immediate values are more important, and why. These trade-off values raise some complex and subtle issues.[5] But I shall set these complications aside here and simply say that, in the normative blueprint, we want to recognize conceptually the entire hierarchy of these value judgements so that we know what we are doing in the design of an energy flow system.

I have suggested that the content of an energy policy in the proposed framework is an integrated energy flow systems design, now including the normative blueprint which supports it. This recognition of the interrelatedness of the whole system, and the values involved in decisions, means that the content of any specific policy is less likely to be determined solely by the interests of particular groups which might benefit from it on some occasion; nor is it determined solely by the efficiency with which it fine tunes markets. The content will instead be structured through identifying the general structure of the evaluative issues at the energy design choice points and the possible entropic flow designs which could actualise those value choices consistently.

This whole generic structure remains, no matter which specific policy is chosen on some occasion, no matter whose particular interests happen to be served in that instance, and no matter which markets happen to be involved. It is this structure which I call the objective structure for energy policy. It can be spelled out in very considerable detail.[6] This entire structure is missing in the conventional liberal literature. Yet it, and it alone, can provide the systematic basis for a thorough, imaginative and democratic choice of energy policy.

5/ One is the presence of inconsistency. For example, most Canadians evidently are happy to accept the traffic death rate associated with the existing system of motor vehicle transportation, but they might not be so happy to fix that price publicly, say in legislation. Societies regularly affirm values publicly which they permit to be violated in actual, unpublicized practice. Consider, for example, the practices of prostitution, insider dealing and medical termination of life *vis-a-vis* their legal status. These attitudes may be socially desirable in an overall sense under special conditions. For an insightful study of these circumstances consult Calebresi and Bobbitt (1978).

6/ See the references in footnote 4, above.

III. Toward a Theory of Objective Public Policies

The framework described above for energy policy can be applied to other public policy fields as well. One can similarly consider the designs of the health care, information and transportation systems and oppose these, respectively, to fragmentary decisions about saleable cures, data and vehicles. And so on. Call the collection of all such constructions the **objective public policy structure** of a society and the collection of all actual public policies at a given time, which will be an instance of this societal structure, the **public policy profile** of a society.

The choice of policy areas to be pursued starts off with the identification of the most appropriate systems analysis of a society, for this will determine the subsystems that most clearly need attention. Appropriateness here is a combination of scientific judgement and value judgements. Moreover, in practice there will be a variety of extra-scientific constraints on the choice of subsystems: historical (e.g., inherited institutions), cultural (e.g., perceptions of relevance), resource (e.g., availability of information), and so on. There ultimately emerges a chosen collection of subsystems as the basis for developing public policies. The more politically mature the society, the more intimately and objectively are these subsystem choices related to scientific understanding of the structure of living processes.[7]

But content is not all there is to objectivity, process must also be included. The notion of objectivity has two distinct dimensions to it. These are reflected in the following remarks: "It is objectively true or false that rats are mammals" and "An objective assessment of alternatives was made." The first dimension concerns the kind of content involved, the second dimension concerns the manner in which acceptance of content has been reached. A **content** is objective, roughly, if its truth conditions are independent of what humans happen to believe or want, of the fact that humans happen to be studying that subject matter and so on. The **acceptance** of an assessed content is objective, roughly, if it has emerged from a choice process designed to eliminate ignorance, bias and error. In science, for example, one strives for objective content free of the intrusion of homocentric projections and which has been objectively accepted through a process of rigorous experimental testing and like investigation of competing alternatives.

In sum, an **objective policy** is one which has maximal objective content and which is chosen in an objective manner. Content has been treated under objective policy structures, described above. Choosing a policy in an objective manner is again a subtle issue; it requires at least the following:

(1) The relevant features of the actual world should play a causal role in bringing about consensus concerning the policy. That is, those deliberating on policy must be genuinely open to the truth about the reality in which and for which the policy operates, including the lives of the people affected by the policy. We object to the intrusion of politics into science because it can make scientists less sensitive to the facts and may influence their experimental practices and their acceptance or rejection of theory. The same situation holds for policy formation. This means we require a critical process in which proposed policies are confronted with imaginative alternatives and all are subject to critical appraisal. The way to generate these alternatives for a given policy area is to look at the most salient normative blueprints and systems design alternatives and to develop retrospectively assessed policies based on these. (More on this in Section IV.)

