

Among the Energy Tribes: A Cultural Framework for the Analysis and Design of Energy Policy

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ABSTRACT

My four years at the International Institute for Applied Systems Analysis (IIASA) have provided the opportunity for some participant observation among the Energy Tribes. The uncertainties that envelop trends in energy supply and demand are so wide that the exploratory mode (asking "What would you like the facts to be?") turns out to be more rewarding than the adversary mode (asking "What are the facts?"). The three Energy Tribes are distinguished by their three contradictory scenarios: "Business as Usual," "Middle of the Road" and "Radical Change Now." Each scenario sets very different bounds on what is credible and incredible, possible and impossible, sensible and foolish, rational and irrational.

More often than not, the name of any particular tribe turns out to mean simply "the people" in the language of that tribe. Each tribe, seeing itself as the repository of everything that is human, consigns all the others to a sort of *unmenschionable* limbo. That, in essence, is what has happened in energy policy analysis.

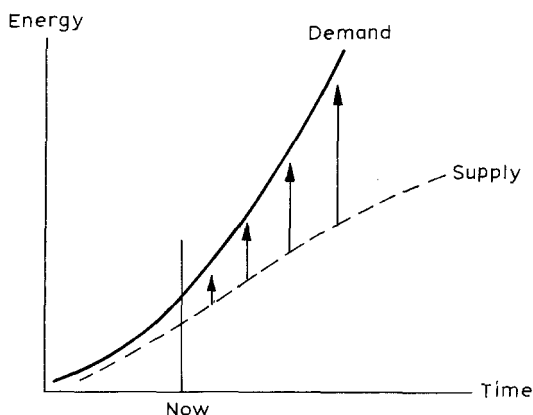
1. Introduction

The anthropologist, long used to working among distant and pre-literate tribes, has devoted much of his effort to the study of what is called the oral tradition; so it is hardly surprising that, when he finds himself a participant observer in the energy debate, he should try to find his bearings by reference to its oral tradition. When the women and children, the young men and the not-so-young men gather around the fire and listen to the tales of the old men, what do they hear? At the International Institute for Applied Systems Analysis (IIASA) tenure is unknown and the average stay is something less than

seven months. This means that even the memories of its most grizzled elders extend only a few years back into the past. Beyond that fuzzy four or five year point all is “dream-time” – a realm of wondrous happenings that are remembered not because they really happened (though they may have) but because they have some crucial significance for the present.

The start of the IIASA Energy Project, almost eleven years ago [1], is lost in this dreamtime and one of the tales that is sometimes recounted to the young warrior scientists concerns an heroic encounter between The Great Energy Chief (The Project Leader) and the Divine Trickster (disguised, on this occasion, as a Visiting Economist).

The Great Energy Chief drew on the blackboard a little diagram of The Problem. Energy demand was increasing but energy supply was beginning to fall away. An energy gap had already opened up and, if nothing was done about it, it would go on getting worse and worse. The solution lay in somehow or other increasing supply so as to close the ever-widening gap.



The Divine Trickster then stood up and said that the economist would see this as only one, rather extreme solution within a whole range of possible solutions. The two curves – supply and demand – were linked by a mechanism – the price mechanism – and their reconciliation would depend on such things as the elasticity of supply and the elasticity of demand; things that, to some greater or lesser extent, might be influenced by policy. “Ah yes” said the Great Energy Chief, “but economics is a soft science and we are taking a hard science approach to The Problem.”

At this The Divine Trickster went up to the blackboard and drew a square which, so the assembled multitude thought, he would presently fill with complex details of the price mechanism. But no; he turned it into a two-by-two matrix and, muttering something about “no names, no pack-drill,” returned to his chair.

	Hard Science	Soft Science
Hard Thinking		
Soft Thinking		

This little matrix provides a convenient frame for surveying some of the existing research on energy policy.

2. Models and their Assumptions

First, let me quickly consign the IIASA energy modeling exercise (and some others) to the bottom left box.

A mathematician colleague, Bill Keepin, has been looking at the IIASA energy study – a study in which three huge computer models are linked together in an iterative loop in order to generate scenarios that indicate where things might go in the future (Fig. 1).

His approach has been to see how much of the modeling he can throw away without altering the scenarios and he has found, to his astonishment, that he can throw it all away. His conclusion is that the inputs are “hard-wired” to the outputs. Experienced modellers, of course, will point out that, with strong constraints, the inputs will strongly influence the outputs but this is not what Keepin is saying. The outputs are not just influenced by the inputs; they are *identical* to the inputs [2].

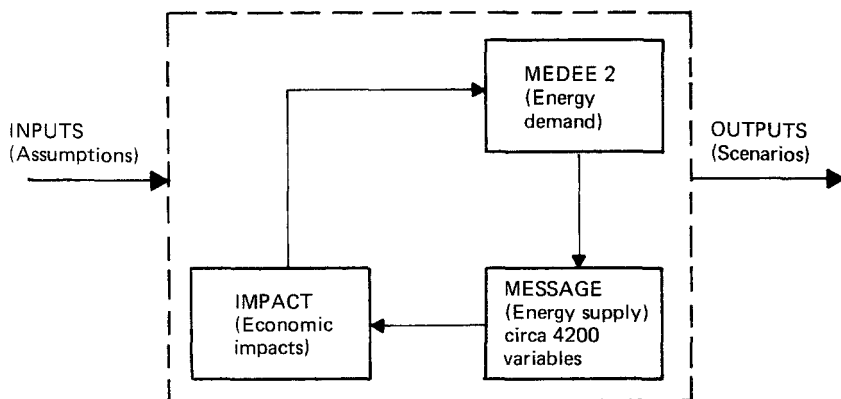


Fig. 1. The IIASA energy models.

