Profitably Stabilizing Global Climate -- An Editorial

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A recent survey paper[1] on modern techniques for preventing anthropogenic climatic change concludes:

> Global warming is not a natural result of normal, optimal economic activity. Rather, it is an artifact of the economically inefficient use of resources, especially energy. Advanced technologies for resource efficiency, and new ways to implement them, can now support present or greatly expanded worldwide economic activity while stabilizing global climate -- and saving money. New resource-saving techniques -- chiefly in energy, farming, and forestry -- generally work better and cost less than present methods that destabilize the earth's climate.

Thus "most of the best ways known today to abate climatic change are not costly but profitable; not hostile but vital to global equity, development, prosperity, and security; and reliant not on dirigiste regulatory intervention but on the intelligent application of market forces."

This is not a new idea. A book-length exposition published a decade ago[2] was summarized[3] and debated[4] in these pages. That decade has brought a wealth of important analytic findings and practical experience. What were then isolated existence proofs are now everyday market realities; what were speculations are now facts; what were hopes are now solid, large-scale achievements. For example, efficient use of electricity is now a multi-billion-dollar-a-year U.S. industry, half utility-financed, and is doubling every couple of years.[5] Energy efficiency, renewable sources, sustainable farming and forestry practices, CFC displacement, and (especially) their previously neglected synergistic combinations[6] have made such enormous strides and are now backed by so much empirical evidence that the terms of the debate have fundamentally changed.

Moreover, these abatement methods are now demonstrably far cheaper than anyone, including us, dared to hope a decade ago, and are becoming even cheaper all the time. In nearly all circumstances, saving fuel now costs less than burning it, so the carbon (and other) emissions avoided by substituting efficient use for fuel are now achievable not at a cost but a profit, and being profitable, can be done largely in the marketplace.

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[1]Lovins, A.B. & L.H.: 1991, "Least-Cost Climatic Stabilization," *Ann. Rev. En. Envt.* 16:433-531. This editorial is adapted from its concluding section.

[2]Lovins, A.B. & L.H., Krause, F., & Bach, W.: 1981, *Least-Cost Energy: Solving the CO_2 Problem*, Brick House (Andover MA), republished 1989 by Rocky Mountain Institute.

[3]Lovins, A.B.: 1982, "Energy, Economic and Climate -- An Editorial," *Clim. Change* 4:217-220.

[4]Ausubel, J.: 1982, "Book review," *Clim. Change* 4:313-317, and A.B. Lovins: 1983, "Response to Jesse Ausubel," *id.* 5:105-108. See also Cherfas, J.: 1991, "Skeptics and Visionaries Examine Energy Saving," *Science* 251:154-156, and Lovins, A.B.: 1991, *id.* 251:1296-1297 and 252:763.

[5]For a general introduction, see Fickett, A.P., Gellings, C.W., & Lovins, A.B.: 1990, "Efficient Use of Electricity," *Sci. Amer.* 262(9):64-74.

[6]*I.e.*, many abatements normally credited with reducing only one radiatively active gas actually reduce two or more, reducing radiative forcing by more per dollar than previous analyses had supposed (see ref. 1, pp. 473-475). This seems a promising area for systematic study.

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Without trying to summarize here the extensive technical evidence marshalled in our survey paper, the dimensions of the resulting change can be sketched by rebutting ten prevalent myths (in italics) about avoiding climatic change:

1. *Greater scientific certainty should precede action.* The uncertainties about climatic change and its potential consequences are substantial, interesting, and likely to cut both ways. But they are also irrelevant to policy, because virtually all the actions needed to abate climatic change (if it does turn out to be a real problem) should be taken anyway to save money. These "no-regrets" actions are about enough to solve the problem if it does exist, and are highly advantageous even if it doesn't. The problem with climatic change isn't decision-making under uncertainty; it's realizing that in this instance, uncertainty doesn't matter.

2. *The issue is whether to buy a "climatic insurance policy" analogous to fire insurance or to defense expenditures (a major investment mobilizing most of the country's scientific and technological resources, and meant to forestall or respond to unlikely but potentially catastrophic threats to national security).* The "insurance" analogy is partly valid, because delaying action until obvious climatic changes are unambiguously underway makes abatement too little, too late, and too costly -- just like trying to install a sprinkler system in a hotel that's currently on fire, or build military forces while you're already under attack, or buy collision insurance after you've crashed your car. Abating climatic change will require significant efforts affecting large numbers of people and stocks of capital over long periods and with long lead times, so waiting too long will certainly raise cost, difficulty, and risk of failure.[7] But the analogy breaks down if, as was shown above, the real choice is not balancing uncertain future benefits against daunting present costs, but rather making the investment as wisely and quickly as possible in order to achieve both the uncertain future benefits *and* the guaranteed financial *savings*. Any insurance "premium" is actually negative: the actions that can stabilize global climate will save money anyway, without counting the avoided costs of trying, or failing, to adapt to possible climatic change. Such "insurance" is unquestionably a good buy.

