

DEVELOPING MARKETS FOR CLEAN ENERGY TECHNOLOGIES

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AP/Wide World Photo

A researcher at Argonne National Laboratory watches a Lexus hybrid car being tested.

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Governments can play a critical role in facilitating clean energy technologies in the marketplace by providing financial incentives and removing market barriers to release the potential of technological innovation.

The challenges to achieving a secure and sustainable energy future are both large and urgent. If recent trends are to continue, global energy demand is projected to increase four times today's level, entailing high costs, greater oil import dependence, worse local and regional air pollution, and higher risks of climate change. Moreover, in the next two decades, more than half of global energy growth will be in developing and transitional economies, as these nations continue to improve their standard of living. The magnitude of these realities calls for changing the course of world energy development through technology innovation and commercialization.

Without massive and global technology development and deployment, such rapid growth in total world energy use will compound the energy-linked problems and challenges already of great concern today.

We have a critical window of opportunity to move the world off its current path and to embark on a trajectory toward a new global energy economy that will at once enhance energy security and economic growth and significantly improve the environment. Substantial investment in energy infrastructure will be required to meet the anticipated growth in demand. Moreover, to transition to cleaner, more efficient energy technologies and to mobilize the necessary private capital to bring the technologies to commercial scale will entail well-designed policies and incentives, effective public-private partnerships, and international cooperation.

Government, therefore, has a crucial role to play in influencing the conditions in the marketplace for adoption and diffusion of cleaner, more efficient technologies. Within today's more competitive, integrated, and efficient global markets, this role becomes one of an enabler and

catalyst. Where there is the potential in the marketplace for net public benefits from using better energy technologies, government can increase the prospects for adoption by focusing on making the energy-related attributes of these products more attractive to suppliers, consumers, and investors, while minimizing interference with market processes.

The Bush administration is pursuing a comprehensive approach to facilitating market development for energy technologies that will be the building blocks for transforming energy systems globally—an approach that accounts for all aspects of the innovation process. The administration’s programs and policies are seeking to accelerate innovation, reduce market barriers, create demand for clean energy services by increasing consumer choices, and improving energy production and consumption systems through better rules and institutions. This multifaceted, economic development approach to technology innovation focuses on building viable markets, domestically and internationally, that will attract investment in less energy-intensive products, cleaner and more energy-efficient processes, and production modernization. It is a pathway that combines technology innovation, investment mobilization, and market-based policy development.

TECHNOLOGY INNOVATION PROCESS

On January 31, 2006, President Bush announced his Advanced Energy Initiative to reduce U.S. dependence on foreign sources of energy and move beyond a petroleum-based economy. To change how we power our homes and offices, the U.S. government plans to invest more in zero-emission coal-fired plants, revolutionary solar and wind technologies, and clean, safe nuclear energy. To change how we power our automobiles, the initiative will increase research in better batteries for hybrid and electric cars and in pollution-free vehicles that run on hydrogen. It also provides funding for additional research in cutting-edge methods of producing ethanol, not just from maize, but also from wood chips, leaves and stalks, or switch grass.

This initiative, as well as other research, development, and deployment programs and activities undertaken during this administration, have emphasized the interac-

tive learning process essential to technology innovation that aims to achieve technical improvements and cost reductions, as well as business and market organizational changes needed to fit the characteristics of the technology. The federal government is playing a pivotal role in encouraging private investment and activating learning processes among all relevant market participants. Toward the goal of technology deployment, the government interacts with the private sector to stimulate technology learning that can progressively reduce costs and lead to product refinements and to develop the ability of market participants to produce and use technologies more cheaply and effectively.

Procurement and niche market development have been two key deployment strategies to motivate learning investments from private sources and to stimulate organizational learning among market actors. Procurement through, for example, the Federal Energy Management Program,

which brings together technology developers, customers, and intermediaries in the chain of supply, is facilitating changes in the way market participants are doing their business, in how they are relating to one another, and in their capability to produce and consume products that are cleaner and more efficient. Similarly, in focusing on specific characteristics of new technologies that are of special interest to certain buyers, niche markets have helped to set into motion learning processes and attract investment in technology development. In particular, the Department of Energy (DOE) is coordinating with the Department

of Defense on expanding use of domestic energy sources (coal, biomass, heavy oil sands, and oil shale) for production of new low-emission transportation fuels for military and civilian use. This coordination will foster research, development, demonstration, and commercial use of such technologies as coal gasification, biomass energy conversion, and syngas-to-liquids technologies (converting natural gas- and coal-derived synthetic gas to liquid fuels and chemicals).

