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Energy and Water Development: FY2015 Appropriations

Carl E. Behrens, Coordinator
Specialist in Energy Policy

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Summary

The Energy and Water Development appropriations bill provides funding for civil works projects of the Army Corps of Engineers (Corps), for the Department of the Interior's Bureau of Reclamation (Reclamation), the Department of Energy (DOE), and several independent agencies.

FY2014 Energy and Water Development appropriations were included as Division D of the Consolidated Appropriations Act, 2014 (P.L. 113-76), which the President signed on January 17, 2014. Its consideration, like all the other appropriations bills for FY2014, had been complicated by the Budget Control Act of 2011 (BCA, P.L. 112-25), which established discretionary spending limits for FY2012-FY2021. The budget impasse was eased with the passage in December 2013 of H.J.Res. 59 (P.L. 113-67), which contained the Bipartisan Budget Act (BBA), establishing less stringent spending caps for FY2014 and FY2015 than the BCA.

With overall spending levels for FY2015 agreed to in the BBA, appropriators anticipate an easier path to reaching agreement on individual appropriations bills than previously. However, the apportionment of the available funding among the bills within the overall limit has not been determined. In addition, there remains the possibility of numerous controversial policy riders being attached to the appropriations bills, complicating passage.

In addition to funding levels, issues specific to Energy and Water Development programs include:

- the distribution of appropriations for Corps (Title I) and Reclamation (Title II) projects that have historically received congressional appropriations above Administration requests;
- alternatives to the proposed national nuclear waste repository at Yucca Mountain, NV, which the Administration has abandoned (Title III: Nuclear Waste Disposal);
- proposed FY2015 spending levels for Energy Efficiency and Renewable Energy (EERE) programs (Title III) that were more than 20% higher in the Administration's request than the amount appropriated for FY2014; and
- funding for the nuclear weapons program and other defense activities, which make up half of the total Department of Energy budget.

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Most Recent Developments

President Obama's FY2015 budget request for Energy and Water Development was released in March 2014. The request totaled \$33.7 billion, compared to a total of \$33.6 billion appropriated for FY2014.

Status

Table 1 indicates the status of the FY2015 funding legislation. Blank cells will be filled as the bill progresses.

Table 1. Status of Energy and Water Development Appropriations, FY2015

Subcommittee Markup		House Report	House Passage	Senate Report	Senate Passage	Conf. Report	Final Approval		Public Law
House	Senate						House	Senate	

Overview

The Energy and Water Development bill includes funding for civil works projects of the U.S. Army Corps of Engineers (Corps), the Department of the Interior's Central Utah Project (CUP) and Bureau of Reclamation (Reclamation), the Department of Energy (DOE), and a number of independent agencies, including the Nuclear Regulatory Commission (NRC) and the Appalachian Regional Commission (ARC).

The Budget Control Act and Energy and Water Development Appropriations for FY2015

FY2015 discretionary appropriations will be considered in the context of the Budget Control Act of 2011 (BCA, P.L. 112-25), which established discretionary spending limits for FY2012-FY2021, enforced by an automatic spending reduction process of sequestration. In December 2013 Congress passed H.J.Res. 59 (P.L. 113-67), which contained the Bipartisan Budget Act (BBA), establishing less stringent spending caps for FY2014 and FY2015 than the BCA. For details, see CRS Report R43411, *The Budget Control Act of 2011: Legislative Changes to the Law and Their Budgetary Effects*, by Mindy R. Levit.

The Opportunity, Growth, and Security Initiative

The Obama Administration added to its FY2015 budget a new government-wide proposal referred to as the Opportunity, Growth, and Security Initiative. It is a \$56 billion fund that would be divided equally between defense and nondefense expenditures. The cost of the initiative would be offset largely with targeted spending cuts and closed tax loopholes.

According to the Administration, this initiative, if passed, would provide an additional \$1.6 billion for the Department of Energy, including:

- \$355 million for “strengthening national resilience to climate change,” including grants to states and increased weatherization programs, as well as distributed energy generation;
- \$200 million for the proposed “Race to the Top” grants to states to implement energy savings;
- \$484 million for other energy initiatives; and
- \$600 million for nuclear weapons programs, including the Readiness in Technical Base and Facilities and Site Stewardship, and nuclear nonproliferation R&D.¹

Funding proposed through the Opportunity, Growth, and Security Initiative is not included in the FY2015 funding levels in the tables that follow.

Table 2 includes budget totals for energy and water development appropriations enacted for FY2008 to FY2015.

Table 2. Energy and Water Development Appropriations, FY2008 to FY2015

(budget authority in billions of current dollars)

FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015 ^a
30.9	40.5 ^b	33.4	31.7	34.4 ^c	36.0 ^d	33.6	33.7

Source: Compiled by CRS.

Note: Figures represent current dollars, exclude permanent budget authorities, and reflect rescissions.

- a. Requested budget authority.
- b. Includes \$7.5 billion for Advanced Technology Vehicle Manufacturing Loan Program.
- c. Includes \$1.7 billion in emergency funding for the Corps of Engineers.
- d. Includes \$5.4 billion in emergency funding for the Corps of Engineers.

Table 3 lists totals for each of the bill’s four titles.

¹ <http://www.slideshare.net/energy/fy-2015-budget-rollout-secretary-moniz-presentation-to-press-and-stakeholders>.

Table 3. Energy and Water Development Appropriations Summary

(\$ millions)

Title	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Title I: Corps of Engineers	10,068.2 ^a	5,467.5	4,533.0			
Title II: CUP & Reclamation	1,014.0	1,113.1	1,043.5			
Title III: Department of Energy	25,160.7	27,274.0	28,426.4			
Title IV: Independent Agencies	252.2	266.9	250.1			
Scorekeeping Adjustments ^b	-525.5	-565.5	-543.0			
E&W Total	35,962.8^a	33,556.0	33,710.0			

Source: FY2015 budget request.

- a. Includes \$5,350 billion in supplemental funding for the Corps of Engineers under the Disaster Relief Appropriations Act, 2013 (P.L. 113-2).
- b. "Budget scorekeeping" refers to official determinations of spending amounts for congressional budget enforcement purposes. These scorekeeping adjustments include offsetting revenues from various sources.

Tables 4 through 16 provide budget details for Title I (Corps of Engineers), Title II (Department of the Interior), Title III (Department of Energy), and Title IV (independent agencies) for FY2013-FY2014, and proposed funding for FY2015. Accompanying these tables is a discussion of the key issues involved in the major programs in the four titles.

Title I: Army Corps of Engineers²

The Energy and Water Development bill provides funding for the civil program of the U.S. Army Corps of Engineers (Corps), an agency in the Department of Defense with both military and civilian responsibilities. Under its civil works program, the Corps plans, builds, operates, and maintains a wide range of water resources facilities. The Corps attracts congressional attention because its projects can have significant local and regional economic benefits and environmental effects, in addition to their water resource development purposes.

In most years, the President's budget request for the Corps is below the agency's enacted appropriation. For FY2014, in P.L. 113-76, Congress provided \$5.468 billion for the agency's annual civil works appropriations. The President's FY2015 budget request for the Corps was \$4.561 billion, not accounting for proposed rescission of prior year funds.

For more on the evolution of Corps civil works funding in recent years, see CRS In Focus IF00012, *Army Corps Civil Works Funding: A Primer (In Focus)*, by Charles V. Stern and Nicole T. Carter. Additionally, in recent years riverine and coastal flooding resulted in the agency receiving supplemental funds. For more on the evolution of Corps civil works supplemental appropriations, see CRS Report R42841, *Army Corps Supplemental Appropriations: Recent History, Trends, and Policy Issues*, by Charles V. Stern and Nicole T. Carter.

² This section was prepared by Charles V. Stern and Nicole T. Carter.

Earmarks and the Corps of Engineers

Corps funding is part of the debate over congressionally directed spending, or “earmarks.” Unlike highways and municipal water infrastructure programs, federal funds for the Corps are not distributed to states or projects based on a formula or delivered via competitive grants. Generally about 85% of the appropriations for Corps civil works activities are directed to specific projects.

