The Incredible Shrinking Energy R&D Budget

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THE FEDERAL GOVERNMENT AND PRIVATE INDUSTRY ARE BOTH REDUCING their investments in energy research and development (R&D) at a time when geopolitics, environmental concerns, and economic competitiveness call instead for a major expansion in US capacity to innovate in this sector. The 2005 federal budget reduced energy R&D by eleven percent from 2004. The American Association for the Advancement of Science projects a decline in federal energy R&D of eighteen percent by 2009. Meanwhile, investments in energy R&D by US companies fell by fifty percent between 1991 and 2003.

This decline occurred despite numerous calls from expert groups for major new commitments to energy R&D. A 1997 report from the President's Committee of Advisors on Science and Technology and a 2004 report from the bipartisan National Commission on Energy Policy both recommended that federal R&D spending be doubled.

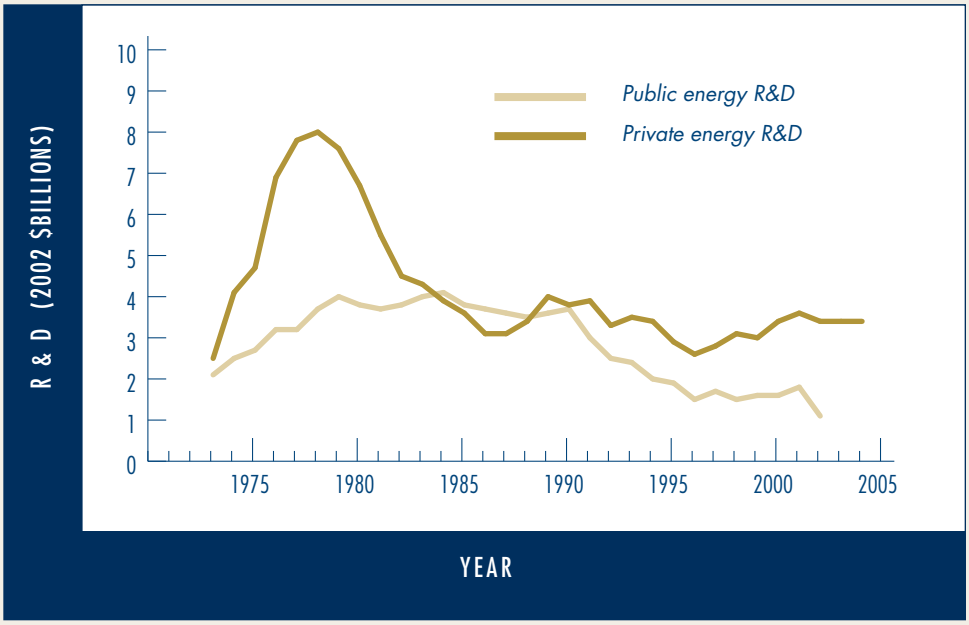
A comparison with the pharmaceutical industry is revealing. In the early 1980s, energy companies were investing more in R&D than were drug companies; today, drug companies invest ten times as much in R&D as do energy firms. Total private sector energy R&D is less than the R&D budgets of individual biotech companies such as Amgen and Genentech. The nation's ability to respond to the challenge of climate change, and to the economic consequences of disruptions in energy supply, has been significantly weakened by the lack of attention to long-term energy planning.

Comparison to previous major government research programs suggests that a serious federal commitment to energy R&D could yield dramatic results. Using emissions scenarios ➢

FIGURE 1

Declining energy R&D investment by public and private sectors

Since 1980, energy R&D as a percentage of total US R&D has fallen from ten percent to two percent. Since the mid-1990s, both public and private sector R&D spending has been stagnant for renewable energy and energy efficiency, and has declined for fossil fuel and nuclear technology.



Sources: Raymond M. Wolfe, *Research and Development in Industry* (National Science Foundation, Division of Science Resources Statistics, 2004); M. Jefferson, et al., *Energy Technologies for the 21st Century* (World Energy Council, 2001); Ronald L. Meeks, *Federal R&D Funding by Budget Function: Fiscal Years 2003–05*, NSF 05-303 (National Science Foundation, Division of Science Resources Statistics, 2004); Robert Margolis and Daniel M. Kammen, "Underinvestment: The Energy Technology and R&D Policy Challenge," *Science*, No. 285, 1999.

