

Department of Energy

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HIGHLIGHTS

- For FY 2014, the Department of Energy will have a new leadership team in place, but its programming, as reflected in the presidential budget request, would offer few changes from FY 2013. As the department states in its “Funding Highlights,” its proposed 8 percent increase above the FY 2012 enacted level would “position the United States to compete as a world leader in clean energy and advanced manufacturing, enhance our energy security, respond to the threat of climate change, and modernize the nuclear stockpile and infrastructure.”
- To meet these objectives, the department would increase spending modestly for basic research programs that “lay the foundation for innovation, long-term economic growth and competitiveness in areas such as clean energy and fundamental physics.” But it would focus its significant new resources for clean energy through very substantial increases for the Energy Efficiency and Renewable Energy (EERE) and Advanced Research Projects Agency-Energy (ARPA-E) accounts, and proposes \$200 million in mandatory FY 2014 funding for vehicle-related technology R&D, paid for by redirecting oil and gas drilling revenues. And it would create a new “Race to the Top for Energy Efficiency and Grid Modernization” by awarding support for state government programs that “implement effective policies to increase energy productivity and modernize the grid.”
- The DOE budget would target resources specifically toward programs designed to meet three presidential energy goals: (1) “Reducing our overall dependence on oil by more than 2 million barrels a day by 2025, and reducing oil imports by half by 2020,” (2) “Doubling

renewable electricity production from wind, solar and geothermal by 2020” and (3) “Doubling energy productivity by 2030.”

- The President’s request would also allocate increased resources to R&D programs that help maintain a “safe, secure and effective nuclear weapons stockpile at levels consistent with the New Strategic Arms Reduction Treaty [New START]” and strengthen “national security by securing, removing an detecting nuclear and radiological material worldwide.”
- The budget would sustain funding for five existing Energy Innovation Hubs and once again add a hub on Electricity Systems, requested last year but not funded under the FY 2013 Continuing Resolution. The Energy Frontier Research Centers (EFRCs) program, managed by Basic Energy Sciences (BES) within the Office of Science, would receive \$69 million in additional support. And in 2014, BES would re-compete all of the centers, affording new EFRCs the opportunity to be chosen and existing ones the possibility of renewal.
- Among the department’s energy programs, only Nuclear Energy would see reduced funding, while EERE would be expanded dramatically. Among the programs administered by the Office of Science, BES and Fusion Energy Sciences (FES) would receive the largest increases, but the additional support for FES R&D (\$65 million) would cover barely half of the \$120 million increase slated for ITER – the international fusion energy project based in Cadarache, France – thereby increasing the financial stress on domestic plasma science. Spending for ITER would rise to \$225 million, an annual cap that would remain in place for the duration of the construction project.
- Finally, the budget request would create an “EV Everywhere Grand Challenge” by establishing a department-wide initiative to develop technologies with a goal of developing plug-in vehicles that are as affordable and convenient as gasoline vehicles by 2022.

HISTORICAL PERSPECTIVE AND POLITICAL CONTEXT

The Department of Energy (DOE) traces its origin to 1946, when Congress established the Atomic Energy Commission (AEC) to oversee the nation’s embryonic nuclear weapons and civilian nuclear reactor programs. In

1974, Congress consolidated energy R&D programs housed throughout the federal government and combined them with the non-regulatory activities of the AEC to create the Energy Research and Development Administration (ERDA). In 1977, when ERDA achieved Cabinet status, it was renamed the Department of Energy.

Today DOE ranks first among government agencies in supporting physical science research and first in supporting national facilities. It ranks second in mathematics and computer science. Its research programs also play an extraordinarily important role in training the next generation of scientists and engineers. DOE's Office of Science, for example, funds programs at 300 leading academic institutions and supports 25,000 Ph.D.s, graduate students, undergraduates, engineers and technicians. The Office of Science also maintains research facilities at 10 DOE laboratories used by a growing community of 29,000 scientists and engineers in universities, industry, and other federal research agencies, residing in virtually all congressional districts and spanning virtually all research disciplines. The Office of Science lays claim to an enviable record of accomplishment: over the course of six decades it has supported research leading to more than 100 Nobel Prizes, with 20 of them awarded in just the last ten years.