A philosopher colleague, Douglas MacLean, has pointed out that this is not really an *identity*; it is an *entailment*. Since the intervening modeling phase turns out to have no impact on the process of getting from the inputs to the outputs, the IIASA modeling exercise constitutes a nice (and wonderfully complex) example of Aristotle's *practical syllogism*. Since the outputs are entailed by the inputs, there simply is no need for any intervening cogitation. Or, as Aristotle (with a single individual in mind rather than a group of policy advisors) has it, "straightway he acts."

That the outputs are hard-wired to the inputs – that the IIASA energy modeling exercise is a practical syllogism masquerading as analysis – I take as proven. The question I want to investigate is "What are the implications of this discovery?" Has Keepin revealed that the resplendent modeling emperor actually has no clothes, or has he simply exposed to public ridicule the full extent of his own naivety? Since there is no satisfactory straight answer to this question, my method is to explore why this should be so.

One response to Keepin's discovery (the response to Keepin's analysis that Wynne [3] found so interesting) is, first, that it is always easy to be wise after the event and, second, that the whole thing was really a non-event anyway. Just as it is better to travel hopefully than to arrive, so the real value of all this effort lies in the process of building the models and not at all in their end-products. This is because, to build the models, you have to identify and put together all the components – all the important variables and their crucial relationships – and this is not something that is at all clearly understood at the outset. The final destination, by contrast, is much less exciting and much less instructive because it is, quite simply, the starting point. The whole modeling exercise, in other words, is a circular walk – an amazingly elaborate and highly instructive way of getting from A to A; from your inputs to your outputs; from your assumptions to your scenarios.

Some of these assumptions, which are crucial if the scenarios are to come out the way they do (that is, if you are to get back to the beginning again) are remarkably precise and supremely improbable. For instance, that twenty-five years from now changes in the price of uranium will result in electricity from Fast Breeder Reactors gaining a two percent cost advantage over electricity from Light Water Reactors. Whilst this may indeed happen, it is not something that any experienced punter would be prepared to put his shirt on.

All this may come as something of a surprise to the innocent bystander, who naively assumed that all this hard science was leading somewhere, but that, to his eternal shame and embarrassment, only goes to show that he simply does not begin to understand what modeling is all about. *Of course* the inputs are hard-wired to the outputs; *of course* the scenarios are one-to-one transformations of the assumptions, and everyone with any pretensions to competence in applied systems analysis knows this from the start. In so far as they all go for instructive circular walks, such modeling exercises (whether they be IIASA's on behalf of its National Member Organizations and other sponsors, the Meadows' "limits to growth" model for the Club of Rome, or whatever) are all the same.

They are different only in their starting points – their assumptions. Some go from A to A, others from B to B, and still others from C to C [4].

This account of what goes on in futuristic modeling is, I hasten to add, not one that is universally accepted. As I have listened to claims and counter-claims, to admissions and denials, to attacks and counter-attacks, and as I have found myself caught between acrimonious exchanges that threaten to extinguish what little sweetness and light once suffused applied systems analysis, I have done my best as a sympathetic observer to extend credence, legitimacy and rationality to all the belligerents. Though it is likely to satisfy none of them, this account is the best that I can come up with. I put it forward, not as the truth, but as an hypothesis. If it were true, I will ask, what then? If it is common knowledge that the outputs are hard-wired to the inputs then who in their right minds, we should ask, would be prepared to spend millions of dollars just to get out what was put in – nothing more, nothing less? Answer: IIASA's prestigious sponsors, the Club of Rome and any other institution that funds a large-scale modeling exercise of this type. The choice of conclusions is simple. Either the funders are fools or it is not common knowledge [5].

I put the available options in this stark and objectionable form because I want to suggest a way of circumventing them. Rather than rushing to accuse the funders of incompetence or the modelers of deception, we might pause to consider the possibility that all this modeling has been in the wrong place. What we should have been modeling surely, is not the trivial process by which assumptions are transformed into scenarios, but the system that is generating the different sets of assumptions. This, in essence, is what my research (and that of colleagues like Mary Douglas and Aaron Wildavsky, 1982) is concerned with. The crucial methodological question becomes: how do we transfer our attention away from the scenarios and onto the system that generates the assumptions that determine these scenarios?

In terms of broad research strategy I will argue that we can move out of the two lower boxes – the “soft thinking” boxes – by a deliberate and thorough rejection of the “hard science/soft science” distinction. We erase this distinction by developing a critique of existing approaches (especially the large-scale modeling exercises) and this critique is a joint enterprise in hard thinking by people whose backgrounds are in fields as diverse as topology, anthropology, engineering and policy analysis. As the critique develops so the hard/soft distinction fades away and we are left with just two boxes – good science and bad science (or, if you prefer it, hard thinking and soft thinking).

3. The Political Culture Approach

Low energy demand and high energy demand, decentralized supply and centralized supply, de-growth and growth, de-coupling and the impossibility of de-coupling, soft paths and hard paths, etc., represent fundamental ways in which individuals seek to rationalize preferred patterns of social relations. The reason the usual arguments over energy are so frustrating is not that some of us are rational and others are not but that

“we” do not understand that “they” operate under cultural concepts rationalizing different ways of life. There is no sense in railing against others because they find scenarios incredible that we find credible when it is our convictions about the very nature of the world that is the setting for those scenarios that they reject.

When, despite all the resources that have been committed to it, a debate still retains such a wide spectrum of credibility, and when different experts still take up such widely-spaced positions along that spectrum, then the customary qualification for participation in the debate – expertise in energy matters – becomes largely irrelevant. Indeed, it may even become something of an encumbrance preventing those who possess it from realizing that their distressingly polarized debate now calls for the attentions of a different kind of expert. When the experts on energy are in persistent disagreement the time has come to call in the expert on disagreement among experts.