In addition to specific projects identified for funding in the President’s budget, for decades Congress annually identified during the discretionary appropriations process many additional Corps projects to receive funding.³ In the 112th Congress, site-specific project line items added by Congress (i.e., earmarks) became subject to House and Senate earmark moratorium policies. As a result, Congress generally has not added funding at the project level since FY2010. In lieu of the traditional project-based increases, Congress has included “additional funding” for select categories of Corps projects (e.g., “ongoing navigation work”), and provided direction and limitations on the use of these funds.⁴ Congress continued this practice, providing \$777 million in “additional funding” for select categories of Corps projects in the enacted FY2014 appropriations.

**Table 4. Energy and Water Development Appropriations
Title I: Army Corps of Engineers**
(\$ millions)

Program	FY2013 Approp.	FY2013 Supplem.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Investigations and Planning	118.5	50.0	125.0	80.0			
Construction	1,586.6	3,461.0	1,656.0	1,125.0			
Mississippi River & Tributaries (MR&T)	238.0	0.0	307.0	245.0			
Operation and Maintenance (O&M)	2,286.0	821.0	2,861.0	2,600.0			
Regulatory	182.9	0.0	200.0	200.0			
General Expenses	175.3	0.0	182.0	178.0			
FUSRAP ^a	99.9	0.0	103.5	100.0			

³ While congressional earmarks make up a relatively small percentage of most agency budgets, a significant number of Corps projects historically received additional funding from Congress for construction or operational expenditures.

⁴ Congress provided additional funding and guidance for several broad categories of projects in the FY2015 Omnibus explanatory statement. The FY2014 statement instructed the Corps to make additional project level allocations in a “work plan” and report back to Congress. Some of the categories to be funded in the work plan were designated by Congress as only being available for projects which were not included in the Administration’s budget request. Recent Work Plan allocations through FY2014 are available at <http://www.usace.army.mil/Missions/CivilWorks/Budget.aspx>.

Program	FY2013 Approp.	FY2013 Supplem.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Flood Control & Coastal Emergencies (FC&CE)	25.6	1,008.0	28.0	28.0			
Office of the Asst. Secretary of the Army	4.6	10.0	5.0	5.0			
Total Title I	4,718.3	5,350.0^b	5,467.5	4,533.0^c			

Source: FY2013 Work Plan, P.L. 113-76, FY2015 budget request.

- Formerly Utilized Sites Remedial Action Program.
- \$5.35 billion in supplemental funding related to the consequences of Hurricane Sandy was provided under the Disaster Relief Appropriations Act, 2013 (P.L. 113-2).
- Includes \$28 million rescission.

Key Policy Issues—Corps of Engineers

Project Backlog and New Starts

The large number of authorized Corps studies and projects that have not received appropriations to date, or that are authorized and have received funding but are incomplete, is often referred to as the “backlog” of authorized projects. Estimates of the construction backlog range from \$20 billion to more than \$80 billion, depending on which projects are included (e.g., those that meet Administration budget criteria, those that have received funding in recent appropriations, those that have never received appropriations). The backlog raises policy questions, such as which activities to fund among authorized activities.⁵

Recent budget requests by the Administration have included few new studies and construction starts, and enacted appropriations for FY2011, FY2012, and FY2013 barred any funding for new projects (defined as projects or studies that have not received appropriations previously). For FY2014, P.L. 113-76 allowed up to nine new study starts and four new construction starts. For FY2015, the Administration requested funding for one new construction start and 10 new studies.⁶

Navigation Trust Funds

In addition to regular appropriations, two congressionally authorized trust funds are administered by the Corps and require annual appropriations. The Harbor Maintenance Trust Fund and the Inland Waterway Trust Fund support cost shared investments in federal navigation infrastructure and have both received attention in recent years. While the Harbor Maintenance Trust Fund has a

⁵ For more information, see CRS Report R41243, *Army Corps of Engineers: Water Resource Authorizations, Appropriations, and Activities*, by Nicole T. Carter and Charles V. Stern.

⁶ The Administration’s FY2014 proposed new starts were Hamilton City, CA (Ecosystem Restoration); Lower Colorado River Basin, TX (Flood Risk Management); Louisiana Coastal Area, LA (Ecosystem Restoration); Columbia River, OR and WA (Navigation).

surplus balance, the Inland Waterway Trust Fund currently faces a shortfall and a curtailment of activities. Both trust funds are subject to appropriations. Authorization issues associated with these trust funds are often addressed through Water Resources Development Acts, or similar legislation.⁷ Both trust funds are discussed below.

Harbor Maintenance Trust Fund

In 1986, Congress enacted the Harbor Maintenance Tax (HMT) to recover operation and maintenance (O&M) costs at U.S. coastal and Great Lakes harbors from maritime shippers. O&M is mostly the dredging of harbor channels to their authorized depths and widths. The tax is levied on importers and domestic shippers using coastal or Great Lakes ports. The tax revenues are deposited into the Harbor Maintenance Trust Fund (HMTF), from which Congress appropriates funds for most harbor dredging.

In 1990, Congress increased the HMT rate from 4 cents per \$100 of cargo value to 12.5 cents per \$100 of cargo value in the Omnibus Budget Reconciliation Act (P.L. 101-508). In recent years, HMTF annual expenditures have remained relatively flat while HMT collections have increased due to rising import volume.⁸ Consequently, a large surplus in the HMTF has developed. The maritime industry seeks to enact a “spending guarantee” to spend down the surplus in the HMT. Some harbor channels are not being maintained at their authorized depth and width, which may in some cases require ships with the deepest drafts to “light load” or wait for high tide. Harbors primarily used by fishing vessels or recreational craft have also complained of insufficient maintenance dredging. Since spending from the HMTF requires an appropriation from Congress, spending more from the HMTF could reduce available funding for other Energy and Water Development activities under congressional budget caps.

The Administration’s FY2015 budget requested \$915 million from the HMTF, leaving an estimated-end-of-year balance of more than \$9.5 billion. For more information on harbor maintenance funding, see CRS Report R41042, *Harbor Maintenance Trust Fund Expenditures*, by John Frittelli.

Inland Waterway Trust Fund

Since the 1980s, expenditures for construction and major rehabilitation projects on inland waterways have been cost-shared on a 50/50 basis between the federal government and users through the Inland Waterway Trust Fund (IWTF).⁹ IWTF monies derive from a fuel tax on commercial vessels on designated waterways, plus investment interest on the balance.¹⁰ Since FY2007, there has been a looming shortfall in the IWTF. In recent years Congress has taken measures to ensure temporary solvency of the IWTF, either by appropriating federal funds beyond the aforementioned 50% federal requirement (FY2009 and FY2010), by limiting IWTF

⁷ For more on congressional consideration of Corps trust fund authorization as part of broad Corps authorization legislation, see CRS Report R43298, *H.R. 3080 and S. 601: Comparison of Select Provisions and Conference Developments*, by Nicole T. Carter et al.

⁸ The exception was 2009, when collections declined along with import volume.

⁹ For more information on inland waterways, see CRS Report R41430, *Inland Waterways: Recent Proposals and Issues for Congress*, by Charles V. Stern.

¹⁰ Pursuant to the Water Resources Development Act of 1986 (P.L. 99-662), the fuel tax has been fixed at \$0.20 per gallon since 1992.

expenditures to the amount available under current year fuel tax revenues (FY2011-FY2013), or by altering the IWTF cost-share requirements for individual projects (FY2014). The IWTF is expected to have a balance of approximately \$42 million at the end of FY2014.

In the past multiple Administrations have proposed fees (e.g., lock user fees, congestion fees) that would have increased IWTF revenues. These fees have been opposed by users and rejected by Congress. In 2011, users endorsed a plan of their own that would increase the current fuel tax by \$0.06-\$0.08 per gallon and alter the cost-share arrangement for some IWTF projects to increase the portion paid for by the federal government. In the current Congress, H.R. 1149 and S. 407 would authorize this proposal and raise the fuel tax by \$0.06 and \$0.09, respectively.

