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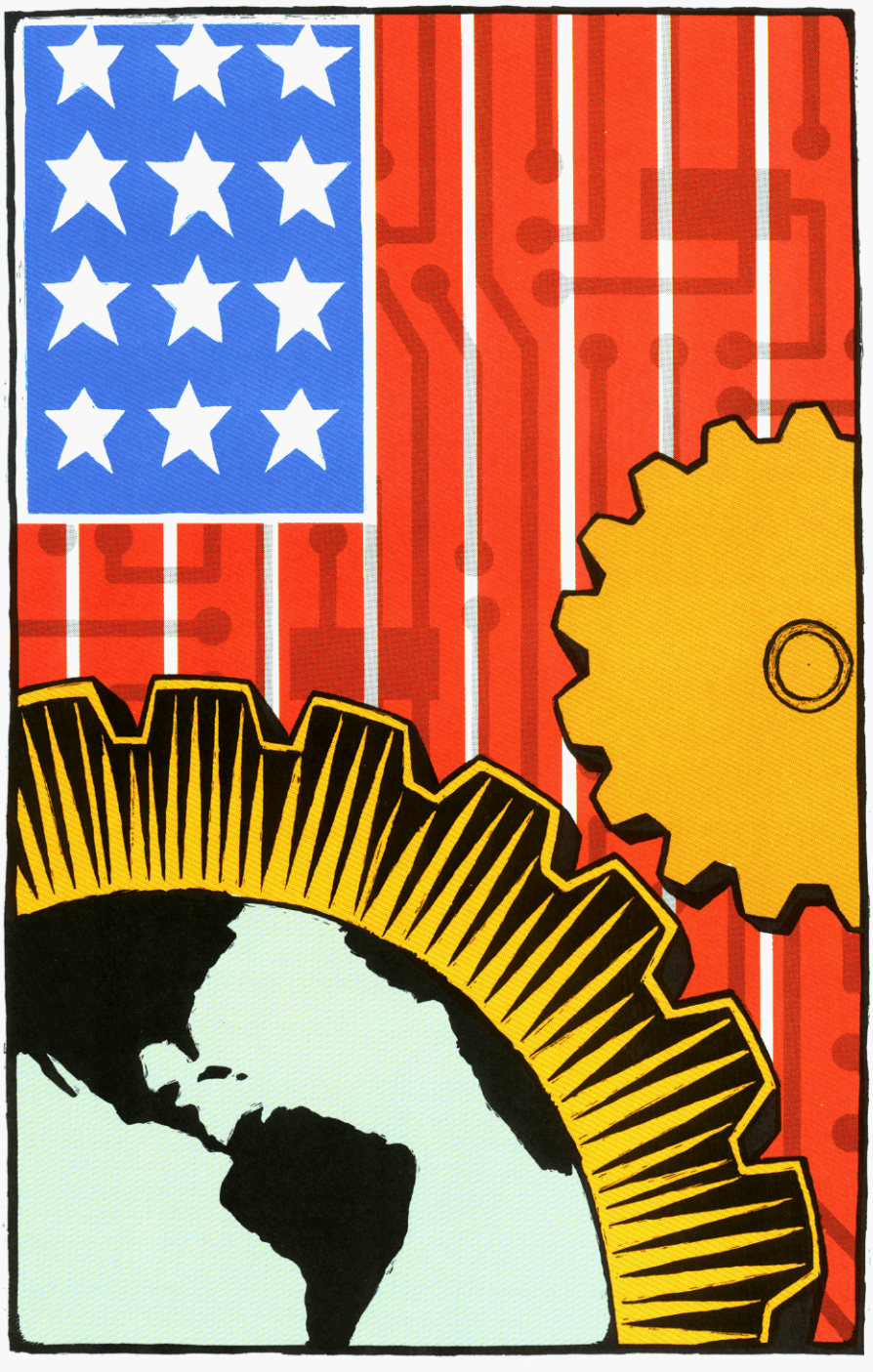
ADAPTING U.S. TECHNOLOGY POLICY TO A CHANGING WORLD



The insight that environmental goals can spur technological innovation permeates the industrial policies of our major trading partners. It has quietly taken hold among the best American companies too, but Washington has been slow to grasp the connection and to revamp U.S. environmental and technology policies accordingly.

Reorienting R&D priorities and funding is crucial if our nation is to encourage development of new technologies that solve environmental problems and that will be essential to economic growth and competitiveness. Only a wholesale technological transformation can prevent the severe environmental pressures resulting from the doubling of population and quintupling of economic output expected in the next century. Yet our allocation of R&D resources is skewed toward the past: 60% of federal R&D dollars are still spent on defense-related research, and environmental factors are given short shrift when decisions are made about which technologies are "critical" to national well-being. Meanwhile, Germany, Japan, and other OECD nations are acquiring an edge in many of tomorrow's environmental technologies. For all these reasons, underwriting the basic technical knowledge needed to solve the next generation of environmental problems should become a national mission.

