ENVIRONMENTAL ISSUES IN PLANNING BUILDINGS ENERGY EFFICIENCY R&D

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INTRODUCTION

The U.S. Department of Energy's Office of Building Technologies (OBT) has initiated analyses on the relationship and impact of buildings energy conservation on the environment. A plethora of activities involving DOE, its national laboratories and other organizations are addressing various aspects of global climate change, acid rain, stratospheric ozone depletion, and indoor air quality. Elements of the current task include (1) a literature review of buildings' contribution to these problems; (2) inventories of OBT studies directly and indirectly related to these environmental problems, and other germane DOE and non-DOE projects; (3) identifying OBT projects that should be done; and (4) analyzing differential impacts on the environment of alternative OBT planning strategies and varying National Energy Strategy scenarios. The success of this project relies, at least in part, on suggestions from the buildings research community on information sources, literature, and ideas that OBT should consider.

TASK ELEMENTS

1. Provide a "big picture" sketch on federal (and possibly international) activity in global change, acid rain and ozone depletion to set the task in context. For example, eight federal agencies have Global Change Research Programs, including the Department of Commerce's National Oceanic and Atmospheric Administration, the Environmental Protection Agency, the National Science Foundation, the National Aeronautics and Space Administration, and the Departments of Defense, Energy, Interior, and Agriculture. In addition, the International Council for Scientific Unions (ICSU) has initiated the International Geosphere-Biosphere Program; the National Research Council has a Committee on Global Change; the United Nations Environment Programme and the World Meteorological Organization study climate change through the Intergovernmental Panel on Climate Change (IPCC) and the World Climate Study Program (WCP); and various other programs exist.
2. Review the contribution of buildings to atmospheric problems through building energy use. For example, Pacific Northwest Laboratory has completed estimates of carbon dioxide emissions reductions from energy conservation as well as of the environmental and economic benefits of avoided energy consumption in buildings.[1]
3. Inventory projects that OBT has initiated on the relationship and impact of buildings energy conservation on the environment. Analyses have included a report on chlorofluorocarbons to the Secretary of Energy; indoor air quality studies at the national laboratories; and several studies under the Least Cost Utility Program, including the Center for Clean Air Policy study on energy efficiency's impact on reducing acid rain.[2] OBT supports projects with indirect environmental impacts (e.g., thermally-activated heat pumps use natural gas instead of electricity). Besides these studies, a plethora of activities within DOE and

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1 *Nicholls, A., T. Secrest, and F. Abel (1989). "The Environmental and Economic Benefits of Avoided Energy Consumption in the Buildings Sector" (draft), Washington, D.C.: Battelle Pacific Northwest Laboratory, October 18.*

2 *Nixon, E., and C. Neme (1989). An Efficient Approach to Reducing Acid Rain, The Environmental Benefits of Energy Conservation, Washington, D.C.: Center for Clean Air Policy, May.*

its national laboratories and beyond them are addressing various aspects of global climate change, acid rain, stratospheric ozone depletion, and indoor air quality.

4. The analysis could begin with a state-of-the-art report and then go on to analyze the impacts of different conservation R&D strategies and different National Energy Strategy scenarios on these environmental problems. OBT has identified five alternative strategies that could be used in planning budget allocations for its R&D program.[3] Table 1 shows these alternative strategies.

   Strategy A, long-term R&D with voluntary adoption, is based on a view that the national and global energy and environmental situations will not become seriously threatening until well after 2010 and on the assumption that free market forces and the activities of other organizations will cause enough adoption of energy technologies to bring about sufficient energy savings by then.

   Strategy B, long-term technology adoption through information exchange, is based on the assumption that the energy situation is not going to become a serious threat to the nation until after the turn of the century. It involves federal leadership in information dissemination so that intermediaries and consumers make good economic decisions. It also assumes that innovations that are adopted voluntarily are more likely to remain in place decades later than those which are mandated.

   Strategy C, short-term R&D with voluntary adoption, is based on the assumption that the energy situation is not immediately threatening and that federal leadership in promoting energy savings should be low profile. This strategy leaves adoption of energy technologies essentially to free market forces and concentrates on bringing to the commercialization stage technologies with the near-term promise of energy savings.

   Strategy D, technology adoption using incentives, is based on an energy and environmental situation defined as serious enough to warrant federal leadership in energy savings in the short-term using persuasive methods; the idea is that there is still time to respond. The threat to national well being is not perceived as so serious as to require that mandatory energy savings be invoked.

   Strategy E, technology adoption through regulation, is based on the view that the energy situation is becoming a critical threat to national security or the environment and that we need

[3] *Farhar, B. C., and F. H. Abel (1989). A Framework for Planning Energy Conservation R&D for Buildings, Washington, D. C.: Office of Buildings and Community Systems, Office of Conservation, U.S. Department of Energy. Strategy alternatives were developed with a interlaboratory group including representatives from Brookhaven National Laboratory, Pacific Northwest Laboratory, the Solar Energy Research Institute, Energetics, Inc., and Princeton Economic Research, Inc.*

Table 1. OBT Strategy Alternatives

	Emphasize Longer-Term (2010)	Emphasize Shorter-Term (1995)
Emphasize Developing Technology Options (R&D)	Strategy A: Long-term R&D, voluntary adoption	Strategy C: Short-term R&D, voluntary adoption
Emphasize Energy Savings (Technology Transfer)	Strategy B: Long-term technology adoption through information exchange	Strategy D: Technology adoption using incentives Strategy E: Technology adoption through regulation

immediate short-term energy savings to meet that threat. Components of the crisis could include oil shortages, increasing foreign competitiveness and incursion into U.S. markets, the continuing unfavorable balance of payments, threats to the nation's security, and continuing carbon dioxide and chlorofluorocarbon emissions with consequences for global warming and ozone depletion.

5. Analyze differential impacts on the environment of proposed National Energy Strategy scenarios, relating them to how OBT could plan its R&D program to be environmentally responsive in the context of national energy policy. Seven scenarios are currently being defined at the U.S. Department of Energy (DOE); they will be analyzed at DOE through the use of models.
   - Emphasis on clean air
   - Emphasis on greenhouse gases
   - Emphasis on greenhouse gases and heightened concern about nuclear power
   - Accelerated development and introduction of new end-use technologies
   - Accelerated development and introduction of new supply technologies
   - Increased access to conventional energy resources
   - Increased concern for vulnerability.

   For example, Scenario 1, Emphasis on clean air, could include, among others, high and very high buildings energy efficiency excursions.
6. Recommend to OBT managers projects that could be undertaken that would be directly and indirectly environmentally relevant and beneficial.

COMMENTS INVITED

The success of this project relies, at least in part, on suggestions from the buildings research community on information sources, literature, and ideas on environmental issues and R&D planning that OBT should consider. Please feel free to contact the author with your ideas and comments at the SERI Washington Office.