Historically, DOE has devoted about half its R&D budget to developing, building and operating its research laboratories. The 17 laboratories comprise multipurpose, specialized-civilian and national weapons facilities that afford researchers across disciplines the opportunity to tackle large, complex problems ranging from climate modeling and combustion dynamics to nuclear safeguards and non-proliferation. Among the facilities for which DOE has responsibility are synchrotron and free-electron laser light sources, neutron sources, specialized accelerators, super computers, and nanoscale research centers.

DOE's R&D budgets have generally tracked the nation's concerns with energy and national security. At times of crisis, the Department's R&D portfolio has thrived, but following the end of the Cold War at the end of the 1980s and in the absence of prolonged uncertainties in foreign supplies of petroleum, R&D budgets in the Department of Energy often declined. Over a period of twenty years beginning in about 1988, DOE saw its R&D level of effort decline by 25-30 percent due to budget strictures and increases in the cost of research that outpaced the GDP deflator. In FY 2009 and 2010, with Congress and the White House increasingly

focused on innovation, competitiveness and energy security, DOE's R&D spending grew much faster than inflation. Since then, the pace of growth has slackened substantially, with portions of the department's research portfolio experiencing flat or declining budgets in inflation adjusted dollars.

Fiscal wrangling and partisan jousting in FY 2013 caused DOE's R&D portfolio to shrink by more than 5 percent after sequestration became a fait accompli – a budget outcome few legislators wanted but one none could find a way to stop. The across-the-board reductions constituted a particularly bitter outcome for a department that had anticipated sustained R&D growth based on the Bush Administration's American Competitiveness Initiative and the bipartisan America COMPETES Act. The Administration's budget request for FY 2014 would provide a partial palliative, although it would fall far short of the resources the department would need to reestablish its ideal budgetary glide path.

Unfortunately, the political environment is practically as toxic this year as it was last year. Although the presidential request is likely to engender a sympathetic response from Senate Democrats, it is even more likely to run into a House ripsaw controlled by traditional Republican budget hawks and newcomer Tea Party government skeptics. The GOP-controlled House will not only view the proposed increases as fiscally irresponsible, but it will recoil at the department's emphasis on large increases for energy technology programs that conservatives believe are best left to the private sector. The outsized increases for EERE and ARPA-E, especially compared to other DOE accounts that would grow more modestly if at all, have run into early headwinds in the Republican-dominated House. It is not clear whether a more sympathetic Senate under Democratic control will have the ability to negotiate a middle ground and if it does, whether the increases for clean energy programs will come at the expense of other DOE accounts, including Science.

Although Congress has long viewed the Department of Energy as a billboard of dysfunction, the Office of Science has generally escaped the obloquy. But during the last few years, even its programs have provoked strong congressional reprimands for poor clarity, lack of strategic planning and abysmal communication. During the last year, the office requested its various advisory committees assemble information and develop priorities that can lead to a new strategic plan suited to a fiscally constrained

landscape. But it is unlikely that such a plan will be in place before Congress finalizes its work on FY 2014 appropriations.

By contrast with the Office of Science, which usually provokes little criticism of its long-term basic research mission – except from the most libertarian of conservatives – ARPA-E often finds itself the subject of complaints even from more centrist conservatives, who philosophically object to its federal role as a catalyst for innovation. But even those critics generally give the agency high marks for performance and transparency. Despite its high approval ratings for management and communication, the harsh budgetary and political environment makes it unlikely that the Administration’s ARPA-E’s R&D request of \$345 million (an increase of \$90 million or 35.3 percent compared to FY 2012) will survive intact.