3. *Abating climatic change would be costly.* Distinguished econometricians have claimed that just achieving the Toronto interim target of cutting CO_2 emissions by 20% -- roughly a third of the reduction probably required for climatic stabilization[8] -- would cost the United States alone on the order of $200 billion per year.[9] Such calculations have been strongly criticized on technical grounds.[10] But worse, their high-cost conclusion is a bald *assumption* masquerading as a fact.[11] The econometric analysis merely asks how high energy prices would need to be, based on historic price elasticities of demand (typically from decades ago), to reduce fossil-fuel use by *x%*, then counts those higher prices or their equilibrium econometric effects as the cost of abatement. This approach ignores the compelling empirical evidence that saving most of the fuel now used is cheaper than even its short-run marginal cost, and hence is profitable rather than costly. The econometricians thus have the amount about right but the sign wrong: using modern energy-efficient techniques to achieve the Toronto target would not cost but *save* the U.S. on the order of $200 billion a year. These techniques did not exist at the time of the behavior described by the historic price elasticities: those elasticities summarize how people used to behave un-

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[7]Schneider, S.: 1989, *Climatic Change: Are We Entering the Greenhouse Century?*, Vintage, New York.

[8]Intergovernmental Panel on Climate Change: 1990, *Report from Working Group 1*, June, WMO/UNEP, summarized in *Science* 249:481 (1991).

[9]Davis, B.: 1990, "Bid to Slow Climatic Change Could Cost U.S. $200 Billion a Year, Bush Aide Says," *Wall St. J.*, 16 April, p. B4; Passel, P.: 1989, "Cure for Greenhouse Effect: The Costs Will Be Staggering," *N.Y. Times*, 19 November, pp. 1 & 10; Nordhaus, W.: 1991, "The Economics of the Greenhouse Effect," *Ec. J.* 101(407):920-937; Manne, A.S., & Richels, R.G.: 1990, "CO_2 Emission Limits: An Economic Cost Analysis for the USA," *En. J.* 11(1):51.

[10]*E.g.*, Williams, R.H.: 1990, "Low-Cost Strategies for Coping with CO_2 Emission Limits," *En. J.* 11(3):35-59 (*cf.* Manne, A.S. & Richels, R.G.: 1990, "The Costs of Reducing CO2 Emissions: Further Sensitivity Analysis," *En. J.* 11(4):69-78); Zimmerman, M.B.: 1990, "Assessing the Costs of Climate Change Policies: The Uses and Limits of Models," Alliance to Save Energy, Washington DC, 10 April.

[11]Nordhaus, W.: 1990, personal communication at Am. Assn. Adv. Sci. meeting, New Orleans, 18 February.

der conditions that no longer exist. Indeed, cost-minimizing energy policy -- if not derailed by the blunder of treating future energy needs as fate instead of choice -- seeks to change those conditions as much as possible.

4. *If such cost-effective abatements were available, they would already have been bought.* This is reminiscent, says physicist Murray Gell-Mann, of the econometrician who, asked by his mannerly granddaughter whether she could pick up a $20 bill she'd just noticed lying on the sidewalk, replied, "No, my dear, don't bother: if it were real, someone would have picked it up already."

The striking disequilibrium between how much energy efficiency is now available and worth buying and how much has already been bought arises from distinctive, well-understood market failures that leave cheap efficiency seriously underbought at present prices. For example, consumers have poor access to information and to mature mechanisms for conveniently delivering integrated packages of modern technologies. Implicit discount rates are about tenfold higher for buying efficiency than supply, severely diluting price signals. Many energy utilities misunderstand their business and want to increase their sales -- even though reducing their sales could increase their profits by decreasing their costs even more. Perverse regulatory signals often reward inefficient and penalize efficient behavior. Markets in saved energy are sparse or absent. And present market signals, omitting externalities that may be as big as the apparent fuel prices, make consumers indifferent to whether they buy, for instance, a 20- or a 60-mile-per-gallon car, since both appear to cost about the same per mile to own and drive.

Solutions exist for each of these market failures. These solutions have been proven in market economies and are rapidly emerging in a wide range of societies, so there is an ample range of effective policy instruments to choose from. Yet the technical and implementation options -- the everyday work of energy-efficiency practitioners -- are mostly unknown to those econometricians who lie awake nights worrying about whether what works in practice can possibly work in theory. Their substitution of a theoretical *assumption* (all market failures are unimportant, so all cost-effective efficiency must already have been bought, so any not yet bought must be expensive) for empirical *facts* is not just a difference of outlook between economists and engineers[12]; it is an intellectual scandal. It reveals widespread ignorance, not least in the press, about the difference between theory and observation.