The central idea in this political culture hypothesis is that there are only a few *rationalizable ways of life*, and that each of them is underpinned by a distinctive *socio-logic* and buttressed by a distinctive *idea of nature*. I will explain these presently but, for the moment, all we need from this hypothesis is the prediction that socially viable sets of assumptions can come in the form of just five different “clumps” and that only three of these clumps will participate in any policy debate (Thompson and Wildavsky, 1982). If the inputs (the assumptions) are hard-wired to the outputs (the scenarios) then, if the hypothesis is valid, we should expect to find three distinct, persistent, and contradictory world views shaping the debate about energy policy [6].

So what I did was to search the literature on energy policy for descriptions of these three world views. I found six accounts, spanning a range of disciplines that runs from engineering to political science, and I then analysed those tripartite accounts to see, first of all, whether they lined up with one another and, secondly, whether they also lined up with the world views predicted by the hypothesis. They did line up (on both counts) but, rather than go into this lengthy analysis here [7], let me just quickly sketch out the three world views by reference to one of these accounts: that provided by Willis Harman and his colleagues (1977) at the Stanford Research Institute.

These authors are engineers with a particular interest in the harnessing of solar energy. Long immersed in energy matters (and sensitized, perhaps, by their solar zeal to the responses of their fellow engineers) they have come to discern three distinct perceptions which they label: Perception A, Perception B and Perception C. They characterize these perceptions by an extensive list of tripartite distinctions. If we summarise these characterizations in terms of the different, and contradictory, ways in which energy demand and supply are perceived as being reconciled we get something like this:

Perception A: “Onward and Upward.” The present trend, given our present skills and knowledge, is sustainable (and, of course, desirable).

Perception B: “Gradual smooth descent.” The present trend is (with some regrets) not sustainable and the solution lies in an orderly transition (carefully planned so as to minimize social and economic disruption) to a sustainable future.

Perception C: “Sudden discontinuous descent.” The present trend is (no regrets) not sustainable and the solution – a sustainable future – can only be reached by a radical change now, a change that will inevitably be accompanied by (desirable) social and economic transformations.

Harman et al. provide a persuasive description which they buttress, to good effect, with arguments borrowed from the history of science (T. S. Kuhn) and from anthropology (Ruth Benedict) but they do not seek an explanation. Rather, their attitude is that these three perceptions are facts of life and, instead of asking “where do they come from?” (and “how can we get rid of the ones we don’t like?”), their concern is with the much more practical and policy-relevant question “how do we live with them?”

They argue that these perceptions are just *there* and that it would be wildly optimistic to assume that two of them will presently go away and leave a single outright winner. Furthermore, these perceptions all lie within the bounds of expert credibility, not in the sense that energy experts of one persuasion concede the expertise of those of the other two persuasions (though they sometimes may) but in the sense that the socially conferred label “expert” is at present attached to some individuals of each persuasion. This means that we simply cannot give an answer to the question “which perception is the right one?” They conclude that, when there is such persistent polarization among both experts and laypeople, the *adversary mode* (arguing about which perception is right) becomes counterproductive as a way of deciding policy. Instead, they urge an *exploratory mode* (discovering where and when each perception is appropriate) and, without too much discussion of what this might be, they point out that if we are to move to such a mode we must, somehow or other, *legitimate all these perceptions*.

The other five tripartite descriptions confirm and fill out the details of Harman et al.’s three perceptions. For instance, Chapman’s (1975) three scenarios – “business as usual,” “middle of the road” (technical fix), and “radical change now” (no growth) – go with the A, B, and C perceptions, respectively. Orr (1977) (a political scientist) identifies the policy actors – the energy corporations, the government, and the public interest groups – and again they line up neatly with the As, the Bs, and the Cs. He then goes on to list the preferred styles of governance – *laissez faire*, *leviathan*, and *jeffersonian* – in each of these perspectives, thereby bringing the whole tripartite scheme very close to the “rationalizations for preferred patterns of social relations” that lie at the heart of the political culture hypothesis.

Taken together, these tripartite descriptions add up to a whole that is much more than the sum of its parts. The sum, you could say, provides a persuasive argument for the existence of the three clumps; the whole goes a long way towards clinching Harman et al.’s argument for a switch to the exploratory mode in deciding energy policy (or policy in any area that is characterized by persistent expert disagreement and by wide uncertainty bounds that are unresponsive to sustained efforts to narrow them; in other words, when we are in the realm of what Alvin Weinberg (1972) has called *trans-science*).

But what about the other two clumps – the clumps that do not participate in the debate

but whose existence is predicted by the cultural hypothesis? One of these clumps does not participate in the debate because it cannot gain access to it; the other does not participate because it chooses not to. The truly poor – those for whom “life is like a lottery” – simply lack the organization, the knowledge, and the media skills that would give them access to the debate. Such individuals have enough on their short-term plate as it is without bothering themselves about energy futures – about things “out there” that they cannot see and that they could not do anything about even if they could see them. So the D Perception is characterized by involuntary myopia and by a curious, but nevertheless realistic, appraisal of the future which we could call the “what you don’t know” scenario. The hermit-like individual, on the other hand, deliberately avoids getting sucked into the debate. His small-scale autonomy is sustained by a voluntary myopia that actively resists the construction of long time perspectives. So this – the E Perception – gives rise to another curious but, in relation to the autonomous strategy that it sustains, still realistic appraisal of the future which we could call the “sufficient unto the day” scenario.

From inside the energy debate these two curious scenarios are seen, at best, as not being scenarios at all and, at worst, as ignorant, facetious, or even downright criminally irresponsible. Be that as it may, the simple facts remain that these two clumps do exist, and that between them they may account for a significant proportion of the population. Though they do not participate in the debate over energy policy the Ds and the Es are not irrelevant to it.

