The H. John Heinz III Center
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Report Brief

TECHNOLOGY POLICIES FOR REDUCING GREENHOUSE GAS EMISSIONS

A well-crafted technology policy can help accelerate the development and adoption of new technologies for lowering emissions of greenhouse gases (GHGs). But the design task is not simple. GHG sources are widely dispersed globally and in terms of economic activity. Hundreds or thousands of technologies are involved.

This Heinz Center project developed a taxonomy of technology policies that can help decisionmakers link policy "levers" with emissions sources. Such an approach may also encourage decisionmakers to look more closely at technology policies that have not been part of the current debate, which has centered on funding levels for research and development (R&D), primarily by the Department of Energy.

A synthesis report gives an overview of the taxonomy, discusses the institutional context, and summarizes reactions of a workshop convened to discuss the project. Both the taxonomy and workshop are the subjects of more extensive reports.[1] The project dealt only with technology policies, not with regulatory or other environmental policies. Principal findings include the following:

- The portfolio of U.S. technology policies for addressing GHG emissions could be better balanced in two ways. First, through added support for radical innovation. Second, through better structured policies for promoting diffusion and deployment of new technologies. In part because the nation's science and technology system is

[1] "Technology Policies for Controlling Greenhouse Gas Emissions: Project Summary," "Technology Policies for Controlling Greenhouse Gas Emissions: A Taxonomy," and "Meeting Summary: Workshop on Technology Policies for Controlling Greenhouse Gas Emissions," are available at www.heinzctr.org or by request from The Heinz Center.

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so highly decentralized, effective policy implementation depends on a widely shared sense of mission to discipline agency-level decisions. At present, no compelling GHG reduction mission exists. Consensus on such a mission would not only improve the government's management of GHG-related technology programs, it would help guide policy selection.

- Almost any portfolio of technology policies aimed at GHG reduction would gain added force from complementary price signals and regulatory initiatives. "Pulling" innovations into the marketplace through incentives often leads to better solutions than does "technology push."

- Government, in cooperation with industry, universities, and environmental groups, should expand the effort to construct both technology "roadmaps" and balanced *technology policy* roadmaps for addressing GHG release. This would not only serve budgetary and planning purposes but help build a sense of mission.

The potential impacts of GHGs are unknown but could be far-reaching. Regardless of whether they turn out to be major or minor, these impacts will operate over lengthy time scales, a half-century and longer. This is a consequence of the "inertia" associated both with climatic processes and the economic activities that contribute to GHG accumulation. Innovation on the scale needed to substantially reduce GHG emissions could, over the longer term and given well-designed policies that encourage entrepreneurial innovation, usher in a new wave of technologies with revolutionary implications for economic growth and wealth creation.

A Taxonomy of Technology Policies

The 14 policy categories listed in Table 1 fall into three groups. The first four involve R&D spending. The next five policies induce private R&D (and/or engineering design and development), support commercialization and production, or do both. The remaining five include measures that foster diffusion and deployment through information transmittal and learning.

Some of the policy tools in the taxonomy are suited to direct promotion of specific technologies through "technology push" or "market pull." Because commercialization—bringing new technologies to market—is almost entirely a private-sector activity, the push-pull distinction can be viewed in terms of business decisions. Firms must make judgments concerning two kinds of risk or uncertainty, technical and business. Technical risk refers to the possibility that target values for critical performance parameters, including costs, may not be achieved. Business risks stem primarily from uncertainties about whether a new product will sell in the quantities expected–even if the product is a resounding technological success.

As indicated in the table, R&D funding reduces technical risk by generating knowledge that can verify feasibility and narrow uncertainties concerning performance. Such policies tend to push technology into the marketplace from the supply side. Other policies function by increasing the incentives for commercialization, thereby pulling technology from the demand side. Rebates for purchasers can have this effect, raising demand and reducing business risks. Diffusional policies, too, can reduce uncertainty, informing businesses or the public of best practices and thereby reducing the risks of adopting new technology.

Table 1

Technology Policies for GHG Reduction by Function/Impact

	Reduction in Technical Risk (Technology Push)		*Reduction in Business Risk (Market Pull)*	
Policy Category	*Knowledge Creation (R&D)*	*Knowledge Application (Development & Commercialization)*	*Through Financing*	*Through Information*
1. R&D contracts with private firms	√	√	Minor	
2. R&D contracts and grants with universities	√			
3. Intramural R&D conducted in government laboratories	√			
4. R&D contracts with consortia that include two or more of the actors above	√	Possible if private firms participate.	Minor	
5. R&D tax credits	Modest impacts possible.			
6. Tax credits or production subsidies for firms bringing new technologies to market		√	√	
7. Tax credits or rebates for purchasers of new technologies			√	
8. Government procurement		√	√	
9. Demonstration projects	√	√	√	√
10. Education and training		√		√
11. Codification and diffusion of technical knowledge		√		√
12. Technical standards-setting		√		√
13. Technology/industrial extension		√		√
14. Publicity, persuasion, consumer information				√

Note: The absence of a check mark in this table does not imply the absence of impact, simply that impacts will usually be less than for checked entries.

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http://www.heinzctr.org

The H. John Heinz III Center for Science, Economics and the Environment, a non-profit institution, furthers the work of Senator John Heinz by improving the scientific and economic foundation for environmental policy. The Heinz Center's distinctive contribution is to foster collaboration among industry, environmental organizations, government and academia. Each of these sectors plays an important role in solving environmental problems, and each must participate in developing robust solutions. The Heinz Center provides an institutionalized venue for these sectors to work together on an array of diverse environmental and natural resource problems.

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- identify emerging environmental issues,
- conduct related scientific research and economic analyses, and
- create and disseminate nonpartisan policy options for solving environmental problems.