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Prospective/retrospective on strategies

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Abstract

This contains my goals for, and reactions to, the Panel on 'Strategies' at the Workshop, 'Advances in Energy Studies: Exploring Supplies, Constraints, and Strategies', 23–27 May 2000, Porto Venere, Italy. The very ambitious goals for the four speakers were not fully realized; hence my reactions are also goals for future work. I propose and discuss specific topics and techniques that are appropriately addressed by energy analysts. Several of these stretch in new directions, or, more typically, towards wider purview over global impacts and equity issues.

1. Introduction

As convener and chairman of the Panel on 'Strategies' at the Workshop, 'Advances in Energy Studies: Exploring Supplies, Constraints, and Strategies', 23–27 May 2000, Porto Venere, Italy [1], I had the luxury of posing difficult questions, several of which have long vexed me. Following (verbatim) is my charge to the four panelists (Horace Herring, Howard T. Odum, Sol S. Penner, and Vaclav Smil).

> Statement of goals for strategies panel (from the Workshop Program).
> A viable long term energy strategy is explicitly attentive to efficiency of use, limits to total consumption rate, and equity of access across nations and regions. All three are important, and seldom treated together. The Strategies Panel will discuss recent research which integrates these three factors. Increasing energy use efficiency has been promoted as a 'no regrets' strategy. This is close to true in a marginal sense, but there are problems, absolutely speaking: 1. increasing resource use efficiency has often been followed by an increase in the use of the resource (Jevons' Paradox), 2. overall limits to energy dissipation are not addressed, while growth and development are implicitly or explicitly promoted as preferable alternatives to addressing distribution questions.

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> Question: What are viable strategies that combine promoting efficiency increase with measures to address points 1 and 2 above? What is desirable? Possible? On what time scales? What are realistic expectations (e.g. how much overshoot, what length time lags, even with a 'good' program)?

Understandably, no one responded at the level the Statement implies. In retrospect, I here react to and expand upon the issues.

I believe that most humans are troubled in a fundamental way about humanity's approach to environmental limits, but they are stuck somewhere between wanting more, not wanting less, and not trusting anyone…leading to unconscious, or-sometimes-conscious denial. I hope for strategies that will concretely help us move in the direction of living fair, intentional, cooperative lives within environmental constraints, and which:

1. explicitly consider the scale of human activity vs. that of the earth, the delivery of justice, and a long-term view,
2. anticipate and address the many elements of resistance.

Therefore an adequate strategy must be a compromise between today's myopic muddle and the enlightened, multigenerational outlook that academics and poets espouse, if not live. Such a strategy will have within the greenery of growthmania the seeds of stasis. By 'stasis' I mean stasis or reduction in unsustainable throughput and human footprint…but continued increase in human development and culture. Human motivation, and, I believe, destiny, is to improve indefinitely, so the issue is to switch growth in welfare away from the growth in physical and biological throughput and depletion, as described by Daly [2].

2. Importance of energy

Energy is especially apt as a focal concept in this discussion. It is obviously important in supporting civilization and it summarizes well our dependence upon resources and upon the sink capacity of the ecosphere. It is a good organizing tool and numeraire for many connections in biophysical and socioeconomic systems. In terms of the broader issue I introduced above, it is amenable to both supply and efficiency-of-use responses. But the efficiency argument also is a sop, allowing one to put off the question of overall consumption, as illustrated in the following spoof.

> News item: No Limits to Anything.
> Physical efficiency of all major technology-life support systems is now so low that tapping the implied potential for improvement will result in essentially no resource, space, or societal limits to an average 3.5%/yr increase in world economic product for all of the 21st century. This will result in a 31-fold increase by year 2100. This radical efficiency improvement is the key to smart growth, a robust concept that will effectively obviate all land use conflicts for that period. Efficiency will not occur without proper incentives, but these can be implemented without increasing the price of anything. It will require, however, relatively fewer barriers to private industry and mobility of capital, as well as high human tolerance for physical mobility, and serious reworking of several physical laws.

The problem of an efficiency—only approach was well—covered by Horace Herring's presentation [3], documenting that increased energy use efficiency has typically been followed by an increase in overall energy use.

On one hand I am improperly taking a self-righteous position here, promoting a no-impacts lifestyle. On the other hand, we as analysts can make progress while compromising between impeccably living the integrated life…and doing he same old stuff. We can calculate something worth calculating. The frustration is that we are still publishing and publicizing in our scientific–academic-think tank circles, distanced from implementation. But that distance also allows us the freedom to push in important, meaningful directions. These should cover sufficiency, efficiency, and equity.