MARKET BARRIERS

Relying principally on market forces, the administration has sought to intervene only in situations where the market fails to allocate resources efficiently and the inter-

“Using the globalizing forces of technology, information, and capital, governments at all levels can help to foster creative business solutions for assuring reliable, affordable, efficient, and clean energy.”

vention will improve net social benefits.

Market barriers slow the rate of uptake of new and improved technologies and create inertia based on conventional technologies. Typical barriers include lack of information, uncompetitive market prices or price distortion, high transaction costs, lack of access to financing, capital stock turnover rates, inefficient market structures, and excessive or inefficient regulation.

The federal government is implementing a wide array of policies that adjust for factors such as pollution that are not accounted for in the market and not reflected in prices, or that make legal/regulatory changes in market organization and structure. Market prices have been adjusted to incorporate these factors through taxes, standards, and regulations that force sellers and buyers to take into account costs that are external to the market. Minimum energy performance standards, for example, have been a very cost-effective means for displacing inefficient products with energy-saving ones in the marketplace. Under the Energy Policy Act of 2005 (EPACT), new energy efficiency standards will be established for many appliances and for office equipment, including compact fluorescent lamps, dehumidifiers, refrigerated beverage-vending machines, unit heaters, ceiling fans, commercial air-conditioning and heating equipment, commercial ice makers, and commercial clothes washers.

The U.S. government also is implementing a variety of performance-based and investment-based incentives and has established reliable information systems that disclose the benefits of energy efficient products. With Energy Star product labeling, the federal government has set energy efficiency guidelines for more than 40 commonly purchased home and business products.



The Energy Star logo.

In 2005, the program led to energy savings of 150 billion kilowatt-hours (about 4 percent of U.S. electricity sales), resulting in utility bill savings of \$12 billion and preventing 35 million metric tons of

greenhouse gas emissions.

EPACT also provides a wide array of incentives for clean energy technologies, products, and services, including tax credits and deductions; energy savings perfor-



An energy-efficient compact fluorescent lightbulb.

Courtesy the Environmental Protection Agency

mance contracting; credit to holders of renewable energy bonds; and funding for state-run rebate programs for Energy Star products. The act also authorizes DOE to issue loan guarantees for new and improved technologies. This financial instrument can be targeted at the risks-discouraging investment by first adopters of advanced technologies to address a significant gap in the development cycle with respect to “getting to market.” Use of loan guarantees can significantly leverage private resources. The EPACT incentives will help to overcome market barriers and allow for market growth that would not otherwise have occurred but for the policy steps.

MARKET TRANSFORMATION

Market transformation programs are helping to raise the profile of energy factors in market activities and affect the institutional framework within which the markets operate, with minimal interference with normal market processes.

The Federal Energy Management Program, for example, is developing markets for energy-efficient technologies, products, and services through a mix of policy tools and incentives, including standards and labels; performance/savings targets; government purchases; energy audits by energy service companies; consumer education and information; energy pricing policies and metering practices; research, development, and demonstration of new technologies; public-private partnerships; and innovative financing, especially energy savings performance contracts and public benefit funds.

Through the Partnerships for Home Energy Efficiency presidential initiative, DOE, the Environmental Protection Agency, and the Department of Housing and Urban Development are collaborating with the private sector to improve the access of homeowners and others to energy

efficient products and services. This initiative also aims at overcoming market barriers by better aligning policies and incentives to market structures in order to address bottlenecks to the uptake of efficient energy and renewable technologies.

CREATIVE BUSINESS SOLUTIONS

Taken together, these efforts represent a holistic approach to market development that combines technology innovation, investment mobilization, and policy development. Through partnerships and networks, this approach

seeks to develop market relationships in which different participants at different levels, whether local, state, federal, regional, or international, operate in a mutually reinforcing manner and leverage one another. The aim is to develop mechanisms for greater cooperation and coordination to advance the social process of innovation. Using the globalizing forces of technology, information, and capital, governments at all levels can help to foster creative business solutions for assuring reliable, affordable, efficient, and clean energy to power economic growth and development in the future. ■