Recent estimates by the Corps indicate that one project, Olmsted Locks and Dam on the Ohio River, is expected to use up the majority of IWTF revenues without significant changes to the cost-sharing requirements for that project.¹¹ At the same time, other navigation construction and major rehabilitation work is expected to stall. Without a new source of revenue or some other change directed by Congress, the overall number of inland waterway construction projects is expected to remain limited. Changes to IWTF policies have historically been under the jurisdiction of the authorizing committees, but in recent years appropriators have expressed frustration with the lack of action on this issue.

For FY2015, the Administration once again requested appropriations for IWTF projects that are less than expected fuel tax revenues.¹² This is similar to the Administration's request for FY2011-FY2014. The FY2015 Administration budget requested approximately \$85 million in inland waterway spending from the IWTF, with an equal amount to be drawn from the General Fund of the Treasury. The Administration also assumed an additional \$80 million in new revenues from an unspecified user fee, presumably separate from the current fuel tax. The majority of FY2015 requested IWTF funds (\$80 million of the \$85 million requested from the IWTF) were proposed for the Olmsted Project. For FY2014, Congress temporarily in P.L. 113-76 reduced from 50% to 25% the costs of the Olmsted project that are to come from the IWTF. For more information on inland waterways, see CRS Report R41430, *Inland Waterways: Recent Proposals and Issues for Congress*, by Charles V. Stern.

Ecosystem Restoration Projects

The Corps portion of the Energy and Water bill typically includes funding for ecosystem restoration projects, such as restoration of the Everglades in South Florida.¹³ Previously, some in Congress had criticized the fact that while the Corps had requested reductions for some "traditional" water project activities in recent budgets, funding requests for Corps environmental activities, which include ecosystem restoration projects, had largely remained steady. For

¹¹ Currently the Olmsted Project accounts for almost all IWTF appropriations. The project was originally authorized at a cost of \$775 million (plus inflationary increases) but recently required an increase to its authorization ceiling in accordance with Section 902(b) of the Water Resources Development Act of 1986 (33 U.S.C. §2280). The FY2014 Continuing Appropriations Act, P.L. 113-46, increased the project's authorization from \$775 million to \$2.92 billion.

¹² Assuming annual fuel tax revenues of approximately \$95 million, spending on inland waterways construction for FY2015 would be approximately \$190 million for each year (or approximately \$60 million less than the average funding provided from FY1992-FY2010).

¹³ Along with the Department of the Interior, the Corps typically receives funding for the Comprehensive Everglades Restoration Program, or CERP. For more information regarding Everglades restoration funding, see CRS Report R42007, *Everglades Restoration: Federal Funding and Implementation Progress*, by Charles V. Stern.

FY2014, the Administration requested \$449 million (approximately 9% of the total FY2014 Corps request, spread among several accounts) for ecosystem restoration projects. For FY2015, however, the Administration requested \$336 million, representing 7% of the total request.

Continuing Authorities Program

Projects funded under the Corps' Continuing Authorities Program (CAPs) are typically smaller projects that can be carried out without obtaining a project-specific study or construction authorization or project-specific appropriations.¹⁴ CAPs are referred to by the section number in the bill where the CAP was first authorized. The Administration's FY2015 budget requested a total of \$10 million for four CAPs, or a significant decrease from the total of \$53 million provided for eight CAPs in FY2014 in the explanatory statement accompanying P.L. 113-76.

Title II: Department of the Interior¹⁵

Bureau of Reclamation and Central Utah Project

Title II of the Energy and Water Development bill includes funding for two sets of activities within the Department of the Interior: it funds the Bureau of Reclamation and the Central Utah Project Completion Act (CUPCA). For FY2014, P.L. 113-76 provided \$1.104 billion for Title II.

For the purposes of Energy & Water appropriations, the FY2015 request for the Bureau of Reclamation and CUPCA was \$1.043 billion. In its budget request, the Administration typically includes an "offset" for the Central Valley Project (CVP) Restoration Fund. Counting this offset of \$56.9 million in its FY2015 request, "net" discretionary authority requested by the Administration for these accounts was \$986 million.¹⁶ As in previous years, additional funding is expected to be available for FY2015 via "permanent and other" funds, but these funds are not included in net discretionary totals and therefore not reflected below.

¹⁴ Information on each CAP is provided in CRS Report R41243, *Army Corps of Engineers: Water Resource Authorizations, Appropriations, and Activities*, by Nicole T. Carter and Charles V. Stern.

¹⁵ This section was prepared by Charles V. Stern and Nicole T. Carter.

¹⁶ Counting of this offset is consistent with prior year budgets.

**Table 5. Energy and Water Development Appropriations
Title II: Central Utah Project Completion Account**
(\$ millions)

Program	FY2013 Approp.	FY2014 Approp.	FY2015 Request^a	House	Senate	Conf.
Central Utah Water Conservancy District	19.8	7.7	[6.3]			
Mitigation and Conservation Commission Activities	1.2	1.0	[1.0]			
Expenses of the Secretary of the Interior	—	—	—			
Total, Central Utah Project	21.0	8.7	[7.3]			

Source: FY2015 budget request.

Notes: Amounts shown in brackets are for comparison purposes only.

- a. The FY2015 budget proposed to transfer the Central Utah Project Completion Account to the Bureau of Reclamation. See **Table 6** below for Administration recommendations for this account.

**Table 6. Energy and Water Development Appropriations
Title II: Bureau of Reclamation**
(\$ millions)

Program	FY2013 Approp.	FY2014 Approp.^a	FY2015 Request^a	House	Senate	Conf.
Water and Related Resources	848.2	954.1	760.7			
Policy and Administration	56.9	60.0	59.5			
CVP Restoration Fund (CVPRF)	50.4	53.3	57.0			
Calif. Bay-Delta (CALFED)	37.6	37.0	37.0			
San Joaquin Restoration Fund ^b	[15.53]	[26.0]	32.0			
Indian Water Rights Settlement ^b	[47.2]	[78.7]	90.0			
Central Utah Project Completion ^a	[21.0]	[8.7]	7.3			
Gross Current Reclamation Authority	993.0	1,104.4	1,043.5			
Total, Title II Current Authority (CUP and Reclamation)	1,014.0	1,113.1	1,043.5			

Source: FY2015 budget request.

Notes: Totals may not add due to rounding. Amounts shown in brackets are for comparison purposes only.

- a. As in recent previous requests, the Administration proposed to transfer the Central Utah Project Completion Account to the Bureau of Reclamation.

- b. As in previous requests, the Administration's request includes funding for these items, which have in the past been funded within Water and Related Resources, as new accounts.

Central Utah Project

The Administration requested \$7.3 million for CUPCA in FY2015, or \$1.4 million less than the FY2014 enacted amount. In FY2015 the Administration once again proposed to make Reclamation responsible for oversight and implementation of CUPCA and transition this account to Reclamation's purview. (These responsibilities are currently in a separate office in DOI.) Previously, following a similar request by the Administration in its FY2014 budget, P.L. 113-76 retained CUPCA as a separate account and provided \$8.7 million for the project.

Bureau of Reclamation

Most of the large dams and water diversion structures in the West were built by, or with the assistance of, the Bureau of Reclamation. Whereas the Army Corps of Engineers built hundreds of flood control and navigation projects, Reclamation's mission was to develop water supplies, primarily for irrigation to reclaim arid lands in the West. Today, Reclamation manages hundreds of dams and diversion projects, including more than 300 storage reservoirs in 17 western states. These projects provide water to approximately 10 million acres of farmland and a population of 31 million. Reclamation is the largest wholesale supplier of water in the 17 western states and the second-largest hydroelectric power producer in the nation. Reclamation facilities also provide substantial flood control, recreation, and fish and wildlife benefits. Operations of Reclamation facilities are often controversial, particularly for their effect on fish and wildlife species and conflicts among competing water users.

As with the Corps of Engineers, the Reclamation budget is made up largely of individual project funding lines and relatively few "programs." Also similar to the Corps, previously these Reclamation projects have often been subject to earmark disclosure rules. The current moratorium on earmarks restricts congressional steering of money directly toward specific Reclamation projects, as it had done in the past.

