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Calls to Action -- Linking Science to Design

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Linking Science to Design

Harrison Fraker

Two recent meetings point the way to a more meaningful and focused collaboration on climate change issues between the fields of science and design. Entitled "Energy, Security and Climate: Resilient Pathways for a Non-Linear World," the first was a workshop at the Lawrence Livermore National Laboratory in California from March 31 to April 2. It was attended by leading climate scientists and energy experts whose conclusion was that the most recent report of the Intergovernmental Panel on Climate Change (IPCC) has underestimated the rate and extent of global climate change.

Attendees at the second meeting, at the National Building Museum in Washington, D.C., from July 10 to 11, were members of a steering committee of American planning and environmental-design professionals calling for a "national organization to leverage the expertise of the design and planning professions and institutions to address the impending catastrophic impacts of climate change."

How Critical is the Situation?

The conclusions emerging from the Lawrence Livermore workshop were sobering. Attendees cited recent empirical observations indicating that climate change has accelerated: worldwide emissions of greenhouse gases (GHG) are growing 30 percent faster than predicted, the southern oceans are sequestering a smaller percentage of emissions, and terrestrial carbon-dioxide sequestration is slowing because of drought. As a result, carbon-dioxide concentrations in the atmosphere have increased even faster than emissions.

Attendees at the LLNL workshop further pointed to observed impacts, such as a dramatic decline in Arctic ice cover, an increasing number of severe weather events around the globe (tornados, cyclones, droughts, and floods), and rapidly retreating glaciers, all of which directly reflect this acceleration and add to concern. They argued that the new data suggest that the probability of extreme climate change effects has become much higher than previously thought, and that the consequences for human health, safety, security, and well-being may be dire.

Current scenarios for reducing greenhouse gas emissions—like the Pacala/Socolow "stabilization wedges" and the McKinsey "cost curve for greenhouse gas abatement"—assume a linear growth rate over decades, allowing fifty to one hundred years to stabilize emissions (at much higher levels than today).[1] But in a "nonlinear world" of critical thresholds these strategies may be too little, too late to avoid catastrophic climate impacts.

In response to this newly perceived urgency, workshop attendees called for implementation of a "Plan Z." If Plan A is business as usual, and Plan B is "too little, too late," Plan Z (for zero emissions, or our contingency plan of last resort) would aim to drastically reduce emissions within decades. The scientists at the LLNL workshop, however, speculated that to be successful, "Plan Z may require the kind of national mobilization that occurred in response to World War II."

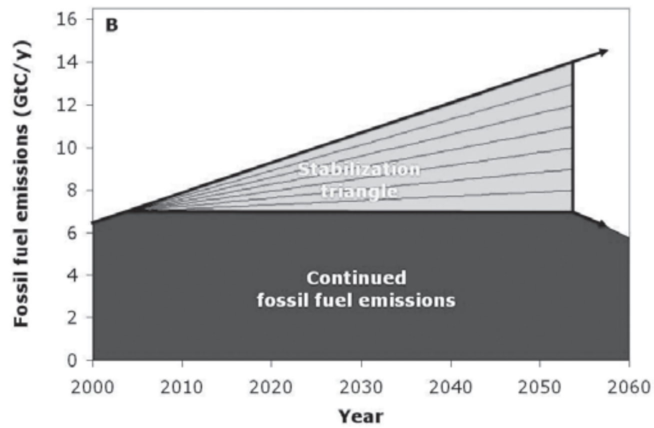
Workshop participants further identified broad areas of research necessary to support Plan Z. They posed critical questions and noted needs in the following areas.

Monitoring the Problem. This is required so that scientists will know if strategies are working.