IN DEPTH VIEW

TOP LINE SUMMARY

For FY 2014 the proposed \$28.4 billion DOE budget would represent an increase of \$1.8 billion or 6.7 percent using FY 2012 as a baseline. Relative to that fiscal year, the presidential request would boost R&D spending dramatically for energy programs [+\$1.0 billion (+48.6 percent)] and the National Nuclear Security Administration (NNSA) [+\$628 million (+14.8 percent)], and it would provide a more modest but still significant increase for the Office of Science [+\$281 million (+6.3 percent)]. The combined R&D portfolio would climb \$1.9 billion or 17.8 percent to \$12.7 billion. (See Table II-11).

ENERGY PROGRAMS

Support for DOE’s energy technology R&D portfolio began to expand dramatically in 2007 following the Democratic takeover of Congress in the 2006 elections. From a base of \$1.1 billion in FY 2006, spending climbed during each of the following four years, reaching a peak of \$2.4 billion in FY 2010. But Republican congressional victories in 2010 halted the rapid ramp up, and spending fell to \$2.0 billion in FY 2011. It rose modestly to \$2.1 billion in FY 2012, but sequestration trimmed the account by several percent a year later, and the mandated reductions remained in place when Congress finally passed a Continuing Resolution to close out spending for FY 2013.

In spite of House GOP hostility to a DOE portfolio that focuses on clean energy technology, the Administration's budget request would cede little political ground. Total spending for EERE would soar by 55.9 percent relative to FY 2012. The \$995 million surge would be driven by major increases for Vehicle Technologies (+\$254 million or +79.1 percent), Advanced Manufacturing as part of an interagency initiative (+\$252 million or +233.9 percent), Building Technologies (+85 million or +39.7 percent), Solar Energy (+\$72 million or +25.2 percent) and Wind energy (+\$52 million or 56.8 percent). Geothermal Technology, with its smaller baseline, would see a smaller dollar increase but a very substantial percentage gain (+\$23 million or +62.3 percent). The Biomass and Biorefinery Systems account, which received \$195 million in FY 2012, would be re-designated Bioenergy Technologies and allocated \$282 million for FY 2014. By contrast, funding for Hydrogen & Fuel Cell Technologies and Water Power would remain essentially flat.

The Administration's continuing focus on clean energy is also reflected in the budget proposed for Electricity Delivery and Energy Reliability. For FY 2013, the President's request had contained \$20.0 million for a new Electricity Systems Hub, but the account would have risen by only \$4.0 million. For FY 2014, DOE has again requested funding for the hub, but this time it would be accommodated within a \$33 million (+24.1 percent) increase in the overall Electricity account.

With natural gas prices remarkably low and supplies growing as the result of "fracking," the White House appears to be backing away slowly from its previously strong commitment to nuclear energy. The FY 2014 budget request reflects such a policy shift. The overall Nuclear Energy account would slip by \$25 million (-3.3 percent), with reductions taken from three R&D accounts: Reactor Concepts (-\$38 million or -34.5 percent), Nuclear Engineering Enabling Technologies (-\$9 million or -12.6 percent) and Fuel Cycle (-\$16 million or -8.8 percent). By contrast the department would commit \$17 million dollars to a partnership with the Environmental Protection Agency and the Department of the Interior's U.S. Geological Survey to "understand and minimize the potential environmental, health and safety impacts of natural gas development through hydraulic fracturing (fracking)." Given the strong geopolitical implications of U.S. natural gas development and production, the planned collaborative R&D effort is likely to be welcomed by members of Congress on both sides of the aisle.

The FY 2014 budget would fund overall Fossil Energy R&D at \$421 million, an increase of \$84 million (+24.8 percent) compared to FY 2012, after all rescissions of prior year balances and cancellations are taken into account for both fiscal years. Clean Coal R&D, a perennial favorite of members of Congress from coal mining regions, would continue to receive sizeable support. That account, with selected programs focused on post-combustion and pre-combustion Carbon Capture, Carbon Storage, Advanced Energy Systems (integrated production and carbon capture) and Cross Cutting Research, once again would be the prime beneficiary of Fossil Energy R&D funding: \$277 million for FY 2014 (See Table II-11).