Reclamation's single largest account, Water and Related Resources, encompasses the agency's traditional programs and projects, including construction, operations and maintenance, dam safety, and ecosystem restoration, among others. The Administration requested \$760.7 million for the Water and Related Resources account for FY2015, ostensibly a significant decrease from the FY2014 enacted amount. However, accounting for the transfer of approximately \$112 million by the Administration from the Water and Related Resources account to newly created accounts for Indian water rights settlements and San Joaquin restoration, the FY2015 request for Water and Related Resources was \$71 million less than the FY2014 enacted level.¹⁷

¹⁷ The Administration has previously requested that these accounts be created independently of the Water and Related Resources account. Congress has previously disagreed with this approach and has instead chosen to maintain these funds within Water and Related Resources.

Drought in California

Drought conditions in California have received attention in recent appropriations bills and could receive attention in FY2015. The enacted appropriations bill for FY2014 (P.L. 113-76) included multiple provisions related to Reclamation drought response and related authorities. For example, it extended through FY2017 authority for Reclamation to provide loans under the Reclamation States Emergency Drought Relief Act (43 U.S.C. 2214(c)) for projects that would mitigate losses associated with drought conditions. It also expanded the Secretary of the Interior's authority to participate in nonfederal groundwater banking in California and waived certain reporting provisions for transfer of irrigation water among selected federal water contractors, while also directing Reclamation and the Fish and Wildlife Service to expedite "programmatic environmental compliance" to facilitate CVP water transfers. P.L. 113-76 also extended the authorization of the Calfed Bay-Delta Authorization Act (P.L. 108-351) through 2015 (continuing certain provisions of the law that were set to expire at the end of FY2014).

FY2015 appropriations could include further efforts to address drought and could include provisions similar to those enacted for FY2014 or in other legislation that has been introduced in the 113th Congress. For example, S. 2198 proposes to expand Reclamation's authority under the Reclamation States Emergency Drought Relief Act (i.e., authorities other than the loan authority that was extended in FY2014 enacted appropriations) and increase the total authorization of appropriations under that act from \$90 million to \$190 million.

Reclamation's FY2015 request proposed funding for individual projects and programs that may also receive added attention due to the drought. For instance, Reclamation proposed \$1.5 million in new funding within its WaterSMART program for a Drought Response Program (see "WaterSMART Program," below) that could be of interest due to the drought's ongoing effects. Some legislation, such as S. 2198, has also proposed increasing the scope and potential recipients of Reclamation funds, including assistance provided under the WaterSMART Program, to incorporate drought-related concerns.¹⁸

San Joaquin River Restoration Fund

The San Joaquin River Restoration Fund was authorized by the enactment of Title X of the Omnibus Public Land Management Act of 2009 (P.L. 111-11), the San Joaquin River Restoration Settlement Act. The Fund is to be used to implement fisheries restoration and water management provisions of a stipulated settlement agreement for the *Natural Resources Defense Council et al. v. Rodgers* lawsuit.¹⁹ The Fund is supported through the combination of a reallocation of Central Valley Project Restoration Fund receipts from the Friant Division water users and accelerated payment of Friant water users' capital repayment obligations, as well as other federal and non-federal sources. The Settlement Act provided \$88 million from the Restoration Fund to be available without further appropriation. Reclamation reports that in FY2015, the balance of the

¹⁸ For more information on these proposals, see CRS Report R43469, *Analysis of S. 2198: Emergency Drought Relief Act of 2014*, by Betsy A. Cody and Pervaze A. Sheikh.

¹⁹ Construction of Friant Dam in the 1940s and subsequent diversion of San Joaquin River water to off-stream agricultural uses blocked salmon migration and dewatered stretches of the San Joaquin, resulting in elimination of spring-run Chinook into the upper reaches of the river. One goal of the settlement is to bring back the salmon run; another is to reduce or avoid adverse water supply impacts to Friant Division long-term contractors. For more information on the settlement agreement and the San Joaquin River Restoration Fund, see CRS Report R40125, *Title X of H.R. 146: San Joaquin River Restoration*, by Betsy A. Cody and Pervaze A. Sheikh.

aforementioned mandatory appropriations is expected to be spent, and without further congressional action, additional receipts will not be available until October 2019.

In lieu of additional mandatory funding for restoration until 2019, Reclamation is requesting discretionary funding of \$32 million for San Joaquin restoration activities as a separate account in FY2015. Previously, following a similar proposal by the Administration in its FY2014 budget, the explanatory statement accompanying P.L. 113-76 agreed to the Administration’s FY2014 request of \$26 million in discretionary funds for San Joaquin restoration, but provided this funding within the Central Valley Project appropriation for the Friant Division, in the Water and Related Resources Account.

WaterSMART Program

In recent years Reclamation has combined funding for “bureau-wide” programs promoting water conservation into a single program—the WaterSMART (Sustain and Manage America’s Resources for Tomorrow) Program. The program is part of the Department of the Interior’s focus on water conservation, re-use, and planning. The FY2015 WaterSMART is shown below in **Table 7**. The FY2015 request for all WaterSMART programs was \$52 million. The explanatory statement accompanying P.L. 113-76 provided nearly \$49 million for these activities in FY2014.

The WaterSMART Program request included two new components in FY2015: Drought Response and Resilient Infrastructure. Both programs would attempt to respond to the effects of climate change. The Resilient Infrastructure Program would attempt to identify and expand opportunities and use information to adapt Reclamation facility operations to account for climate change and reduce the potential effects of wildfire on Reclamation facilities. The Drought Response Program would fund new “comprehensive” planning actions, as well as implementation actions under existing authorities to address water shortages.

Table 7. Reclamation WaterSMART Program
(\$ millions)

Program Name	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
WaterSMART Grants	22.6	19.0	19.0			
Basin Studies	6.0	4.7	3.9			
Title XVI Projects	20.0	21.5	21.5			
Drought Response	—	—	1.5			
Resilient Infrastructure	—	—	1.5			
Cooperative Watershed Management Program	0.25	0.25	0.25			
Water Conservation Field Services	6.2	3.4	4.5			
Total	52.0	48.9	52.1			

Source: FY2013 Bureau of Reclamation Operating Plan, Bureau of Reclamation FY2015 Congressional Justifications, H.Rept. 113-135, S.Rept. 113-47, and explanatory statement accompanying P.L. 113-76.

Title III: Department of Energy

The Energy and Water Development bill has funded all DOE's programs since FY2005. Major DOE activities funded by the Energy and Water bill include research and development on renewable energy and energy efficiency, nuclear power, fossil energy R&D, the Strategic Petroleum Reserve, energy statistics, general science, environmental cleanup, and nuclear weapons programs.

The FY2013 continuing resolution, P.L. 113-6, funded DOE programs at \$25.1 billion, including the sequestration requirements of the Budget Control Act. The FY2014 bill, P.L. 113-76, appropriated \$27.3 billion for DOE. The Administration's request for FY2015 was \$28.4 billion.