(2) The process of policy choice is one where public goods and bads emerge as a clear counterweight to the interests of particular groups. The public goods and bads are fairly assessed, while principles of justice form the basis for incorporating particular interests into policy evaluations. There are complex issues involved here,

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7/ In science we do not yet have any clear-cut account of epistemic institutional design, and only the bare beginnings of an account of methodological dynamics (since we are hampered by not being linked to institutional design in the past). For discussion of this problem, see Hahlweg and Hooker (1988) and Hooker (1987, Chapters 7 and 8). The latter also contains a copious bibliography.

since there are competing principles of justice, and competing choices between public and private interests. The institutional process must incorporate the given criteria and be capable of coping with the complexities involved. (Such a process is briefly discussed in Section IV.)

(3) The community which is to choose a policy should be clearly specified, as should its role in the choice process. In both science and public policy we exclude mental incompetents and the arguably immoral. This alone requires careful reflection and if one wants further exclusions it is necessary to deal with even more complex issues. In regard to science, the competent community is shrinking steadily as scientific complexity increases. Only the institutional design involved in the acquisition of knowledge holds the scientific process together, otherwise it would fragment into a thousand specialties, each too small to sustain an objective process of scientific acceptance. One has the sense of some difficult regulatory problems emerging here.

Analogous considerations apply to the public policy decision process. The complexity of policy tends to exclude competent participation by the community affected, as do a variety of regulatory requirements (e.g., those which determine their right to intervene in environmental assessment hearings and the like). One can take two deliberate kinds of action to counter these tendencies. First, one can develop a language of public policy description which reveals value judgements, permits entry to the relevant information and provides an integrating framework for relating sectional interests to public interests. The future scenarios framework of section IV is intended to do this. Second, one can institutionalise processes that require intra-communal negotiations which give an important role to common interests and principles of justice, as in point (2) above. By reinforcing these actions the policy making advocated here reinforces democratic participation.

(4) The policy choice process should be regularly open to correction. This should include the possibility of fundamental re-conceptualisation, as well as fine tuning in the light of learning and changing reality. However, each review has a cost, so that there also needs to be an institutional design for the process of initiating reviews, and this too should satisfy the foregoing clauses.

(5) If policy choice is to be a rational process, the institutional design solutions intended to satisfy the first four of these clauses should themselves be argued critically against competing alternatives.

This is a far from complete account of objectivity, even for such "simple" cases as those in science; I have tried simply to develop a notion of objectivity rich enough to be unified for both science and public policy.[8] In any event, I hope that I have clarified how public policy can be re-thought as a process of the design of our world and how it can be approached in a far more objective spirit than is possible within the framework of liberalism, yet in a way that respects democratic, liberal traditions and reinforces democracy.

The next section proposes a particular process for policy formation.

IV. Knowledge, the Future and Policy Process

Our relationship to the future has changed in a fundamental way as our capacity to regulate has developed. The industrial revolution with its artificial moveable factory already represented a massive shift in the link between society and environment. Our own times mark an equally important shift in our relationship to the acquisition and use of information and to science. This shift has deep implications for our relation to past and future planning.

The age-old method of learning has been to observe passively — so as not to disturb nature — and to generalise from what was observed. We still find such activities today in areas where we have relatively little information, for example in some biological classification. Alongside passive observation there has been an equally ancient method of probing to disturb nature and learning from her reaction, although this method was only given prominence with the Galilean

8/ For more on these themes see the references of note 1.

revolution in science in the Renaissance. Only controlled disturbance, i.e., experimentation, alone proved adequate to develop the technological knowledge required for the industrial revolution. It was not really until James Watt's application of scientific investigation to the improvement of Newcomen's engine a century ago that we began to have the systematic alliance of science and technology that is now so rapidly transforming the world. Yet one of the consequences of this combination of two powerful tools has been to develop a third still more powerful method: the method of possibility and design.