5. *Abating climatic change would drastically curtail American and similar lifestyles, and would mean less comfort, mobility, etc.* Nothing could be further from the truth. The fuel-saving technologies that can stabilize global climate while saving money actually provide unchanged services: showers as hot and tingly as now, beer as cold, rooms as brightly lit, torque as strong and reliable, homes as cozy in the winter and cool in the summer, cars as peppy, safe, and comfortable, etc. The quality of these and other services can often be not just sustained but substantially improved by substituting superior engineering for brute force, brains for joules: *e.g.*, efficient lighting equipment provides the same amount of light, but it looks better and you see better; efficient buildings provide superior comfort; and superefficient cars can be safer, peppier, and more comfortable than today's cars. The same is broadly true of sustainable agriculture and silviculture, which provide comparable yields with superior quality, resilience, human health, and (generally) profitability.

6. *Abatements would be so costly and disagreeable that they could only be achieved by draconian, authoritarian government mandates incompatible with democracy.* On the contrary, modern abatements can be so profitable and attractive that they can be largely if not wholly achieved by existing institutions, within the present framework of free choice and free enterprise. Planners unaware of market-driven alternatives seem perversely anxious to set up new bureaucracies to tell people how to live. Many bizarre schemes have been suggested for substituting dirigisme for markets, penury for development, risks for rewards, and costs for profits. All that is unnecessary.

7. *Combating climatic change requires tough tradeoffs -- swapping one kind of pollution or risk for another.* Abating climatic change through advanced resource efficiency can simultaneously reduce or eliminate many other hazards too -- oil-security risks, nuclear proliferation, utilities' planning and financial risks, declining farm and forest yields, etc. -- without creating new ones.

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[12]Evans, D.J. *et al.*: 1990, *Policy Implications of Greenhouse Warming*, National Academy Press, Washington DC.

8. *Available means of abatement, singly or combined, will be too small and too slow, so climatic change is inevitable and we must start trying to adapt to it.* This counsel of despair is misguided. To be sure, some significant degree of climatic change or increased climatic volatility in some places may already be unavoidable if the more sensitive models prove valid[13] , or if greater climatological or ecological understanding continues to bring unpleasant surprises. A modest degree of adaptation may therefore be prudent if not inevitable:[14] *e.g.*, planning coastal developments to accommodate some sea-level rise and water projects to tolerate shifts in rainfall, or reversing the narrowing of crops' and forests' genetic bases. Nonetheless, the techniques described in ref. 1, if their benefits are properly understood, show promise of such rapid and widespread deployment that most of the harm projected in today's best climatic models could almost certainly be avoided. Many abatement measures also happen, as a free byproduct, to increase resilience in the face of whatever climatic change may nonetheless occur.[15]

9. *Abating climatic change would lock developing countries into abject poverty, or at least prevent their achieving their legitimate aspirations -- even though most climatic change so far has been caused by the industrialized countries.* On the contrary, the abatement options discussed in ref. 1 are not merely compatible with but essential to sustainable global development and increased equity: without high levels of resource efficiency, the required infrastructure investments for energy, water, materials, etc. make development unaffordable.

10. *Policymakers already know what their options are and haven't chosen those described here, so either the policymakers are stupid or the options don't work.* Many policymakers suppose that abatement must be slow, small, costly, inconvenient, and nasty -- not because that's true, but simply because they don't know any better. The difficulty, we suspect, may be the one economist Ken Boulding described: that a hierarchy is "an ordered arrangement of wastebaskets designed to prevent information from reaching the executive." The options described in ref. 1 are available, demonstrated, and often in widespread and successful use. Many, however, are so new that they are not yet widely known even to technical experts, and will take many years to filter up to decisionmakers through normal channels. What is needed, therefore, is better and faster technology transfer to the policymakers. We hope our survey paper, and this summary of some of its implications, will contribute to that effort and launch a vigorous debate.

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[13] IPPC, *op. cit. supra*; Krause, F., Bach, W. & Koomey, J.: 1989, *Energy Policy in the Greenhouse*, report to Dutch Ministry of Housing, Physical Planning and Environment, International Project for Sustainable Energy Paths (El Cerrito CA), September, Vol. 1, summarized in Krause, F.: 1989, "Required Speeds of Fossil Fuel Phase-Out under a 2 Degree C Climatic Change Limit," at 2:102-109 in *Energy Technologies for Reducing Emissions of Greenhouse Gases*, OECD/IEA Experts' Seminar, Paris, OECD (Paris).

[14] Schneider, *op. cit. supra*.

[15] For example, more energy-efficient buildings can more easily maintain comfort despite unexpectedly extreme outdoor temperatures, and sustainable farming and forestry practices, partly because of their biodiversity, tend to be more forgiving of changes in temperature or moisture than finely tuned, input-dependent monocultures.