4. The Political Culture Hypothesis

Is economic growth possible without energy growth? The As and the Cs say “no”; the Bs say “yes.” Can our present energy growth be sustained? The Cs say “no”; the As say “yes.” Faced with a situation in which people attach themselves to contradictory positions, there are two questions you can ask. You can ask who is right or you can ask where the positions come from. The political culture hypothesis is an attempt to answer the second of these two questions. The hypothesis is concerned with *the social generation of alternative assumptions about the nature of the world, about the nature of man, and about the nature of the relationship between man and the world*. To say that our present energy growth is, or is not, sustainable is to make assumptions about the nature of the world; to say that economic growth is, or is not, possible without energy growth is to make assumptions about the nature of man in society; and, since both energy growth and economic growth inevitably involve man in modifying the world, both sets of statements make assumptions about the nature of the relationship between man and the world.

My argument is that we simply cannot free energy policy analysis from its tedious and counterproductive tribalisms until we have put in place a “hard thinking” conceptual framework that is capable of transcending the pernicious “hard science/soft science” distinction. So what follows is not a report on research into human factors and energy but, rather, a *research programme* for their investigation.

A full outline of the conceptual framework spans three levels:

1. The micro-level of the individual as a *social being*.
2. The meso-level of *the social organization*.
3. The macro-level at which the distinctive *political cultures* associated with each of these types of organization become related to one another, through the institutional arrangements we call government, to produce a *political regime*.

Since an exposition of the full framework is inevitably a lengthy business, I will concentrate here on just one of these levels – the micro [8].

The Micro-Level

Individuals have to be seen as active strategizing agents. They do not just sit there like zombies waiting for policy to hit them. Nor can we assume just a single strategy and evaluate at this micro-level in terms of whether it responds to policy or not. People do not just respond; they react. More precisely, people do not just *have* needs, nor do they just *have* resources; they manage them. But, and this is the crux of the political culture argument, they do not all manage them in the same way. There are, I will argue, a small number of socially induced personal strategies for managing needs and resources. What is more, three of these strategies enable those who adopt them to do much more than simply react to policy. They enable them to actually participate in the debate that determines what that policy will be. So these micro-level strategies have some profound implications. They illuminate, and connect into a circle, the two ends of the policy process: formulation and implementation. In other words, Time's arrow points in both directions. The socially induced strategies allow us to derive the obstacles to implementation from the policy actors' positions or, if we so wish, to derive the positions from the obstacles. Each can be seen as the cause of the other. Both can be understood in terms of the strategies that link them.

This micro-level has been emphasized by George Gaskell (1983) who has observed that most of the problems encountered in trying to reduce energy waste in buildings (the British government's "Save It" campaign) derive from the fact that individual behavior is not captured by the assumptions of economic rationality. What I want to do is to lay out a framework of *plural rationalities* – socio-logics and their sustaining ideas of nature – that will capture that behavior. Since I am not an economist I will not use the economist's language to do this, but I do not see what I am saying as contradicting the economist. Indeed, it seems to me that everything I will be saying is consistent with the sorts of arguments that are advanced in the new institutional economics [9].

The Socio-Logics and Their Sustaining Ideas of Nature

The gregarious and well-fleshed businessman who trots out that old quip about being unable to reconcile his net income with his gross habits is, in a rather backhanded way, boasting about his worldly success and we can be pretty sure that, if he manages to push

his income a few notches higher, he will not take that opportunity to close the gap. No, he will just develop some even grosser habits thereby maintaining his insatiability and his expansive optimism – he will be propelled ever onward and ever upward until that unfair day when death (Nature's way of saying "slow down") [10] finally puts a stop to it all.

From this we might deduce that needs are infinite and that their ordering – the sequence in which they come to be satisfied – is brought about by the finiteness of resources. But, if we were to adopt this view of the nature of needs and resources, what would we make of Po Chü-i?

What I shall need are very few things.
 A single rug to warm me through the winter;
 One meal to last me the whole day.
 It does not matter that my house is rather small;
 One cannot sleep in more than one room!
 It does not matter that I have not many horses;
 One cannot ride on two horses at once! (Po Chü-i, circa 835a)

Po Chü-i's needs cannot be infinite for they fit comfortably inside the confines of his quite modest resources. If we want to be able to handle both the exuberant businessman and the sufficient Po Chü-i, we will have to modify our idea of the nature of needs and resources. Both resources and needs will have to be finite with the needs fitting inside the resources. Po Chü-i, clearly, has rather overdone things whilst in the other direction the businessman is a bit out of control and heading for trouble.

But then comes a knock on Po Chü-i's door. It is a small deputation of public officials come to tell him that he has not got enough bed-clothes, he is not eating enough, his mobility is inadequate and his small house is in contravention of Parker-Morris standards. He is to be moved into an old people's home where he will be properly clothed, properly fed and properly housed. He has been living below *the poverty line*. As he makes this involuntary transition to the old people's home so his needs are expanded for him until they reach their correct level. If we want to be able to handle these public officials, as well as the businessman and Po Chü-i, we will have to revise our ideas about the nature of needs and resources yet again. The needs of individuals are, as it were, given, and resources (which are inherently rather unruly things) have to be extended a bit here and trimmed a little there so as to fill out this rigid frame. On this view both the businessman and Po Chü-i are, in their different ways, somewhat pathological cases that will have to be brought into line if nature is not to be outraged.

But there is something unsatisfying about accepting this account of the nature of needs and resources. We have already met the likes of our businessman, our Po Chü-i and our public officials – they are the As, the Es and the Bs, [11] respectively – and to accept that two of them (the As and the Es) are pathological in some way is tantamount to removing their legitimacy – to imposing the narrow provincialism of just one perception of needs and resources (that of the Bs) on all the others. If we want to preserve the legitimacy of the various perceptions that, in their different ways, contradict the B perception, we must consider the idea that needs and resources have a certain social malleability. People, we

must concede, do not just *have* needs nor do they just *have* control over resources; they are, to some variable extent, able to *manage* their needs and to *manage* their control over resources.