It works like this. When you have enough information about a phenomenon and a sufficient depth of theoretical understanding, you know much more than what it is — you know what its possibilities are. A simple illustration is provided by Newton's laws of motion. They tell us not only why, as a matter of fact, some particular projectile fell where it did, given its starting point, but they also tell us all the possible trajectories which projectiles can have. This is made dramatically obvious by human space travel: there were no facts of humans in space to observe objectively in advance, there were no tentative probings of ways of travelling to the moon to learn from disturbing them; rather we needed to understand in advance all that was possible for us, so that we could do it right the first time.

Once we have a theoretical representation of the possibilities, then the problem of the future becomes: which one of these possibilities shall we make actual? In other words, the future must be designed. We anticipate the future and shape it by design.

The shift from facts to possibilities, from reaction to anticipative design, is all around us. It is found in genetic engineering, in communications systems, in the development of materials. Everywhere the future belongs to those who have been able to grasp the shift from the past (observation and reaction) to the future (possibility and design).

This change has profound implications for societal decisions. We must use our scientific knowledge to understand the possibilities for our environment and design an environmental future. We must use our understanding of the possibilities inherent in our new technologies to design a viable economic structure for our future. We must understand the possibilities inherent in our multiculturalism and social institutions and design a viable societal future for ourselves. Our world is increasingly complex and the consequences of action are increasingly large, whether for good or ill. If we cannot as a species master the process of transforming complexity into possibility, from there to design a viable future, then we shall perish.

The need to bring this view to bear on public policy making is clarified when one considers the extent to which our world has become a human artifact, the result of past decisions, the realisation of human value judgements. We are surrounded by our technologies, and by the environmental artifacts which they create (roads, cities, airplanes, etc.). Even our agriculture is dominated by plant and animal species that are now largely human artifacts, and will become increasingly so in the future under genetic engineering. Indeed, the atmosphere of the planet is becoming a noticeably human artifact, unintentionally, and with very dubious benefits. Even more pervasively, social institutions and the cultures they support are artifacts, experiments carried on (sometimes over millennia) in what it is to be human. As the world is transformed into a human artifact it becomes less and less possible to escape from the normative dimensions. The secret of wilderness is that it is an environment still exhibiting no human norms in its designs. But the city is saturated with norms because it is a human artifact.

These conditions pose deep challenges to a theory of public policy making. They remind us that the future must also be regarded as increasingly a human artifact; it can no longer be looked upon as a natural object, a fact already there or objectively determined by present trends. Rather, it must be chosen. Even the pretence not to act is in effect to choose that future which is an extrapolation of the status quo.

In such complex circumstances, the consideration of method is central to an adequate theory of public policy formation. The above discussion has provided hints as to what an adequate method might be; I turn now to a more explicit formulation.

There are two fundamentally different ways of approaching the future: the forecasting method and the method of possibility and design (which is referred to in this application as "backcasting").

Forecasting is the usual way: start from where you are now and consider a small change in the next little while, which is predicted from past trends; next make the most efficient response to that small change; now go on from there. For example, Australia's oil production is declining in a fairly predictable way. Based on past trends the federal government may predict that it is going to decline 8% in 1989. Economists come up with the most suitable response, based on some criterion of efficiency. Then in 1990 it declines another 9% and they again give an efficient response to that. In 1991 the exercise is repeated again. With prediction you inch your way into the future, attempting to achieve an optimal outcome with each little change.

