



Highlights of [GAO-07-550T](#), a testimony to Subcommittee on Energy and Water Development, Committee on Appropriations, House of Representatives

Why GAO Did This Study

For decades, the nation has benefited from relatively inexpensive energy, but it has also grown reliant on fossil fuels—oil, natural gas, and coal. Periodic imported oil supply disruptions have led to price shocks, yet the nation's dependence on imported energy is greater than ever. Fossil fuel emissions of carbon dioxide—linked to global warming—have also raised environmental concerns. The Department of Energy (DOE) has funded research and development (R&D) on advanced renewable, fossil, and nuclear energy technologies. GAO's report entitled *DOE: Key Challenges Remain for Developing and Deploying Advanced Energy Technologies to Meet Future Needs* examined the (1) R&D funding trends and strategies for developing advanced energy technologies; (2) key barriers to developing and deploying advanced energy technologies; and (3) efforts of the states and six selected countries to develop and deploy advanced energy technologies. GAO reviewed DOE R&D budget data and strategic plans and obtained the views of experts in DOE, industry, and academia, as well as state and foreign government officials.

What GAO Recommends

GAO's report recommended that the Congress consider further stimulating the development and deployment of a diversified energy portfolio by focusing R&D funding on advanced energy technologies.

www.gao.gov/cgi-bin/getrpt?GAO-07-550T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Jim Wells, at (202) 512-6877 or wellsj@gao.gov.

ADVANCED ENERGY TECHNOLOGIES

Key Challenges to Their Development and Deployment

What GAO Found

DOE's budget authority for energy R&D, when adjusted for inflation, fell 85 percent from its peak in fiscal year 1978 to fiscal year 2005. Energy R&D funding in the late 1970s was robust in response to constricted oil supplies and an ensuing energy crisis, but R&D funding plunged when oil prices returned to their historic levels in the mid-1980s. DOE's R&D efforts have resulted in steady incremental progress in reducing costs for renewable energy, reducing harmful emissions of coal-fired power plants, and improving safety and efficiency for nuclear energy. Nevertheless, the nation's dependence on conventional fossil fuels remains virtually the same as 30 years ago.

Further development and deployment of advanced renewable, fossil, and nuclear energy technologies face several key challenges:

- **High Capital Costs.** The high capital costs of advanced energy technologies worry risk-averse investors. For example, solar cells made to convert solar energy into electricity for homeowners and businesses have been typically too expensive to compete with fossil fuels. DOE's R&D efforts include developing new materials for solar cells that could decrease manufacturing costs.
- **Environmental Concerns.** Advanced energy technologies need to address harmful environmental effects, including bird and bat fatalities cause by wind turbines, carbon dioxide and mercury emissions by coal-fired power plants, and spent nuclear fuel from nuclear power reactors.
- **Technology-Specific Challenges.** Challenges that are unique to each technology also create barriers to development and deployment. Ethanol, for example, will need to be manufactured with more cost-competitive technologies using agricultural residues or other cellulosic materials in order to expand beyond corn. Other challenges include developing new wind technologies to expand into low-wind and offshore locations; developing advanced coal gasification technologies to further reduce harmful emissions and high capital costs; and working with the nuclear power industry to deploy a new generation of reactors and develop the next generation to enable reactors to reprocess highly radioactive spent nuclear fuel or produce hydrogen.

Many states and foreign countries have forged ahead of the federal government by successfully stimulating the deployment of renewable energy technologies. For example, renewable energy accounts for 3 percent of Texas' electricity consumption because Texas enacted legislation in 1999 and 2005 requiring its electric utilities to meet renewable energy capacity standards. Similarly, Denmark has used mandates and financial incentives to promote wind energy, which provided 19 percent of its electricity in 2005.