Table 8. Energy and Water Development Appropriations
Title III: Department of Energy
(\$ millions)

Program	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
ENERGY PROGRAMS						
Energy Efficiency and Renewable Energy	1,691.8	1,900.6	2,316.7			
Electricity Delivery and Energy Reliability	129.2	147.2	180.0			
Nuclear Energy	708.4	888.4	863.4			
Race to the Top	0.0	0.0	0.0			
Fossil Energy R&D	498.7	561.9	475.5			
Naval Petrol. and Oil Shale Reserves	14.1	20.0	20.0			
Elk Hills School Lands Fund	0.0	0.0	15.6			
Strategic Petroleum Reserve	182.6	189.4	205.0			
Northeast Home Heating Oil Reserve	3.6	8.0	1.6			
Energy Information Administration	99.5	117.0	122.5			
Non-Defense Environmental Cleanup	223.5	231.7	226.2			
Uranium D&D Fund	448.2	598.6	531.0			
Science	4,681.2	5,066.4	5,111.2			
Energy Transformation Acceleration Fund (ARPA-E)	250.6	280.0	325.0			
Nuclear Waste Disposal	0.0	0.0	0.0			
Departmental Admin. (net)	119.2	126.4	129.1			
Office of Inspector General	39.8	42.1	39.9			
Office of Indian Energy	0.0	0.0	16.0			
Adv. Tech. Vehicles Manuf. Loan	5.7	6.0	4.0			

Program	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Sec. 1705 Loan Guarantee	0.0	20.0	7.0			
Rescission (Clean Coal Technology)	0.0	0.0	-6.6			
TOTAL, ENERGY PROGRAMS	9,096.2	10,203.8	10,582.9			
DEFENSE ACTIVITIES						
National Nuclear Security Administration (NNSA)						
Weapons Activities	6,966.9	7,781.0	8,314.9			
Nuclear Nonproliferation	2,237.4	1,954.0	1,555.2			
Naval Reactors	994.1	1,095.0	1,377.1			
Office of Administrator	377.5	377.5	410.8			
Total, NNSA	10,575.8	11,207.0	11,658.0			
Defense Environmental Cleanup	4,627.1	5,000.0	5,327.5			
Other Defense Activities	760.0	755.0	753.0			
Defense Nuclear Waste Disposal	-0.7	0.0	0.0			
TOTAL, DEFENSE ACTIVITIES	15,962.1	16,962.0	17,738.5			
POWER MARKETING ADMINISTRATION (PMAs)						
Southeastern	0.0	0.0	0.0			
Southwestern	11.2	11.9	11.4			
Western	90.9	95.9	93.4			
Falcon & Amistad O&M	0.2	0.2	0.2			
TOTAL, PMAs	102.0	108.2	105.0			
Total, Title III	25,160.7	27,274.0	28,426.4			

Source: FY2015 budget request.

Key Policy Issues—Department of Energy

DOE administers a wide variety of programs with different functions and missions. In the following pages, some of the most important programs are described and major issues are identified, in approximately the order in which they appear in **Table 8**.

Energy Efficiency and Renewable Energy (EERE)²⁰

President Obama has declared energy efficiency and renewable energy to be a high priority, stressing their importance to jobs, economic growth, and U.S. manufacturing competitiveness. For example, the 2013 *Economic Report of the President* notes that “President Obama has set a

²⁰ This section was prepared by Fred Sissine.

goal of once again doubling generation from wind, solar, and geothermal sources by 2020.” But Congress so far has not supported his efforts to boost spending for these programs. His proposed FY2011 budget for EERE of \$2.4 billion was reduced to \$1.8 billion, the FY2012 request for \$3.2 billion was cut to \$1.8 billion, the FY2013 request for \$2.3 billion was cut to \$1.7 billion, and the FY2014 request for \$2.8 billion was cut to \$1.9 billion.

For FY2015, DOE requests \$2.32 billion for the EERE programs. Compared with the FY2014 appropriation, the FY2015 request would increase EERE funding by about \$416 million, or nearly 22%.

DOE requests an additional \$180 million for Electricity Delivery and Energy Reliability (EDER) programs (described in the next section). **Table 9** gives the programmatic breakdown for EERE and EDER.

Table 9. Energy Efficiency and Renewable Energy Programs
(\$ millions)

Program	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Hydrogen/Fuel Cell Technologies	95.8	92.9	93.0			
Biomass and Biorefinery Systems	185.2	232.3	253.2			
Solar Energy	269.1	257.1	282.3			
—Concentrating Solar Power (CSP)	—	90.1				
—Photovoltaic (PV) Power	—	79.1				
Wind Energy	86.1	88.1	115.0			
Geothermal Technology	35.0	45.8	61.5			
Water Power (Hydro/Ocean)	54.7	58.6	62.5			
Subtotal, Renewable and Hydrogen	725.9	774.7	867.5			
Vehicle Technologies	303.2	289.7	359.0			
Building Technologies	204.6	177.9	211.7			
Advanced Manufacturing	114.3	180.5	305.1			
Federal Energy Management	28.3	28.2	36.2			
Subtotal, Efficiency R&D	650.3	676.3	912.0			
Facilities and Infrastructure	24.9	46.0	56.0			
Program Direction	160.5	162.0	160.0			
Strategic Programs	23.6	23.5	21.8			
R&D Subtotal	1,585.1	1,682.6	2,017.3			
Tribal Energy Program	9.4	7.0	0.0 ^a			
Clean Energy Economic Development Projects	0.0	0.0	14.0			
Subtotal, Demonstration and Deployment	9.4	7.0	14.0			

Program	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Weatherization Grants	131.7	173.9	227.6			
State Energy Grants	47.1	50.0	63.1			
Use of Prior Year Balances	-81.6	-2.4	-5.2			
Rescission	—	—				
Total EERE Appropriation	1,691.8	1,900.6	2,316.7			
Electricity Delivery and Energy Reliability (EDER)	129.2	147.2	180.0			

Source: FY2015 budget request.

- a. DOE requests that this funding line be moved from EERE to the Office of Tribal Energy.

EERE-wide Cross-Cutting Initiatives

The FY2015 request continues an emphasis on five broad initiatives that cut across multiple EERE programs:

(1) Grid Integration Initiative. Under this initiative, launched in 2012, EERE’s vehicles, solar, and buildings programs would work in coordination with DOE’s Grid Tech Team²¹ to address electric grid integration barriers and opportunities associated with variable, distributed renewable energy generators, electric vehicle charging, and building efficiency and controls. Thus, EERE would coordinate with DOE’s Office of Electricity Delivery and Energy Reliability (EDER).

(2) EV Everywhere Grand Challenge. This DOE-wide initiative aims to make technology breakthroughs that would enable the United States, by 2022, to become the first country in the world to invent and produce plug-in electric vehicles that are as affordable and convenient as gasoline-powered vehicles.

(3) SunShot Grand Challenge. This DOE-wide initiative seeks to achieve directly cost-competitive solar power by 2020.

(4) Clean Energy Manufacturing Initiative. This relatively new EERE initiative aims to dramatically improve U.S. competitiveness in the manufacture of clean energy products (like solar modules, LED lights, batteries, and wind blades) and to increase energy productivity as a means to strengthen U.S. competitiveness across multiple manufacturing industries.

(5) Wide Bandgap Semiconductors for Clean Energy Initiative. Wide bandgap semiconductor technology was initially developed for military and solid-state lighting uses. DOE believes it is a key next-generation platform for semiconductor devices with the potential for developing high-power-conversion electronics that are much more compact, more energy efficient, and able to operate at much higher temperatures and voltages than existing commercial technology. DOE contends that this “revolutionary” technology could be a platform for the next generation of

²¹ DOE created the Grid Tech Team to develop a stronger and more extensive network of effective public-private partnerships needed to ease the transition to a more modern grid. DOE, EDER, *DOE Grid Tech Team*, <http://energy.gov/oe/services/doe-grid-tech-team>.

electric vehicle drivetrains, solar inverters, high-efficiency motors, solid-state transformers for the grid, and many other critical, clean energy applications.

Hydrogen/Fuel Cell Program

This program aims to reduce petroleum use, greenhouse gas emissions, and criteria air pollutants, while contributing to a more diverse and efficient energy infrastructure. The program supports applied research, development, and demonstration (RD&D) of hydrogen and fuel cell technologies, as well as efforts to overcome economic and institutional barriers to commercial deployment. The fuel cell program targets a cost below \$40 per kilowatt (kw) and a durability of 5,000 hours (equivalent to 150,000 miles) by 2020. For hydrogen produced from renewable resources, the target is to bring the cost (dispensed and untaxed) below \$4.00 per gasoline gallon-equivalent (gge) by 2020. DOE requests \$93 million—virtually the same as the FY2014 appropriation. In addition to R&D, the funding would address barriers to commercialization by supporting early market fuel cell demonstrations and by developing equipment codes and standards.