3. Principles

The principles I embrace are:

A. the world has a proximately limited capacity to sustain humans,
B. the finitude of supply of inexpensive energy and, especially, the by-products of extraction/refining/use/disposal are *major* problems,
C. the efficiency discussion does not usually explicitly include a question of overall scale, but it should,
D. new indicators and, especially, appropriate economic signals are needed to reinforce energy/environmental policy,
E. social equity must be addressed.

Therefore strategies should:

1. include calculations incorporating the degree to which redistribution and overall growth trade off with one another. This has traditionally been anathema;
2. include explicit use of newer indicators of human welfare as distinct from conventional economic indicators such as GNP. Several are in use already, e.g. ecological footprint, genuine progress indicator, human development index (referenced below);
3. be comprehensive so that 'adding-up' the regional, national, and global impacts of local activities is routinely done;
4. be attentive to the sources of instability in the game-theoretic sense (shared resources, role of envy and competition);
5. include the number of operating automobiles per human as an explicit indicator. In my opinion, no other artifact combines the magnitude of impact, satisfaction of human wants and needs, and perverseness of dynamics of the private car;
6. go beyond improved efficiency as its own justification, and calculate the impact of that efficiency improvement in the context of growth of population and pro capita consumption levels;
7. be explicit about time scales, delays, and rates of change, and how these match with human expectations.
8. explicitly address how to incorporate off-site and distant impacts into regional planning practice;

9. either reject (with cause) or embrace the idea that the economic system should provide needed signals to reinforce good intentions;
10. be explicit about the role of population growth and immigration as time bombs and 'attempted safety valves';
11. be explicit about the role of community coherence, shared norms and goals, and cooperation.

I suggest that items 1, 2, 3, 4, 5, 6, and 7 are appropriate areas for quantitative analysts such as we. I discuss this short list in more detail below.

4. Discussion of points 1, 2, 3, 4, 5, 6, and 7

1. Consider growth vs. redistribution.

The growth–redistribution tradeoff is so threatening to many people that it seldom is confronted directly. There is a strong hidden message that just by mentioning it an analyst one is prompting marginalization and an invitation to retire early. But it must be confronted. The facetious 31-fold growth scenario above implicitly assumed that everyone's economy grows at 3.5%/yr, but consider one in which the US, Canada, western Europe, etc. grow at 0.1% and that Asia, Africa, South America, etc. grow at 3.5% until they reach the pro capita level of Euroamerica. Consider the driving forces for growth: if they are dominated by relative economic consumption, the one-fits-all pattern will not change the ratio of rich to poor at all. Projections involving different growth rates for rich and poor are sometimes done, especially if they still involve positive economic rates for both. For example, the global energy scenarios published by Goldemberg et al. [4], had pro capita energy decreasing in the rich world and increasing in the poor world. Thanks to improving efficiency, though, pro capita economic output grew in both.

2. Promote and use other indicators besides GNP.

GNP was not intended as a welfare indicator by its originators, but it is so used in most political discussion, Alternatives include:

1. ecological footprint: its introduction [5,6], some controversies [7,8], updates [9],
2. index of sustainable economic welfare (ISEW) [10], and its successor, GPI [11],
3. human development index [12].

These indicators tend to include additional elements that a purely environmental or social welfare perspective would stress. Certainly any indicator is incomplete, but these fill some gaps. Ecological footprint is impacts-oriented, expressing in terms of land area the human dependence 'up- and down-stream'. The comparison of land required for our lifestyles with how much land there actually is, is vivid and compelling (and indeed there is controversy over the details). GPI includes (rather crude) terms for long-term environmental damage (largely mediated through energy use), but also has important contributions from more 'economic' quantities, such as work by homemakers (which is not in GNP but adds to welfare) and crime control (which is in GNP but does not represent increased welfare).

A particularly controversial but reasonable adjustment is made in GPI for income distribution—the more unequal the distribution, the less that aggregate income contributes to aggregate welfare. What is most useful, and also risky, is that these indicators are quantitative and can be used like GNP (whereas previously we had GNP and otherwise unquantified coffee table chatter about the 'best things in life'). Another compelling aspect of GPI is that it seems to parallel GNP for poorer nations, but for richer ones, GPI tends to level off or even decline as GNP continues to grow. The threshold seems to be approximately the US/western Europe per person level reached around 1970 [13]. However, there is also justifiable contention about that conclusion [14]. In any case, we require better indicators, and these are decent attempts in that direction.