The businessman and Po Chü-i now regain their dignity; far from being pathological cases, we can credit each of them with the savvy to forcefully manage his needs and his resources in accordance with the different personal strategies that he is following. Four logical, and equally legitimate, possibilities follow.

1. You can manage neither your needs nor your resources.
2. You can manage your needs but not your resources.
3. You can manage your resources but not your needs.
4. You can manage both your needs and your resources.

What may not be immediately obvious is that, for the fortunate individual who has both degrees of freedom, there is a third one. If he has the scope to manage both his resources and his needs then, depending on how he chooses to mix these two managements, he also has the chance of managing the size of the overlap between his resources and his need. For many individuals this is the crucial variable.

Annual income twenty pounds, annual expenditure nineteen nineteen and six, result happiness. Annual income twenty pounds, annual expenditure twenty pounds ought and six, result misery. [Mr. Micawber] (Dickens, p. 231).

So there are, in all, three degrees of freedom – scope to manage needs, scope to manage resources, and scope to manage the overlap between them. At the origin – the point at which all these scopes are completely frozen up – there is no personal management space at all but, as the scopes gradually unfreeze, so a three-dimensional management space opens up and, as this space opens up, so the fourth possibility splits to give two clearly separate extremes – possibility 4a and possibility 4b, as shown in Fig. 2.

This personal management space, with its five “corners” defining five possible strategies for the management of needs and resources, provides us with the conceptual means for avoiding all the pitfalls that accompany the assumption of a single rationality. As the various possibilities unfold so rationality becomes plural.

Possibility 1: Since the individual has no scope to manage his needs or his resources, he really cannot be said to have a management strategy. His concern, rather, is just to cope as best he can with an environment over which he has no control. Po Chü-i, once he is transferred to the old people’s home, finds himself in this sort of situation. Both his needs and his resources have been assessed by the kind-hearted public officials – they are no longer in his control – and he can count himself lucky that the resources he is given are exactly equal to the needs he is given. Sometimes, for people in his sort of predicament, they can be wildly out of alignment. So the rational response if you find yourself at Possibility 1 is: keep your fingers crossed and hope that Lady Luck smiles on you – survive by coping.

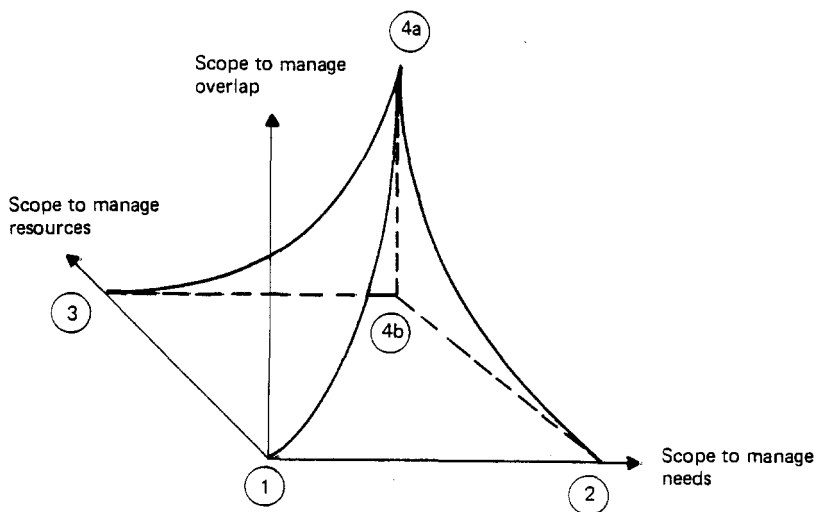


Fig. 2. The personal management space and its five extremes.

If this is the rational response what is the nature that it is the rational response to like? It is essentially cornucopian, in that there clearly are plenty of resources out there, but it is a lottery-controlled cornucopia – the horn of plenty only disgorges in your direction when it is your lucky day. Dignity calls for some matching of response and environment and this is achieved by adopting the appropriate attitude – fatalism.

Possibility 2: Since resources here are fixed and you can do nothing about them, your only available strategy is to decrease your needs so as to ensure a comfortable (or at any rate, a non-negative) overlap. But it is no use doing this on your own. If resources are fixed and finite then one man's gain is inevitably another man's loss and so this need-reducing strategy, to be effective, will have to be followed by everyone. In a strongly collectivized social context individuals can all see the advantages of such behavior and in the background, of course, there is always the threat of strong group sanctions to encourage those individuals who may be dragging their altruistic feet.

For this to be the rational response nature cannot be cornucopian – it must be strictly accountable. At Possibility 1 the a priori – the unquestioned gut-conviction about how the world is – can be summarized in the phrase: “If your number comes up . . .”; but at Possibility 2 there can be no such thing as a windfall – nature is a zero-sum game.

Possibility 3: If you cannot do anything about your needs then the only available strategy is to increase your resources so as to make sure that the overlap does not go negative. On the other hand, there is little point in going to an inordinate amount of trouble to increase the size of the overlap if your needs are fixed. Po Chü-i in his old people's home cannot fit this strategy because, though his needs are fixed, he is not in any

position to manage his resources, but what about those who put him there – the public officials? They are from different departments and different grades within a complex hierarchical organization and complex hierarchical organizations maintain themselves by imposing equally complex and ranked patterns of needs upon the individuals who compose them. Individually the members of such groups within a hierarchy have little manipulative ability but collectively (by working to rule, for instance) they are able to increase their share of the cake so long as, in so doing, they do not overtake the group above them. If this collective strategy is being pursued at all the different levels of the hierarchy then the result is *differential maintenance*.