Bioenergy (Biomass and Biorefinery) Program

This program aims to foster a domestic bioenergy industry that produces renewable biofuels, bioproducts, and biopower. The goals are to curb oil dependence, reduce greenhouse gas emissions, and stimulate economic and job development—especially in the farms and forests of rural areas. While biofuels and industrial bioproducts (plastics, solvents, alcohols) may soon be price-competitive, swings in oil prices pose an ongoing challenge to achieving cost-competitiveness. The program strategy addresses a feedstock collection barrier by focusing on converting raw biomass to solid pellets or to “green crude” bio-oil that is easy to transport at large scale.

Recent goals expand the program scope to include the development of biofuels that would contribute to production targets of the Renewable Fuel Standard (RFS). These “drop-in” liquid fuels are largely compatible with existing infrastructure that deliver, blend, and dispense fuels. Examples include biomass-based hydrocarbon fuels (renewable gasoline, diesel, and jet fuel), hydrocarbons from algae, and biobutanol. The program aims to help the non-food “drop-in” biofuels reach a wholesale finished-fuel cost under \$3 per gge by 2017 and \$3/gge for algal biomass productivity by 2020.

DOE requests \$253 million in FY2015 for Bioenergy (Biomass and Biorefinery) programs, a \$21 million increase over the FY2014 appropriation. The largest requested subprogram increase would support a joint effort with the Departments of Navy and Agriculture for commercial-scale biorefineries that produce military-specification fuels. The increase would be partially offset by a \$16 million cut for feedstocks, due to greater reliance on feedstock activities at the U.S. Department of Agriculture.

Solar Energy

For the Solar Program, DOE requests \$282 million, an increase of \$25 million over the FY2014 appropriation. The funding would support the SunShot Initiative goal to achieve a cost of solar power of 6 cents/kwh to make solar power cost-competitive without subsidies by 2020. This includes solar photovoltaic R&D; activities that enable a 50% reduction in non-hardware “soft

costs”); and development and demonstration of innovative solar energy manufacturing technologies to increase U.S. competitiveness, in support of DOE’s Clean Energy Manufacturing Initiative. FY2015 funding would also support development of advanced thermal storage and supercritical carbon dioxide power cycles so that concentrated solar power can achieve baseload grid parity.

Wind Energy

There are three key goals for the Wind Program. First, for land-based windfarms, there is a goal for the energy cost of utility-scale turbines to reach 5.7 cents/kilowatt-hour (kwh) by 2020 and 4.2 cents/kwh by 2030. Second, for offshore settings, the goal is to cut energy cost from 21 cents/kwh in 2010 to 17 cents/kwh (unsubsidized) by 2020. Third, there is an overall goal to increase installed windfarm capacity from 60 billion watts (gigawatts, gw) in 2012 to 125 gw by 2020 and 300 gw by 2030.

DOE requests a \$27 million increase over the FY2014 appropriation, to \$115 million. The main share of that increase—\$22 million for Technology Validation and Market Transformation—is focused on support for three advanced offshore wind demonstration projects planned for operation by 2017. The remaining increase would support an Atmosphere to Electrons initiative, to optimize wind farms with improved performance and lower the cost of wind energy. FY2015 funding would also enable pursuit of new designs, materials, and manufacturing processes for longer blades to capture greater wind resource and to address transportation barriers, in support of DOE’s Clean Energy Manufacturing Initiative and of achieving full market cost competition for wind energy.

Geothermal Technologies

This program aims to lower the risk of resource exploration and cut power production costs to 6 cents/kwh for hydrothermal power by 2020 and for newly developed technologies by 2030. DOE requests \$62 million, an increase of \$16 million over the FY2014 appropriation. The funding would continue site characterization of the Frontier Observatory for Research in Geothermal Energy (FORGE). FORGE is a dedicated site that enables testing of novel technologies and techniques, with a central focus on optimization and validation of enhanced geothermal systems. FY2015 funding would also accelerate “play fairway” analyses that provide assessments of exploration risk and the probability of finding new resources on a regional scale, resulting in maps and studies that reduce the industry’s drilling and development risks.

Water Power

Water power technologies employ marine and hydrokinetic (wave, tidal, current, and ocean thermal) resources—and conventional hydropower resources—to generate electricity. Hydropower technology is well established, but the fledgling industry for marine and hydrokinetic (MHK) power facilities is still looking to develop a clear technology theme. For the Water Power Program, DOE requests \$63 million, an increase of \$4 million over the FY2014 appropriation. The funding would support the launch of HydroNEXT, a new EERE initiative that focuses on conducting R&D that would allow for increased hydropower opportunities at non-powered dams, water conveyance systems, and new stream reach development. It would also support development of new low cost modular hydropower systems that minimize civil works and environmental impact and maximize design for manufacturing. Further, FY2015 funding

would support marine and hydrokinetic activities to develop and validate open-source design tools and support testing of wave and tidal energy systems, to enable industry to develop robust next generation systems.

Vehicle Technologies

This program is driven by the 10-year EV-Everywhere Challenge (launched in 2012), which aims to achieve parity for plug-in electric vehicle (EV) affordability and convenience by 2022. The EV Challenge focuses on advanced battery technology, power electronics, and advanced charging technology—with the goal of assuring U.S. leadership in the global market for next generation electric vehicle technology. A key supporting technology goal is to cut 2008 battery production cost 70% by 2015 (and 88% by 2022). Further, the program seeks to achieve (1) a cut of 1.8 million barrels per day (16%) in the national oil use trend by 2020, (2) a fuel economy of 62 miles per gallon (mpg) for cars by 2025, and (3) a 50% increase in heavy duty truck fuel economy by 2015. Also, the program participates in the Grid Integration Initiative.

To help achieve those goals and support the EV Everywhere initiative, DOE requests \$359 million, an increase of \$69 million—the second-largest program increase for FY2015. The funding would support a number of aggressive vehicle technology goals: battery energy storage, electric drive R&D, and advanced power electronics initiatives in support of the EV Everywhere Grand Challenge; improvements in lightweight materials performance; more efficient combustion engine technologies; and alternative fuel vehicle community partner projects, which are new competitively awarded projects to build strategically placed, high-impact, community-scale demonstrations of alternative fuel vehicles.

There are four main parts to the \$69 million increase. First, funding for batteries and electric drives would increase by \$27 million, focused on reducing weight and costs, developing motors and magnets without rare earths, and improving wide bandgap semiconductors for power electronics. Second, funding for outreach and deployment would rise by \$19 million to initiate Alternative Fuel Vehicle Community Partner projects. Third, funding for materials technology would increase by \$16 million, emphasizing carbon fiber and other composites, lightweight materials compatible with manufacturing infrastructure, and high temperature materials for valves and turbochargers. Fourth, funding for fuels and lubricants would rise by \$11 million, mainly to expand work on drop-in biofuel compatibility with components and infrastructure—to replace conventional gasoline, diesel, and jet fuel.

Building Technologies

This program develops energy efficiency measures to curb building-related energy costs, with a goal of reducing energy use 50% by 2030. The program strategy is designed with three linked paths: improve building components (envelope/windows, HVAC, lighting, and sensors/controls), strengthen market pull (through cooperation with private industry), and raise energy efficiency levels for new equipment (via standards) and new buildings (via model codes).

DOE requests \$212 million for FY2015, an increase of \$34 million over the FY2014 appropriation. The funding emphasizes emerging technologies, to accelerate the development of lighting, heating and cooling, and other energy efficiency solutions for the nation's buildings that offer savings of 50% or more; and supports the equipment and appliance standards programs to establish minimum energy efficiency requirements pursuant to federal statutes. FY2015 funding

also assists home builders achieve high efficiency levels, improve access for homeowners to home improvement services, and improve the information, tools, and resources available to the commercial sector with a goal of achieving 20% energy savings by 2020.

There are two main parts to the \$34 million increase. First, funding for emerging technologies would increase by \$23 million, focused on R&D on sensors, controls, and grid integration, and on new air conditioning technologies. Second, a \$13 million increase would aim to accelerate equipment efficiency standards and building codes.

The request also includes \$10 million—a constant level of funding—to support the Pennsylvania State University (PSU) Consortium for Building Energy Innovation, a project that originally began as the Building Energy Efficiency Design Innovation Hub.