Forecasting has the advantage of flexibility. For example, if someone invents a cheap synthetic replacement for oil in 1990 after we have made two small changes in 1988 and 1989, we breathe a big sigh of relief, switch over to that and away we go with our same old motor vehicle technologies. But forecasting also has three serious disadvantages. First, it will inch its way optimally to destruction just as well as to success. We have to understand the possibilities inherent in the entire system before we can assess what real efficiency is. Second, even supposing an improvement is involved, short-term efficiency will not distinguish whether you are going uphill to the local maximum of small value or to the mountain of large improvements. What if you must first go down (be inefficient at something) to eventually climb high? Third, the forecasting approach projects from the present, it assumes that the present is acceptable or anyway fixed. All it does is change the present a little bit. What if the present is not okay? What if the present builds in a fundamental blunder or a repugnant set of value judgements? The forecasting approach will never challenge those defects seriously, instead it will tend to extend them. Even an inefficient industry or institution will be cheaper to support in the short term, because it avoids the initial cost of changing it. Prediction looks back to past trends in order to assess at best a short term future; if those trends fail us, then prediction fails us. But history teaches us that sooner or later most trends fail, as change bites more deeply.

By contrast, the method of possibility and design deliberately discards past trends wherever discarding is appropriate. Taking the mountain-climbing analogy further, suppose you wanted to get to the top of Everest. Would you start from Kathmandu and simply say, "We will take each step at a time and they should always be upwards?" Not if you are serious. Neither would one say, "Let us take the shortest route to the top," because the shortest route to the top may involve crossing a ravine which you cannot manage. What a mountain climber does, as knowledge permits, is say, "Let us start (in imagination) from on top of Everest and let us think our way back down. What are the alternative routes up that last face? And to get to that stage, is the western approach more manageable than the eastern slopes? What kind of equipment will we need? When will we need to go downhill in order to make it up eventually?" The way that a sensible climber plans the future illustrates a second method for approaching the future in policy making: **backcasting**. The contrast is drawn out in Figure 2.

First you put yourself in the future, then you think imaginatively about what the alternatives are there, what designs could be brought about. This simple step in itself opens up a whole range of fundamental changes (which may look inefficient from a forecasting point of view in the short term). In this way we widen the horizons about what is possible for a nation — if a nation does not permit that kind of imagination, it goes nowhere. Having explored the possibilities, you then consider them in relation to reasonable constraints, for example on capital accumulation, rates of educational change, the potential for technical change.