If this is the rational response then the nature that it is the rational response to cannot be completely accountable nor can it be completely cornucopian. Nature, as it were, holds up a mirror to society. Nature *is* bountiful but within accountable limits, and these limits are given by the imperative to maintain nature's isomorphism with society – differentials have to be maintained and we cannot allow the reflection to become blurred by levels merging or, worse still, changing places. The *a priori* here is that the leopard cannot change its spots. There are all kinds of things that leopards *can* do but spot-changing is not one of them. If leopards could change their spots we simply wouldn't know where we were and so, to those individuals to whom knowing where they are (and where everyone else is relative to them) is very important, spotless leopards are unthinkable.

Possibility 4a: Here both needs and resources are manageable and the individual has chosen to manage them in such a way that he also has the scope to manage the overlap between them. This means that, unlike our exuberant businessman, his needs will nestle comfortably inside his resources. If he manages his resources up then his needs can follow at a safe distance; if he is managing his resources down (perhaps because he cannot manage them up, perhaps because he does not want to) he will have to bring his needs down a little bit ahead of them. Po Chü-i, before he is taken into the old people's home, is in this situation. Though he could increase his resources he chooses not to; that way lies coercive social involvement and he has had enough of that.

People when they are old are often burdened with ties;
 But I have finished with marriage and giving in marriage.
 No changes happen to jar the quiet of my mind;
 No business comes to impair the vigour of my limbs.
 Hence it is that now for ten years
 Body and soul have rested in hermit peace (Po Chü-i, circa 835a).

This is the rational response to a nature that is essentially benign, provided one makes oneself a part of it. For those whose needs are slight (and whose time horizons are short) nature will always provide. When Po Chü-i starts to take some thought for the morrow, and to worry about what is to become of him in his failing years, he relies on the Winter Chrysanthemum to dismantle his alarming time structure.

At this sad season why do you bloom alone?
 Though well I know it was not for my sake,
 Taught by you, for a while I will smooth my frown (Po Chü-i, circa 835b).

Possibility 4b: The exuberant businessman would consider himself to be in a bad way if he caught himself talking to the chrysanthemums; chrysanthemums are for buying and selling. You don't waste your time talking to flowers; you talk to people – important people. The businessman wades straight into all that social involvement that Po Chü-i has been at such pains to avoid. He clearly has the scope to manage both his needs and his resources and he chooses to reject the overlap-managing option and to manage his needs and his resources upwards to the very limit of his entrepreneurial skills and his physical abilities.

Unlike Po Chü-i, plenty of changes happen to jar the quiet of his mind. He is right in the middle of the turbulent stream of competitive individualism where success comes to he who boldly and skillfully accepts the risks – the opportunities – that present themselves there. Nature is cornucopian, but it is not a freely available cornucopia nor is it controlled by lottery – it is controlled by skill. It is a jungle out there; it is the survival of the fittest; it is nature red in tooth and claw.

So this brief outline, with its few carefully chosen examples, suggests that these five logically possible personal strategies for the management of needs and resources are actually taken up in real life. At the same time, the idea that the management scopes are frozen up or thawed out according to variations in an individual's social context provides us with a plausible way of mapping these five need and resource management strategies onto the process of social life (Fig. 3).

How far this takes us from the conventional concerns of energy policy analysis.

5. Postscript

My aim in this article has been to open up a rather new, and perhaps disconcerting, approach to policy analysis. I have tried to be provocative rather than definitive; to draw attention, in a deliberately outrageous way, to what I see to be some of the deep and general implications of Keepin's analysis of the IIASA energy models. Though I do try to extract a little fun from the Energy Tribes and their earnest struggle, my purpose is every bit as serious as theirs.

My professional interest is in those policy debates that are characterized by high levels of uncertainty and by persistent disagreement among experts. Such debates, I believe, have been seriously misunderstood. The reasons for this misunderstanding are many but prominent among them is the particular historical path that has led from operations research (OR), through applied systems analysis, to policy analysis as we now know it.

The classic OR approach proceeds in three stages: problem formulation, problem analysis, problem solution. This linear and uni-directional scheme is admirably suited to handling those problems that are so well-structured that there really can be no doubt as

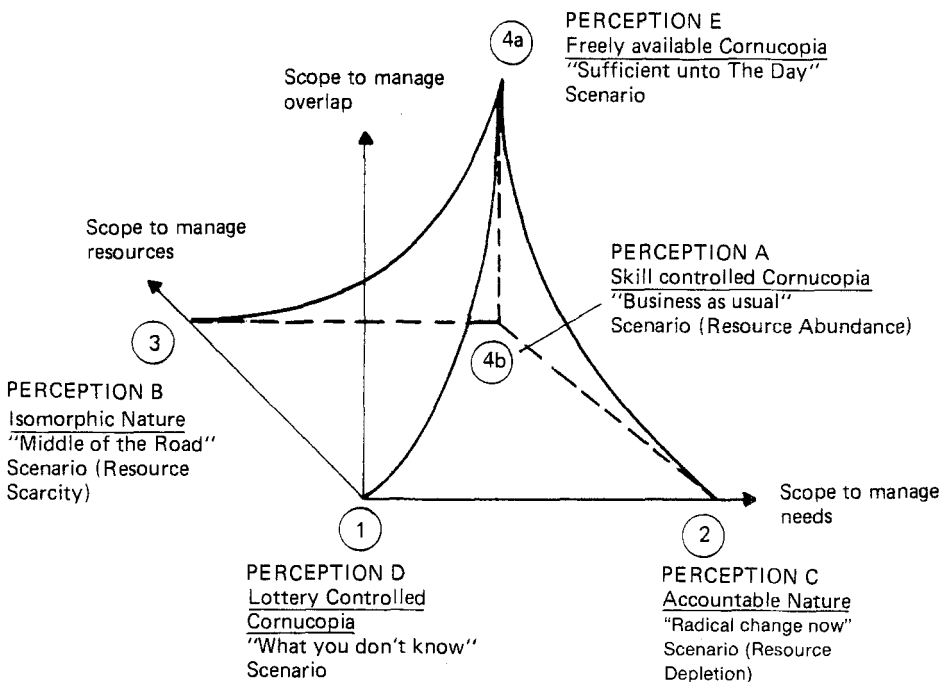


Fig. 3. The management space with the socially induced perceptions, the ideas of nature, and the credible scenarios mapped onto it.

to both their existence and the nature of their existence. A celebrated example of such a problem is how to distribute fire stations (each of which has to go in one particular place) so as best to cope with fires (which have a tendency to break out all over the place). Though it contains some uncertainty (we do not know, for sure, where the fires will break out) the problem itself is clear-cut. This OR approach, we could say, enables us to tune an already acceptable understanding of the problem.