Advanced Manufacturing

Domestic manufacturers face increasing challenges in the global marketplace. The Advanced Manufacturing Office (AMO) was designed to focus on national interests—especially concerns about jobs, critical materials, and international competitiveness. The general goal for AMO programs is to reduce the energy use of manufactured goods across targeted product life-cycles by 50% over 10 years. More specific objectives include (1) 50% energy savings through advanced materials and industrial processes, (2) help leading companies cut energy intensity by 25% over 10 years, and (3) facilitate installation of 40 gigawatts (gw, million kilowatts) of combined heat and power equipment by 2020.²²

To meet these goals and objectives, DOE requests \$305 million, a net increase of \$125 million over the FY2014 appropriation—the largest EERE program increase requested for FY2015. Most of the requested increase—about \$109 million—would be directed to the subprogram on Advanced Manufacturing R&D Facilities. Also, a \$9 million increase would be provided for Advanced Manufacturing R&D Projects, mainly for the Advanced Incubator.

The proposed \$109 million increase for Advanced R&D Facilities includes up to \$70 million to create at least one new Clean Energy Manufacturing Institute (CEMI) and provide support for two existing institutes. The new institute would address any one of several topics: nanomaterials for energy, next generation electric machines, bio-manufacturing, smart manufacturing, or other topics. The two existing institutes are the Next Generation Power Electronics Manufacturing Innovation Institute (MII, North Carolina) and the Advanced Composites MII (announced in March 2014).

The CEMIs form part of a larger proposed interagency network aimed at bringing together universities, industry, and the government to jointly invest in solving industry-relevant problems. This activity aims to improve U.S. manufacturing competitiveness, in support of DOE's Clean Energy Manufacturing Initiative and the President's initiative for a multi-agency National Network for Manufacturing Innovation (NNMI). All three institutes are consistent with the President's NNMI.²³ The institutes focus on technologies applicable to multiple industries and

²² DOE, EERE-Advanced Manufacturing Office, *FY14 Budget At-a-Glance*, http://www1.eere.energy.gov/office_eere/pdfs/budget/manufacturing_ataglance_2014.pdf.

²³ For the NNMI, there are currently four institutes in place and five additional institutes scheduled to be established in 2014, and there is a goal to establish a total of 45 institutes over 10 years.

markets. A key goal is for each institute to become financially sustainable within five to seven years after it is established.

CEMI is a relatively new EERE cross-cutting activity that would be anchored by AMO and would incorporate activities under many of EERE's other programs.²⁴ The main goal is to improve U.S. competitiveness in the manufacturing of clean energy products, such as solar photovoltaic modules, LEDs, batteries, and wind turbine blades. The CEMI institutes would provide small- and medium-sized enterprises affordable access to cutting-edge physical and virtual manufacturing capabilities (e.g., 3-D printing equipment) and facilitate technology use in the U.S. manufacturing sector to bolster its global competitiveness. DOE plans to invest \$70 million-\$120 million into each CEMI institute, to be used over a five- to seven-year period. For each institute, DOE plans to provide up-front funding to the greatest extent possible.

Another R&D facility, the Critical Materials Hub (led by Ames National Laboratory), was created in FY2012 to focus on technologies that enable manufacturers to make better use of critical materials (e.g., rare earth elements) and to eliminate the need for materials that are vulnerable to supply disruptions. Many rare earth elements are essential to technologies of the clean energy industry.²⁵ Examples include wind turbines, solar photovoltaic panels, electric vehicles, and energy-efficient lighting. DOE requests \$25 million—level funding—to extend the Hub's operation for a fourth year.

Also, DOE requests \$10 million of further support for the Manufacturing Demonstration Facility at Oak Ridge National Laboratory.

Federal Energy Management Program (FEMP)

FEMP provides expertise, training, and other services to help federal agencies achieve congressionally mandated energy efficiency and renewable energy goals. DOE requests \$36 million, about \$8 million more than the FY2014 appropriation. The increase would support expanded marketing and outreach and the development and implementation of tools to streamline energy savings performance contracts (ESPCs), expanding the General Services Administration's (GSA's) schedule for equipment replacements, and devising a new protocol for measurement and verification of ESPCs.

Strategic Programs

The Office of Strategic Programs (formerly Program Support) is a crosscutting EERE office focused on accelerating development, commercialization, and adoption of energy efficiency and renewable energy technologies. Strategic EERE planning and partnerships support the transition of EERE technologies to market, communications and engagement with energy stakeholders, development of international markets for U.S. clean energy companies, and policy analysis for

²⁴ Going forward, DOE expects to establish CEMIs as an alternative to the concept of "manufacturing demonstration facilities" (MDFs), which it implemented in FY2012 with the establishment of the Critical Materials Hub (discussed in the next paragraph). DOE's Oak Ridge National Laboratory is the home for AMO's first MDF focused on additive manufacturing and low-cost carbon fiber. For more on MDFs, see <http://www1.eere.energy.gov/manufacturing/rd/mdf.html>.

²⁵ The Hub also supports materials needs for defense and other strategic industries.

decision making and management of the EERE portfolio. For this program, DOE seeks a slight decrease of about \$2 million relative to the FY2014 appropriation.

Weatherization Grant Program

This program addresses regulatory, financial, and planning barriers faced by state and local governments. The goal is to foster technologies, practices, and policies that support state and local governments in providing home energy services to low-income families that help them reduce energy costs and save money. DOE has noted that many states have expended leftover Recovery Act funds and now need new funds to avoid cutting core programs and services.²⁶ DOE requests a \$54 million increase over the FY2014 appropriation, solely to increase the number of households served in the FY2015 cycle.

State Energy Grant Program

This program supports both administrative and program activities at many state energy offices. DOE requests an increase of \$13 million over the FY2014 appropriation. The proposed increase would help support a new, \$10 million program of Clean Energy and Economic Development Partnerships to assist regional shale gas growth zones in creating “sustainable” economic development roadmaps. Rapid local growth associated with shale gas development challenges infrastructure and services. Thus, the proposed program would focus on economic diversification and the long term, to reduce the potential for a boom-bust cycle. Also, \$4 million in state grant funding would be used to establish a new Local Technical Assistance Program, which would support scale-up and adoption of energy efficiency and clean energy technologies.

Electricity Delivery and Energy Reliability (EDER) Program²⁷

This office drives electric grid modernization and resiliency through R&D, demonstration, partnerships, facilitation, modeling and analytics, and emergency preparedness and response. It is the federal government’s lead entity for energy sector-specific responses to energy security emergencies—whether caused by physical infrastructure problems or by cyber-security issues. DOE requests an increase of \$33 million over the FY2014 appropriation, which includes a \$15 million increase for the Infrastructure Security subprogram and a \$10 million increase for the Smart Grid R&D subprogram.

The Infrastructure Security and Energy Restoration subprogram helps secure the U.S. energy infrastructure against all types of hazards, respond to and reduce the impact of disruptive events, and assist in quickly restoring energy when events occur. The requested increase would support the development of advanced mitigation solutions for hardening infrastructure against all hazards, including geomagnetic disturbances, physical threats, and devastating weather events.

²⁶ Also, in FY2014, collection and analysis of data from ARRA projects would enable updated estimates of program energy savings, cost savings, leveraged funds, and other impacts. For more details about the program see CRS Report R42147, *DOE Weatherization Program: A Review of Funding, Performance, and Cost-Effectiveness Studies*, by Fred Sissine.

²⁷ This section was prepared by Fred Sissine.

The Smart Grid program aims to modernize the electricity distribution system, which includes improved reliability, operational efficiency, resiliency, and disaster recovery. The requested increase would expand R&D on microgrids—localized power grids that can disconnect from the traditional grid to operate autonomously. Microgrids can help mitigate grid disturbances and strengthen grid resilience. The increase would also support an evolution towards higher performance smart grids, or “Smart Grid 2.0.”

Nuclear Energy²⁸

The Obama Administration’s FY2015 funding request for nuclear energy research and development totals \$863.4 million. Including advanced reactors, fuel cycle technology, infrastructure support, and safeguards and security, the total nuclear energy request is \$25.0 million (2.9%) below the FY2014 funding level. DOE’s FY2015 nuclear R&D budget justification describes the following major goals for the program:

- Improve the safety, reliability, and economics of nuclear power plants;
- Implement a “consent based” strategy for developing nuclear waste storage and disposal facilities;
- Develop improved waste management and fuel cycle technologies; and
- Understand and minimize the risks of nuclear proliferation and terrorism.