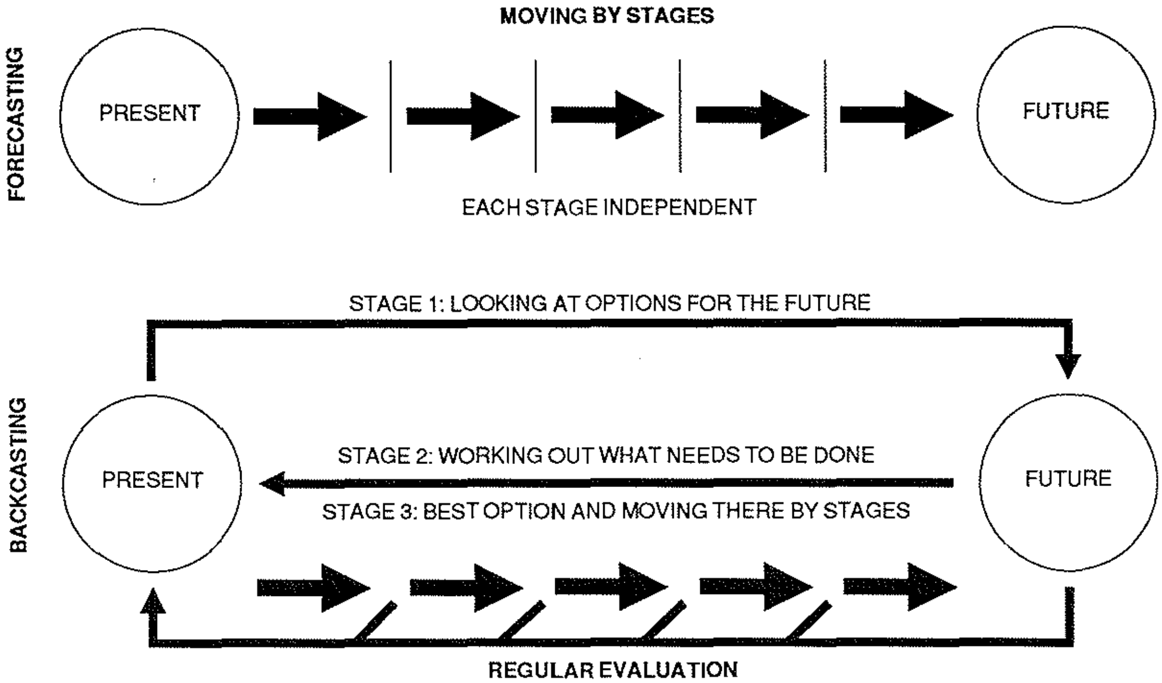

Figure 2: Forecasting and Backcasting

Second, for each alternative future you seriously wish to explore, you work your way backwards towards the present in stages, making appropriate plans for the beginning of each stage. If you want to make a structural change in the Canadian energy sector, you must start from the outcome you would like to see and, as you step backwards in time, you say to yourself: "Given that I am five years away from the change I want, what sort of change would need to be in place here in order to bring about the future I desire?" Then come back five years more, and repeat the question, and so on. In this way we may well be led to change basic structures, structures that had been the basis for past trends. You take the stages in reverse order because a decision about a later stage, nearer the goal, may significantly change your earlier strategy.

Third, after having evaluated the most interesting alternative future designs in terms of their feasibility, costs and benefits, you choose the most valuable one. With that design you can work your way forward in time in order to realise it, while attempting to be efficient at each step along the way, as in the forecasting method. But in this case you know where you are trying to go.

Finally, because we are going to make mistakes, we will have to periodically revise our plan. We must check regularly that the world has not changed under our feet in ways we had not anticipated. When it has, we need to go back and redo this process, rethink what kind of future design we want.

This four-step method is backcasting. There is nothing new in it. It is used repeatedly in business, politics and in our personal lives when we have clear views on the goals we want to achieve. To appreciate the advantages of this approach in public policy formulation, consider our energy future as an illustration.

Not so long ago our energy problem was relatively simple: make full use of what was most readily available. But today our energy problems are much more complex and much more grave. There is no automatic energy future. What is even possible for our energy future depends on a large number of technical, economic and even social decisions that we will make along the way, and these decisions in turn depend upon how imaginative we have been in applying our existing knowledge of possibilities to understand the alternative futures open to us.

Backcasting invites us to explore alternative energy futures by focusing on six questions:

(1) What can we do to open up our future energy options and, conversely, what current decisions would close them down? For example, developing decentralised solar technologies might increase our future options; committing ourselves to a national electricity grid fed by coal and/or nuclear power might close them down economically.

(2) Through what kinds of decisions is the future shaped? Since energy demand depends on the nature of such things as our transportation system, our cities and the buildings within them, there are a wide range of decisions which will affect future energy demand. Similarly a wide range of technical and economic decisions will affect the availability of future energy technologies.

(3) Under what constraints must we operate? These have to do with the sources of energy and the reserves of each type, our climate, the availability of capital, a realistic turnover rate for housing stock and so on.

(4) On what sets of value judgements do our decisions rest? They range widely, from our notions of acceptable risk (cf. nuclear versus solar energy), our ideals for social life (e.g., how much mobility is necessary?), our economic values (e.g., an acceptable view on the distributions of wealth from energy exploitation), our environmental values (cf. river damming versus coal mining), and so on.

(5) Which realistic future alternatives can be open to us? For instance, we can contrast solar and biomass industrial structures with a coal-fired electric future. But other alternatives, and mixes of them, are also possible.

(6) How do we go about making our choice of an energy path? Here we are concerned with the democratic process. Who should be in charge of energy planning (cf. governments versus electricity commissions)? How do we balance the role of technical experts versus the participation of various public interest groups?