But not all policy problems are of this type. Sometimes, far from the problem containing some uncertainty, it is the other way around; it is the uncertainty that contains the problems. In cases such as these we cannot even get Stage I – problem formulation – straightened out. The classic OR approach is a non-starter. We can tune an acceptable understanding of the problem only if an acceptable understanding already exists. Such untuneable problems are by no means rare. They occur in any policy area where there is persistent expert disagreement and wide uncertainty bounds that are unresponsive to sustained efforts to narrow them; in other words, whenever we are in the realm of trans-science.

How far will the vapor cloud from a liquefied natural gas (LNG) spill travel and still remain flammable? "One and a half kilometers" says one expert; "one hundred and fifty" says another. What is the annual per capita fuelwood consumption in the Himalayas?

"60 kilograms" says one expert; "4,000" says another. How much hazardous waste is produced each year in the United States? "40 million metric tons" says one authoritative report; "250 million" says another. The stark choice in nuclear power, according to the astronomer Sir Fred Hoyle, is between "energy or extinction"; for others nuclear power *is* extinction.

Such debates are examples not of decisionmaking under uncertainty but of *decision-making under contradictory certainties*. Far from an agreed and tuneable understanding of the problem, the uncertainties in these debates are so wide that each expert is free, as it were, to choose what he would like the facts to be. The available data, in other words, do not suggest a single credible and generally consistent picture of what is going on. Such a picture can be obtained only by arbitrarily declaring some of that data to be anomalous.

But these Arbitrary Declarations and these Free Choices of Fact, though they are the conceptual means by which the anthropologist makes some sense of what is going on, are not directly revealed when we look at the individual policy actor. They are, as it were, *structural*; they are not so much conscious decisions on the part of the policy actor as decisions that are supplied to him, in the form of unquestioned and self-evident assumptions, by the institutions in which he happens to be embedded. Rather than leaping out at us, they have to be laboriously exposed by *de-constructing* the individual's cultural framework; by analytically dismantling the various a priori supports that, in conferring credibility here and incredibility there, sustain the relationship between him and his institutions. This structural bias is often the cause of a needless misunderstanding between the "hard" scientist and the "soft" scientist. The "hard" scientist who finds himself embroiled in these sorts of policy debates, the "soft" scientist should point out, stands accused not of dishonesty but of humanity. That, at any rate, is the cultural hypothesis that underlies what might be termed the theory of decisionmaking under contradictory certainties.

So, on this hypothesis, the first part of the problem (and perhaps the most difficult part to grasp) is that there is not *a* problem. There is a plurality (but not an infinitude) of contradictory and contending problems, each one focused by the shared credibility it enjoys in the eyes of those who subscribe to it, and each held separate from the rest by the mutual incredibility that is the global corollary of locally focused (that is, tribal) credibilities. The reason, of course, is that if the institutions are pluralized so too will the facts that those institutions mediate be pluralized.

The second part of the problem (and this is where the design capabilities come in) is to accept this state of affairs; to stop demanding *a* problem when there is not *a* problem, and to take up a conceptual position from which diversity, contention and contradiction (far from being undesirable qualities that must be eradicated before any progress can be made) can be seen for what they really are – our ultimate resource. This – the de-tribalization of energy policy analysis – is simply one specific instance of anthropology's proper task: the de-provincialization of rationality.

To do this – to de-provincialize rationality – we do not have to rush headlong into the relativist camp, but we do have to embrace the exploratory mode. The perhaps unpalat-

able point I wish to make (and it is the point on which this whole *trans*-science approach rests) is that, if we want to retain any shred of scientific integrity, we must somehow or other extend legitimacy to each and every problem definition that can be formulated in such a way that all its assumptions lie within the current bounds of uncertainty. To stick with just the adversary mode – to go on and on demanding to know which of these problems is the right one when, try as we may, we cannot gain access to that knowledge – is simply to encourage the arbitrary tyranny of one legitimate position over all the others. That, *in nuce*, is what has happened with the IIASA energy models.

I am not saying that *all* modeling does this, nor am I saying that all modeling *has* to embrace the exploratory mode, nor am I saying that it is an either/or choice *between* the adversary and exploratory modes. All I am saying is that there is an important distinction between *cis*-science (what we normally call science) and *trans*-science, and that we should keep an eye out for the signs (such as persistent disagreement among experts) that will tell us when we are moving from the one to the other. While Keepin and Wynne have rightly highlighted the perils that lie in wait for the modeler who omits to equip himself with iteration and with sensitivity analysis, my contribution to this collaborative critical effort is to urge him (in certain specific circumstances) to adopt a third piece of equipment – the exploratory mode.

When, try as we may, we cannot discover which contradictory certainty is the right one, we can still do something. We can understand the cultural, institutional and organizational sources of those diverse certainties. The adversary mode, you could say, allows us to get rid of what we cannot live with; the exploratory mode allows us to live with what we cannot get rid of. Each has its part to play in the wise deciding of policy. Wisdom lies in knowing when to use which.