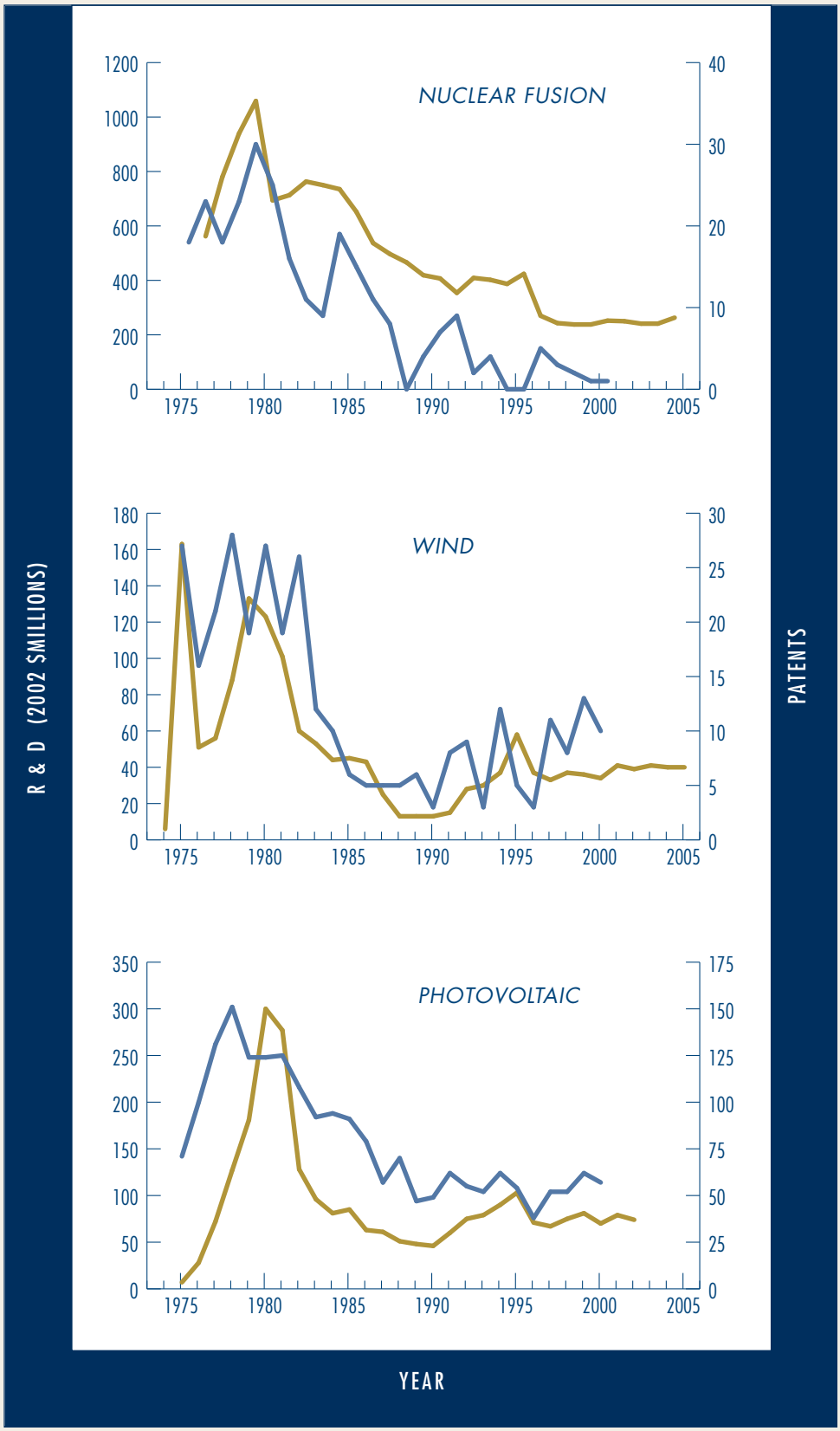


FIGURE 2

Correlations and declines in patenting and federal R&D

Patenting provides a measure of the outcomes of innovation. We use records of successful US patent applications as a proxy for the intensity of innovative activity and find strong correlations between public R&D and patenting. Since the early 1980s, all three indicators—public sector R&D, private sector R&D, and patenting—exhibit consistently negative trends. The data include only US patents issued to US inventors. Patents are dated by their year of application.

Source: US Patent and Trademark Office patent database.

from the Intergovernmental Panel on Climate Change and a framework for estimating the climate-related savings from energy R&D programs developed by Bob Schock from Lawrence Livermore National Laboratory, we calculate that energy R&D spending of $15 to $30 billion/year would be sufficient to stabilize CO_2 at double pre-industrial levels. This five- to ten-fold increase in spending from current levels is not a "pie in the sky" proposal; in fact it is consistent with growth seen in several previous federal programs, such as the Apollo Program, which took place in response to clearly articulated national needs. In the private sector, US energy companies could increase their R&D spending by a factor of ten and would still be below the average R&D intensity of US industry. Past experience indicates that higher investments would be repaid several times over in technological innovations, business opportunities, and job growth. The recent $500 million agreement between British Petroleum and several universities, which established the Energy Biosciences Institute at UC Berkeley, is a step in the right direction. But it falls far short of the level of funding that's both needed and possible.

R&D investment is an essential component of a broad innovation-based energy strategy that includes transforming markets and reducing barriers to the commercialization and diffusion of nascent low-carbon energy technologies. The economic benefit of such a bold move would repay the country in job creation and global economic leadership, building a vibrant, environmentally sustainable engine of new economic growth. ◆

Figures and text are drawn from Kammen, Daniel M. and Nemet, Gregory, "Reversing the Incredible Shrinking Energy R&D Budget," Issues in Science and Technology, *Fall 2005.*

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FIGURE 3

Fuel cell patenting and stock prices

One bright spot in the nation's energy innovation system is increased investment and innovation in fuel cells. Despite a seventeen percent drop in federal funding, patenting activity intensified by nearly an order of magnitude, from 47 in 1994 to 349 in 2001, with much of the activity driven by private sector investment fuelled by rising stock prices. The relationship between fuel cell company stock prices and patenting is stronger than that between patenting and public R&D. The five firms shown account for 24 percent of fuel cell patents from 1999 to 2004. Almost 300 firms received fuel cell patents in those years, reflecting participation both by small and large firms.

Source: US Patent and Trademark Office patent database.