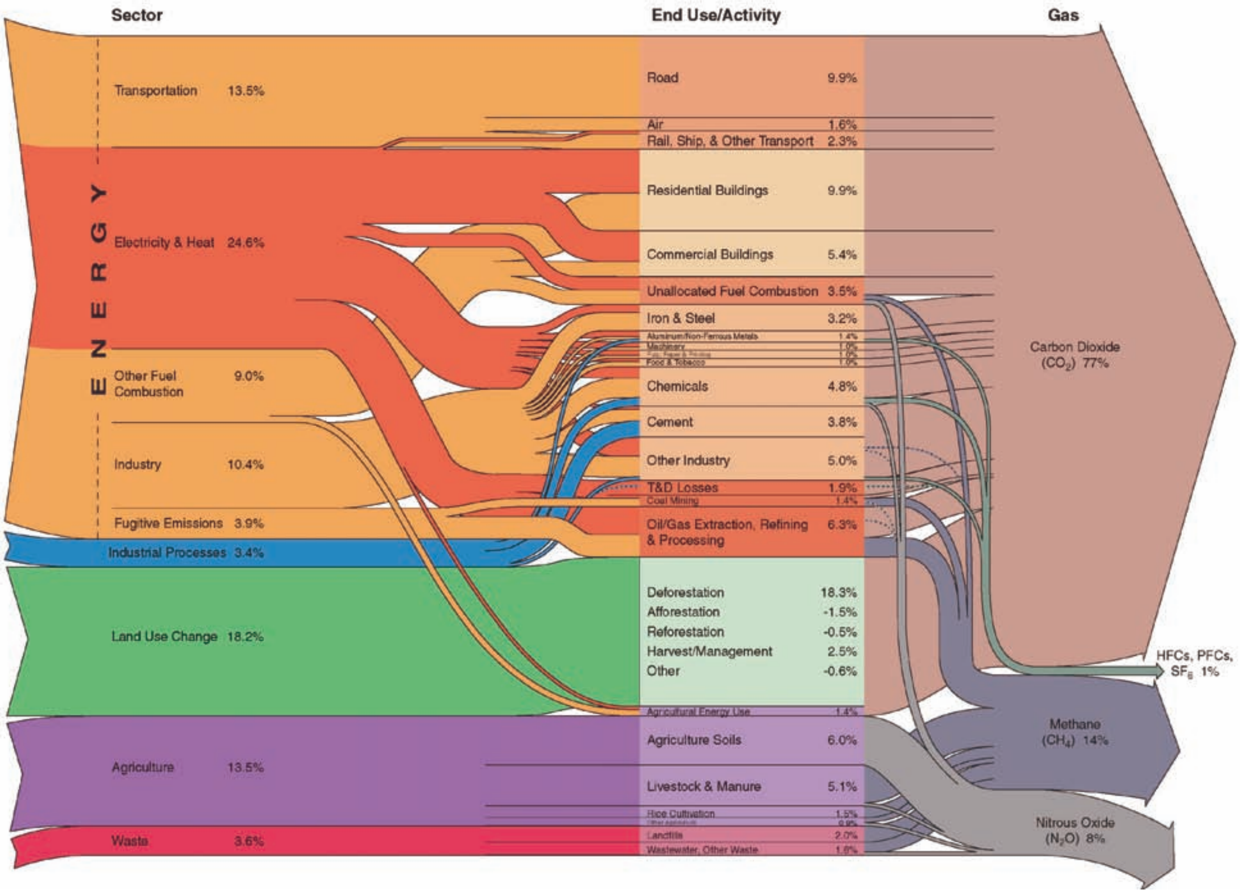
Energy technologies. How fast and broadly can low-emission technologies in the areas of wind and solar power, carbon capture, geothermal energy, nuclear power, and especially energy efficiency be deployed?

Food, land use, and urban research. What can be done to make the food system, which produces one-third of greenhouse gas emissions, more efficient? How can cities, which generate 60 percent of emissions, be made more efficient? More research is also needed on the effects of deforestation, reforestation, and aforestation.

Social science for managing energy system changes. Some Orwellian questions arose here, such as is "war mobilization" an appropriate way of thinking about such an emergency response?



Above: Stephen Pacala and Robert Socolow's diagram of "stabilization wedges." Each wedge represents an equivalent global emissions savings by 2054, "achieved by a single strategy that will not occur without deliberate attention to global carbon. Implementing seven wedges should place humanity, approximately, on a path to stabilizing the climate at a concentration less than double the pre-industrial concentration."



Geo-engineering. Some attendees discussed purposeful intervention in major earth systems (e.g., atmospheric composition, ocean current, and earth chemistry).

Relationships with the developing world. Attendees stressed the importance of satisfying the legitimate growth needs of developing countries while also not following the carbon-emitting model of the developed world. It called for leadership by example, collaboration, and technology sharing.

Systems integration and Plan Z strategy. This scheme calls for a much greater understanding of how social, political, technical, and environmental systems are connected—i.e., research on this "system of systems." Can the measures in Plan Z add up to a strong enough, fast enough response?

Mobilizing Designers and Planners

At the very same time that environmental scientists have been concerned enough to call for a Plan Z, environmental planners and designers have been arguing that a "whole-systems" design approach is necessary to address climate change effectively. This view was discussed in Washington, D.C., by the steering committee for the establishment of a National Academy for Environmental Planning and Design. Using scientific justification such as that provided by the LLNL workshop, representatives of the planning and design professions made the following case for a whole-systems approach in a recent white paper.[2]

To achieve a clear way forward, global societies need to undertake more planning, design, and research to address the physical, social, economic, cultural, and policy changes required to achieve a reduction of greenhouse gas emissions. Time is of the essence, because some scientists think the current concentration of greenhouse gases (390 parts per million) has already begun to create cumulative and extremely dangerous climate interference.