OFFICE OF SCIENCE

The Office of Science (SC) continues to be the dominant federal sponsor of physical sciences research, a role it has played for decades. It also continues to provide extensive support for research in computer science, mathematics, biological and environmental science, materials science, nanotechnology and engineering. After almost two decades of declining level of effort, SC in 2007 became one of three key federal programs identified in the America COMPETES Act for budget doubling by FY 2016. But except for major increases in FY 2009 and 2010, SC has fallen far short of the authorized doubling trajectory. With no updated strategic plan in place that recognizes the new fiscal climate, SC is under duress.

The FY 2014 request would increase support for SC by \$217 million or 4.4 percent to \$5.2 billion. Three programs that have benefitted from favored treatment by the White House in recent years would account for 60 percent of that total: Basic Energy Sciences, which supports 16 scientific use facilities, two energy hubs and 46 EFRCs, would receive \$1.9 billion [+ \$218 million or +13.2 percent]; Biological and Environmental Research, with its allocation split almost evenly between Biological Systems and Climate & Environmental Sciences, \$625 million (+\$33 million or +5.6 percent); and Advanced Science Computing research, \$466 million [+ \$37 million or 8.7 percent.

Two programs that have suffered particularly from funding shortfalls would get partial relief. Nuclear Physics, which was facing the prospect of having to jettison one of its three major thrusts (the Continuous Electron Beam Accelerator at Jefferson Laboratory, the Relativistic Heavy Ion Collider at Brookhaven and the planned Facility for Rare Isotope Beams at Michigan

State), would get an infusion of \$35 million [+6.6%], bringing its total to \$570 million, enough to allow all three to survive although not thrive. Fusion Energy Sciences, which must meet the U.S. contractual obligation to ITER, would remain strapped for resources, even as it would see its allocation rise by 16.6 percent to \$458 million. To help accommodate the ramp-up of U.S. ITER support to \$225 million, DOE would terminate MIT's Alcator C-Mod facility.

Of the six SC activities, only High Energy Physics would see virtually no increase. In recent years, the \$777 million program, once the flagship of American physics, has suffered from lack of community consensus, as well as inadequate visibility. As a result, its budget has slowly drifted downward. And the FY 2014 presidential request would fall far short of allowing any serious progress on major initiatives such as Project X at Fermi National Laboratory or the Sanford Underground Research Facility at the Homestake mine in South Dakota.

The weak public profile of American high-energy physics was evident when CERN announced the discovery of the Higgs boson at the Large Hadron Collider in Geneva, Switzerland on July 4, 2012. Even though the U.S. had contributed more than \$500 million to the effort and deployed 1,700 scientists and engineers – the largest contingent of any participating nation – the front-page news stories barely acknowledged the major role Americans had played. Only recently have U.S. high-energy physicists begun to recognize their need to coalesce around a common vision and communicate more effectively to lawmakers and the public the contributions they make to scientific discovery, technological innovation and the inspiration of the technical workforce of the future.

ATOMIC ENERGY DEFENSE ACTIVITIES

The DOE and its predecessors have long had responsibility for managing the nuclear weapons stockpile, supplying naval reactors, addressing the environmental legacy of nuclear weapons work, and attending to technical issues associated with non-proliferation goals. For FY 2014, consistent with commitments the Administration made during ratification of the New START, spending for Atomic Defense R&D would rise substantially, by \$631 million (+14.8 percent) to \$4.9 billion, providing major increases for the National Nuclear Security Administration's Weapons Activities, Naval Reactors and Defense Nuclear Nonproliferation as detailed in Table II-11.

But, the largest adjustment to any Atomic Defense R&D activity would be a 24.5 percent reduction to Livermore National Laboratory's National Ignition Facility (NIF) budget. Having failed to achieve ignition by 2012 as promised, the 192-laser inertial confinement facility would be directed to shift its emphasis from ignition testing to experiments aimed at understanding the scientific complexities that have prevented NIF from reaching its goals. The budget would also eliminate all NIF support for non-defense high-energy density physics research activities and require the laboratory to charge scientists engaged in such studies for any facility time they use.