Technologies can be considered "environmentally critical" if they entail large and cost-effective reduction in environmental risk, if they embody a significant technological advance, if they are generically applicable at the precompetitive stage, and if their adoption involves a favorable ratio of social to private returns. Using these criteria as a sieve, we identified a set of such technologies. Recognizing that this is a highly judgmental exercise, we conducted a thorough literature review and a wide-ranging series of interviews with technical experts, most of them engaged in technology development in industry, government, and academe. We explored

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two main questions: What technologies should be included on the list? and, How do environmental factors affect technology development?

Ultimately, we chose 12 environmentally critical technological areas: energy capture, energy storage, energy end-use, agricultural biotechnology, alternative and precision catalysts, separations, precision fabrication, materials, information, and contraception. Although counterpart lists exist in other countries, nothing like it has previously been compiled in the United States.

Several caveats are in order. This list of technologies is exemplary, but not exhaustive. It focuses on broad technical areas, reflecting our view that public R&D dollars should be spent on technologies that are "upstream" from commercial applicability, where advances can open the door to broad systemic changes that prevent environmental problems before they arise. The fact that these 12 environmentally critical technologies resemble those on nonenvironmental lists demonstrates that environmental concerns are part of the mainstream, not the periphery, of industrial technology development.

Most technologies will be developed by the private sector, but there is a critical role for government to play in supporting private sector efforts. We studied this role by surveying public programs that support environmental technology development in the United States and other countries.

Many U.S. firms recognize the cost savings possible from more efficient, less polluting processes—and the profit potential of a burgeoning world market for environmental goods and services. Yet there is frustration at the lack of a long-term technology policy for the nation. Industry's efforts focus mostly on the near term, so they need to be supplemented by a public policy supporting work on broader technical issues of generic importance. It is in these areas that private investment tends to be deficient because firms cannot claim ownership of basic research findings that are more akin to ideas than technologies. This deficiency has long been seen as justifying public support for science—and, more recently, for generic industrial technology. We think it is equally persuasive in the environmental context. Another problem with private R&D investment is that it is often needlessly duplicative. Pooling resources in cooperative R&D efforts would make sense, and the government could encourage this by providing a forum for negotiations, contributing information and expertise, and leveraging private funding through modest monetary support.

The programs that promote environmental technology in other countries must be viewed in the context of their overall technology policies. In each of the five countries surveyed—Japan, Germany, the Netherlands, Italy, and Canada—the development of technologies to achieve national economic objectives is long-standing public policy. Government and industry usually see themselves as partners in efforts to improve national economic competitiveness. Typical policies identify broad technical areas in which government R&D funding supports the development of industrial technology, making it easy to develop component environmental programs. The assumption was widespread among all five countries that environmental technologies will become increasingly important in international economic competition.

How does the United States stack up in this context? Historically, our country led the way in attacking environmental problems—mostly through regulation, which in turn generated demand for environmental technology. U.S. science has committed significant resources to environmental research, too, and many of our national technical institutions, labs, and universities, are focusing increasingly on environmental issues. But our nation's commitment to technology development is grossly inadequate. As late as last year, 92% of all public R&D funding went to just five areas: defense, health, space, general science, and energy. From 1988 to 1991, R&D budgets relevant to the environment shifted away from applied research. Environmental consciousness may be growing among policy makers, but in technical areas it is diffuse and incoherent. Where the need for environmental technologies does surface, such as in the national list of critical technologies, it has been relegated to a distinct category rather than incorporated throughout.

The federal government should consider the following seven actions to remedy this situation:

- Create a federal institute for environmental technology that would fund R&D in private firms and public laboratories.
- Establish cross-cutting environmental criteria in R&D funding to ensure that federal programs across the board pay attention to possible environmental gains.
- Craft new missions for national laboratories in environmental technology development and transfer.
- Promote and support new patterns of R&D cooperation, including public/private partnerships, R&D consortia, and creation of international institutions.
- Promote increased international collaboration in environmental technology development.
- Reform and redesign regulations that will encourage technological innovation.
- Reorient such programs as the Commerce Department's Advanced Technology Program to focus more on environmental technology.

These options form a coherent and mutually reinforcing package. But the particular policy avenue that is chosen matters less than whether a broad new direction is set, one that provides for more funding for R&D, a new institutional focus, coordination across environmental and technology policy, public–private cooperation in technology development, more market incentives, and a reformulation of current regulatory and technology programs. The importance of public support for the next generation of environmental technology can scarcely be overstated—and the time to act is now.

This article is adapted from testimony the authors gave before a U.S. Senate subcommittee.

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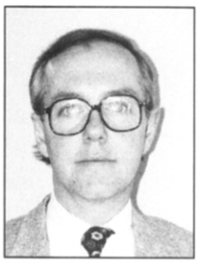

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