As a world leader, the United States government cannot wait for a comprehensive, global plan. It must move forward quickly to implement low-risk, "no-regrets" options and to promote a more sustainable future in both its domestic and foreign policies. At the same time, the environmental design professions need to define the scenarios in Plan Z that are most likely to succeed, with good information and clear options available "just in time."

Many of the options for addressing climate change described by Pacala/Socolow, although technically feasible, involve major technology development and cost reductions in order to achieve widespread market acceptance. For example, major scientific research has already gone into carbon sequestration, biofuels (from sources like switch grass that do not compete with food production), more efficient nuclear power (that eliminates the waste-disposal problem), and entirely new methods of withdrawing carbon from the atmosphere. Unfortunately, most of these options are decades from large-scale deployment.

There are, however, more immediate options. Among these are greater energy efficiency in buildings and vehicles, land use and transportation planning to reduce vehicle miles traveled, lower-carbon agricultural practices, investment in more efficient and low-carbon infrastructure, and the development of renewable energy resources. All of these will depend on how we plan, design, approve, finance, build, maintain, and operate our built environment.

Frequently, the biggest hindrance to deployment of these more immediate options is their place in a complex web of legal, political, economic, and social constraints. Nonetheless, reconsideration of currently disconnected energy, waste, water, and transportation systems according to a whole-systems approach could create tremendous efficiencies and synergies. Waste becomes energy, sewage becomes a water resource, and garbage powers alternate transportation modes that reduce vehicle miles traveled. Through better design and planning, we can reap double and triple dividends. But to unlock the legal and policy frameworks, change the economic incentives, and weigh the social consequences, this approach must also be shown to improve people's lives. And when we apply a whole-systems design approach at the scale of the neighborhood, the metropolitan region, the megaregion, the nation, and across international borders, the challenge becomes increasingly complicated. Large-scale solutions must consider issues such as energy and resource depletion, environmental pollution, epidemic disease, and geopolitical unrest.

In pursuing a comprehensive campaign to save the planet and regenerate human civilization, the planning and environmental-design professions must relate their work to that of others. The work must involve architects, communications designers, developers, ecologists, economists, engineers, industrial designers, interior designers, landscape architects, lawyers, planners, policy analysts, sociologists, and urban designers, among others. While the organization of such a collaborative effort may appear overwhelming, the planning and design fields are ideally suited to lead it. What we lack is an overarching national organization to galvanize, convene, coordinate, and help conduct a whole-systems planning and design effort.

A National Campaign

The discussions of the thirty-member steering committee (which represents) imagined that a new National Academy for Environmental Planning and Design could help lead this effort. It would convene the best, most innovative thinkers from the many disciplines and professions involved in the built environment. They would identify and describe, in concrete physical and spatial terms, the most promising and effective whole-systems strategies for reducing greenhouse gas emissions.

Rather than compete with other academies like the National Academy of Sciences or the National Academy of Engineering, the new organization would complement work being done across disciplines by creating design alternatives that employ existing analyses and findings. In this way the design process can become a "search engine" for creative solutions. To date, most preliminary assessments of GHG-reducing scenarios have been hypothetical and overly technical, based on scientific parameters. Collaborative work by planning and environmental-design professionals on whole-system alternatives would allow more detailed assessment of barriers, and might suggest practical steps to broaden application, estimate costs, and evaluate needed policy-change recommendations.

The challenge is profound, the solution is essential, and the time is now! We need both science and innovative whole-systems design to address this global challenge.

Notes

1. See Stephen Pacala and Robert Socolow, "Stabilization Wedges: Solving the Climate Problem for the Next 50 years with Current Technologies," *Science*, 305 (2004), pp. 968-72. The McKinsey Company has undertaken a variety of studies in recent years to assess the relative economics of different approaches to reducing greenhouse gas emissions.
2. Harrison Fraker, Tom Fisher, and Doug Kelbaugh, "A Rationale for a National Organization to Leverage the Expertise of the Design and Planning Professions and Institutions to Address the Impending Catastrophic Impacts of Climate Change," White Paper for the National Academy of Design, July 2008.

Opposite: Flow diagram of the sources and activities across the global economy that produce greenhouse gas emissions. Source: World Resources Institute.