Notes

- 1 For the purposes of this essay, the “ethnographic present” is set at 1983.
- 2 To a subset of the inputs, to be precise. (See Keepin’s paper in this volume.) In other words, not only can he throw all the modeling away without altering the scenarios, he can throw some of the assumptions away as well.
- 3 See Wynne’s paper in this issue.
- 4 In the “Limits of Growth” model, for instance, the crucial assumption (Roberts, 1974, p. 355) is that we live in a world of *resource depletion*. The Meadows’ “stabilized world models,” Roberts stresses, “do not avoid the problems of resource exhaustion. These have merely been *postponed* beyond the time frame of the simulation runs. The cause of resource exhaustion is not *growth* but *activity*. Even a non-growing economy uses resources. If there is only so much “stuff” in the world and we inevitably use it, then its exhaustion is equally inevitable.” (Emphasis in original.)

The hard-wiring of inputs to outputs – the practical syllogism – follows directly from this and other related assumptions.

The inevitable and imminent “crisis” in the simulation analysis is the result of a number of structural and quantitative assumptions which are both poorly supported and implausible. Make different assumptions and you get different results. The model can be made to behave in almost any way one wishes. Although the authors claim that the behaviour of the system is “counter-intuitive,” in fact it follows directly and transparently from its assumptions. Far from revealing “the basic structure of the world

system," the work primarily reveals the beliefs and prior commitments of those who wrote it. The operation of the model adds little if anything to the simple assertion of its conclusions as an article of faith (p. 352).

- 5 There is a third possibility: that both funders and modellers were explicitly aware that the modeling was nothing more than a way of identifying and putting together the components of the system. This possibility, as Wynne makes abundantly clear, was never entertained by either.
- 6 The contradiction between the assumptions is crucial to the separation of the world views. Caputo (1983), for instance, has shown that the highest credible solar contribution in one study of energy futures for Western Europe is lower than the lowest credible contribution in another study. Rather than an overlap there is a void – a perception gap – between two particular clumps of energy experts.
- 7 This is set out in Thompson (1982). Originally there were five accounts (Harman et al., 1977; Chapman, 1975; Orr, 1977; Schanz, 1978; Humphrey and Buttel, 1980). Since then a sixth (Spronk and Veeneklaas, 1983) has come to my attention. None of these accounts refers to any of the others.
- 8 For a brief summary of the other two levels, and some suggestions as to how they relate to the micro-level, see Thompson (1983).
- 9 In which markets, hierarchies, and egalitarian groups (sects) are seen as competing, yet complementary, arrangements for the handling of social transactions. Each has its advantages and disadvantages and the concern is not with which one is right – that is a meaningless question – but with the question of appropriateness: which kinds of transactions are best handled by which kind of institutional arrangement?
- 10 The satirical dart appropriate to the sort of eager risk-acceptance that goes on in this entrepreneurial social context. The equivalent definition for the risk-averse individual is: "Life is a sexually-transmitted terminal disease."
- 11 These distinctions, I must stress again, derive from the various strategies that individuals as *social beings* are led to adopt. They are neither innate nor immutable.

References

- Caputo, Richard (1983). Personal communication and "Worlds in collision: is a rational energy policy possible for W. Europe?" *Futures* 16(3): 233–259.
- Chapman, Peter (1975). *Fuel's Paradise: Energy Options for Britain*. Harmondsworth: Penguin.
- Dickens, Charles. *David Copperfield*. Harmondsworth: Penguin edition, 1966.
- Douglas, Mary and Wildavsky, Aaron (1982). *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers*. Berkeley: University of California Press.
- Gaskell, George (1983). In a paper presented at a conference in Cambridge (England) on "Human factors and energy use in buildings," 5–6 September. Proceedings to be published by John Wiley, Chichester.
- Harman, Willis, Reuyl, John S., Carlson, Richard C., Levine, Mark D. and Witwer, Jeffrey G. (1977). *Solar Energy in America's Future*. Second edition. Stanford Research Institute. (The first author on the report was Reuyl but Harman was the principal author of the section devoted to perceptions.)
- Humphrey, Craig R. and Buttel, Frederick H. (1980). "The sociology of the growth/no growth debate," *Policy Studies* (5): 336–345.
- Orr, David W. (1977). "US energy policy and the political economy of participation," *The Journal of Politics* 41: 1027–1056.
- Po Chü-i (circa 835a) "A mad poem addressed to my nephews and nieces," Translated (circa 1918) by Arthur Waley. Republished in Allott, Kenneth (Ed.) (1950), *Contemporary Verse*. London: Penguin.
- Po Chü-i (circa 835b). "The chrysanthemums in a eastern garden," Allott (1950), op.cit.
- Roberts, Marc J. (1974). "The limits of the limits to growth," in L. Waverman (Ed.), *The Energy Question*. Toronto: Toronto University Press.
- Schanz, John J. Jr. (1978). "Oil and gas resources – welcome to uncertainty," *Resources*, No. 58 (Special Issue, March). Resources for the Future.
- Spronk, Jaap and Veeneklaas, Frank (1983). "A feasibility study of economic and environmental scenarios by means of interactive multiple goal programming," *Regional Science and Urban Economics*, 13: 141–160.
- Thompson, Michael (1982). "Among the energy tribes: the anthropology of the current policy debate." Working Paper, WP-82-59, International Institute for Applied Systems Analysis, A-2361, Laxenburg, Austria.

- Thompson, Michael (1983). "Postscript: a cultural basis for comparison," in H. C. Kunreuther, J. Linnerooth, et al., *Risk Analysis and Decision Processes: The Siting of Liquefied Energy Gas Facilities in Four Countries*. Berlin: Springer-Verlag.
- Thompson, Michael and Wildavsky, Aaron (1982). "A proposal to create a cultural theory of risk;" in H. Kunreuther and E. V. Ley (Eds.), *The Risk Analysis Controversy: An Institutional Perspective*. Berlin: Springer-Verlag.
- Weinberg, Alvin (1972). "Science and trans-science," *Minerva* 10: 209–222.