Backcasting then offers a rich framework within which to explore a whole range of traditional public policy material. It is a framework of questions and of method, not a prediction of what the future will be. Presenting public policy in this framework has, I believe, some very distinct advantages.

Backcasting brings to the surface the values that are inherent in every choice. The contrasts between alternative images of the future are first and foremost contrasts in values. The normative blueprints in the backcasting methodology make this plain. In the forecasting method images of the future are not approached in terms of their contrasting values; the future is whatever it turns out to be, as we increment our way along. In this way the forecasting approach can create the illusion that there are no values involved, that you have merely done the next efficient thing and that is all. The hidden values in future choices become very clear in the backcasting approach.

The approach integrates facts and values. Every design, every choice among future alternatives, is an integrated choice of a set of values realised as particular facts, as actual features of our future world. In a past time when nature did its thing largely independently of us and we just reacted to it, you could think of nature as having facts and us as having values. But when you design the world, when the world is an artifact made by us, this separation is no longer possible and we must teach ourselves to think through both together.

It relates subjects that now tend to be overly compartmentalized. You cannot isolate economic policy from social and science policies if you are thinking about, say, the future of motor vehicle transportation and cities. You must come to grips with the cross-disciplinary impacts, and in a more accessible manner. For instance, to relate the broad policy process to the process of education, we cannot expect average citizens and students in school to learn abstract connections among disciplines and be highly motivated, but they can explore alternative conceptions of such immediately experienced things as cities, transport, energy use, political participation, or neighbourhood activities.

Backcasting hones our capacity to extract information critically. We are swamped with information, most of it trivial, while much of the really important information remains hidden from us. Futures Studies hones our ability to search for information more perceptively.

The backcasting approach empowers people. Relative to alternative methods, it has more potential to give to them a sense that they are involved, that they are capable of making decisions, and that they are participating in their own futures. Participation engenders a sense of responsibility for decisions and reduces alienation and disaffection. It leads people to a better understanding of technological change and its implications for our institutions.

The real impact of changing technology is in changing organisation, in every sphere: in the flow and use of information (instant world currency markets, phone banking, etc.), in machines and factories (robots, just-in-time stock control), services (supermarkets, futures markets), warfare ("smart" missiles, Star Wars) and so on. The more we shift away from nineteenth century fixed institutions into a world which is geared around technologically induced reorganisation, and the more our world becomes a multicultural world, the more desperately we all need a solid understanding of what our society is about. The backcasting method provides a framework in which people are led to explore an integrated picture of our society's institutions.

Participation in backcasting motivates people. This is the simplest but likely the most important of its features. And the reason is simple: it is our own future we are discussing. It is understandably difficult for people to be realistic and to accept discipline in the service of vague and distant goals. With its tighter link between present decisions and future consequences, the mentality of backcasting helps.

V. Concluding Comments

This paper has explored the processes of public policy formation as an exercise in Future Studies. Clearly, it is crucial how we institutionalise these processes. For most of human development we have not consciously designed institutions at all, and in the short span of history in which designs have been growing slowly more conscious, those designs have been exceptionally crude. They have been essentially simple variations on two extreme models: that of the linear authoritarian hierarchy (monarchies, armies, industries, etc.) and that of the free market. With them we face a set of conflicting constraints. The linear hierarchy is quickly choked by its constricted information flows and constrained in intelligence by its lack of feedback and the few at the top. The free market is constrained by its imperfections and its lack of foresight.

And both of them are constrained by their inability to represent within their workings a systematically coherent, interconnected world. Public policy processes of the sort advocated here require precisely such a capacity. They also need to be institutionalised so as to reinforce the capacity for participative democracy that this approach provides. Rather than the centrally organised, strongly hierarchical, specialising institutions that one designs for efficient commodity regulation, effective institutions designed to formulate public policy will need to be significantly decentralised, oriented towards participation and consensus. These aspects of institutional design have not been investigated in this paper.

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