3. Add-up.

Daly wrote [2] that the problem is that the human race is in-between frontier and spaceship situations. In the frontier, there are no resource limits, either on the supply or the disposal side: we can freely drink from and bathe (or worse) in the same river. In a spaceship, rigorous attention to adding-up is required; dereliction brings prompt rebuke, disaster, death. We now have strong evidence of many types that the spaceship situation is imminently close. The summed impacts of humans are depleting stratospheric ozone, causing accelerated global warming, depleting many ocean fisheries, leveling the rain forest, causing dead zones in the sea, extincting species, drawing down area water tables, etc. Who contributes what part, and what the total is, is now more widely discussed than previously, but hardly enough. We need to institutionalize this. A critic will say that the important point here is to have the potential for action when these overall impacts are reckoned; until then, why calculate? But we are already acting, e.g. the Montreal Protocol on CFCs, the Kyoto Agreement on greenhouse gases. Our being analysts allows us to calculate these potentially crucial added-up quantities even if we do not know exactly who will use them. A further complication is indirect effects. While it is difficult enough to add-up direct, visible, impacts, it is much more difficult to include indirect, off-site dependencies. In fact it embodies a contradiction. Success today often seems based on importing desirable things and exporting environmental insults. With adding-up, however, we must acknowledge that an exported insult becomes someone's unwelcome import.

4. Stress instability.

What drives growth? Almost all impetus comes from competition-envy in its various prettified and sanitized versions. In the Tragedy of the Commons, we find that it takes only two acquisitive competitors to deplete a common property resource. Further, if others are not acquisitive, but wish to preserve what they have and/or *not lose relative to other players*, they eventually join in destructive competition as well. There are many analogies in trade wars, land wars, water wars, and shooting wars. Perhaps the dilemma is that growth is a consequence of instability, but also stabilizes. Our challenge is to understand alternatives to growth as a stabilizer, and to understand and anticipate that many steady states are unstable ones.

5. Count the cars.

We do a disservice to the private automobile to consider it merely as a representative environmental problem. That is like calling Superman a decent athlete. In my opinion the car/pickup

truck/sport utility vehicle is the *most* significant environmental problem in developed countries. It is also a leading problem in developing countries. Solving 'auto-like' problems is well enough, but until we solve the auto problem *itself* we are just scratching the surface of a sustainable, just, livable society. The auto combines massive resource requirements (energy, land, materials); massive environmental impacts (land use, materials use, air pollution, wildlife destruction, noise, safety); massive economic forces; massive disruption/reshaping of culture and the way humans interact with one another; fundamental, strong human motivations and wants; and powerful feedback-rich dynamics in its penetration into the market. There are now 600 million cars worldwide, one for every 10 humans (one for every two in the US, Canada, western Europe, Australia, etc.) With negligible exceptions, all humans want a car. For China, India, or most of Africa to even approach the 1:2 figure implies three billion cars worldwide, a daunting prospect. The number of cars pro capita vs. time will tell:

1. developed countries: how well they are doing in getting greener,
2. developing countries: how well they are doing in taking an alternate path.

Therefore I propose the number of cars pro capita (this exact quantity) as an important indicator.

6. Go beyond efficiency.

I propose persistent and consistent use of the formula I = PCT and its variants [15,16]. Even as energy (or other) efficiency is promoted, we should stress that total impact (I) (e.g. energy demanded per unit time, or land used, or CO_2 released per unit time) can be expressed as a compounding of population (P), pro capita consumption (C), and technology (T). Efficiency is subsumed in technology. The idea is simple and simplified, and the mathematics trivial (e.g, twice as many cars using 60% as much fuel per car means a 20% increase in overall auto fuel use). Yet this idea is typically not included in political or other debates. Usually an advocate stresses only one of the quantities P, C, or T. Efficiency proponents are particularly prone to omitting reference to P and C. Our responsibility here is to keep I = PCT visible in every application.

7. Stress dynamics.

Analysts like us know about time lags, yet we do not kick out our TV screens in frustration when we see politicians taking credit for prosperity which is (because of lags in the business cycle) attributable to occurrences 10–15 years earlier, when the other party was in power. We understand, even though the Montreal Protocol is in place and effective, that atmospheric CFCs will not start to come down for 10–20 years. We know that the characteristic times for the immediate consequences of changing technologies are given roughly by the device lifetimes (e.g. 15 years for a refrigerator, 12 years for an automobile, 30–40 years for a power station). Yet we do not protest when opponents of conservation schemes explicitly or implicitly claim that limited success after 2 years means that the program is a flop. Thinking and presenting results dynamically is necessary to give good programs their proper due, to give them the needed time to be effective—and to showcase long-term dire effects. We have a responsibility to present the time profile of a result.

5. Conclusion

'Strategies' implies a broad view and many real-world issues. Techniques and approaches developed over thirty-plus years of energy analysis can, and should be extended to this broader purview of a finite earth peopled by diverse constituencies concerned with time scales and equity. My list of topics is certainly not exhaustive, but it is specific. I hope to see activity in at least some of these important directions.

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