DOE’s Office of Nuclear Energy would lead a major initiative announced in the FY2015 budget request to commercialize the Brayton cycle for commercial power plants. Called Supercritical Transformational Electric Power Generation (STEP), the initiative is proposed to be a joint effort by DOE’s nuclear energy, fossil energy, and renewable energy programs. The Brayton cycle uses supercritical gas to drive electric generators rather than the steam cycle that dominates the industry today. DOE’s budget justification predicted that Brayton-cycle power plants could reach efficiencies of up to 50%, compared with 33% for steam-cycle plants. The STEP program is to reach a 50-50 cost sharing agreement with the private sector in FY2015 to develop a 10 megawatt (electric) Brayton cycle pilot plant. Funding for the STEP initiative, provided within the nuclear energy budget, would total \$27.5 million in FY2015.

Reactor Concepts

The Reactor Concepts program area includes research on advanced reactors (often referred to as Generation IV reactors), including advanced small modular reactors, and research to enhance the “sustainability” of existing commercial light water reactors. The total FY2015 funding request for this program is \$100.5 million, a reduction of \$12.3 million from FY2014. Much of this program had previously focused on the Next Generation Nuclear Plant (NGNP), a high-temperature gas-cooled reactor demonstration project authorized by the Energy Policy Act of 2005. The reactor was intended to produce high-temperature heat that could be used to generate electricity, help separate hydrogen from water, or be used in other industrial processes. Under EPACT05, the Secretary of Energy was to decide by the end of FY2011 whether to proceed toward construction of a demonstration plant. Then-Secretary of Energy Steven Chu informed Congress on October 17, 2011, that DOE would not proceed with a demonstration plant design “at this time” but would

²⁸ This section was prepared by Mark Holt.

continue research on the technology. Potential obstacles facing NGNP include low prices for natural gas, the major competing fuel, and private-sector unwillingness to share the project's costs as required by EPACT05. Congress accepted the Administration's proposal for FY2014 to shift remaining NGNP research activities to the Advanced Reactor Concepts subprogram.

DOE proposes to combine the Small Modular Reactor R&D and Advanced Reactor Concepts subprograms into the Advanced Reactor Technologies subprogram in FY2015. Funding for the combined subprogram would be \$70.2 million, a reduction of \$12.6 million from the combined subprograms in FY2014. Reactor concepts being developed by the Advanced Reactor Technology subprogram are generally classified as "Generation IV" reactors, as opposed to the existing fleet of commercial light water reactors, which are generally classified as generations II and III. Nuclear technology development under this program focuses on "fast reactors," using high-energy neutrons, fluoride salt-cooled high-temperature reactors, and high temperature gas-cooled reactors. International research collaboration in this area would continue under the Generation IV International Forum (GIF).

DOE's FY2015 request for the Light Water Reactor Sustainability subprogram is \$30.3 million, \$350,000 above the FY2014 appropriation. The program conducts research on extending the life of existing commercial light water reactors beyond 60 years, the maximum operating period currently licensed by the Nuclear Regulatory Commission. The program, which is cost-shared with the nuclear industry, studies the aging of reactor materials and analyzes safety margins of aging plants. This subprogram is also conducting research to understand the Fukushima disaster and to develop prevention and mitigation measures, according to the DOE justification.

Small Modular Reactor Licensing Support

Rising cost estimates for large conventional nuclear reactors—widely projected to be \$6 billion or more—have contributed to growing interest in proposals for small modular reactors (SMRs). Ranging from about 40 to 300 megawatts of electrical capacity, such reactors would be only a fraction of the size of current commercial reactors, which typically exceed 1,000 megawatts. Several modular reactors would be installed together to make up a power block with a single control room, under most concepts. Current SMR proposals would use a variety of technologies, including high-temperature gas technology and the light water (LWR) technology used by today's commercial reactors.

DOE requested \$97.0 million for FY2015 to provide technical support for licensing small modular reactors, \$13 million below the FY2014 funding level. Under the program, DOE is to pay up to half the costs associated with NRC design certification and licensing of selected SMRs, as well as for economic studies and other analyses that would support SMR deployment in general. The program has focused on LWR designs because they are believed most likely to be deployed in the near term, according to DOE. The FY2015 budget justification says the SMR licensing and technical support program will continue through FY2017 and cost DOE a total of \$452 million. The program is similar to DOE's support for larger commercial reactor designs under the Nuclear Power 2010 Program, which ended in FY2010.

A consortium led by Babcock & Wilcox (B&W) was announced by DOE in November 2012 as the first award recipient under the program. DOE and the B&W consortium signed a cooperative agreement in April 2013 to implement the award, allowing for federal payments of around \$226 million over five years to design and license a commercial demonstration of B&W's 180 megawatt mPower SMR. The mPower demonstration plant would potentially be constructed at

the Tennessee Valley Authority's Clinch River site near Oak Ridge, TN, by 2022, according to the DOE justification.

DOE selected a second SMR to receive assistance under the program in December 2013. The NuScale Power SMR has a generating capacity of only 45 megawatts. Under the company's current concept, up to 12 reactors would be housed in a single pool of water, which would provide emergency cooling. The NuScale SMR is intended to be ready for commercial operation by around 2025, according to DOE.²⁹ The DOE budget justification contends that reduced funding for the SMR program will be sufficient for both the B&W and NuScale projects in FY2015.

Small modular reactors would go against the overall trend in nuclear power technology toward ever-larger reactors intended to spread construction costs over a greater output of electricity. Proponents of small reactors contend that they would be economically viable despite their far lower electrical output because modules could be assembled in factories and shipped to plant sites, with minimal on-site fabrication, and because their smaller size would allow for simpler and more effective safety systems. In addition, although modular plants might have similar or higher costs per kilowatt-hour than conventional large reactors, their ability to be constructed in smaller increments could reduce electric utilities' financial commitment and risk.

Fuel Cycle Research and Development

The Fuel Cycle Research and Development Program conducts "long-term, science-based" research on a wide variety of technologies for improving the management of spent nuclear fuel, according to the DOE budget justification. In general, the program is investigating ways to separate radioactive constituents of spent fuel for re-use or to be bonded into stable waste forms. The total FY2015 funding request for this program is \$189.1 million, \$2.9 million above the FY2014 appropriation.

The Administration is seeking a nearly one-third increase for the Used Nuclear Fuel R&D subprogram, from \$60.0 million in FY2014 to \$79.0 million in FY2015. This subprogram focuses on establishing a new spent fuel management system, consistent with the Administration's moves to terminate the previously authorized waste repository program at Yucca Mountain, NV. DOE released its Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste in January 2013 that calls for a "consent-based siting process" for nuclear storage and disposal facilities. The Used Fuel subprogram would also conduct waste transportation analyses and research on potential waste repositories, including salt caverns and deep boreholes, according to the DOE justification. DOE is also proposing that Congress provide mandatory appropriations for the spent fuel management program beginning in FY2018 to supplement discretionary appropriations. (See the "Nuclear Waste Disposal" section for more details.)

Other major research areas in the Fuel Cycle R&D Program include the development of accident-tolerant fuels for existing commercial reactors, evaluation of fuel cycle options, development of improved technologies to prevent diversion of nuclear materials for weapons, and technology to increase nuclear fuel resources, such as uranium extraction from seawater.

²⁹ DOE Office of Nuclear Energy, "Small Modular Nuclear Reactors," <http://www.energy.gov/ne/nuclear-reactor-technologies/small-modular-nuclear-reactors>.

Fossil Energy Research and Development³⁰

For FY2015, the Obama Administration requested \$475.5 million for the Fossil Energy Research and Development program with the provision that it remain available until expended and that \$114.2 million remain available until September 30, 2016, for program direction. The request represents a 15% decrease from the FY2014 appropriation of \$561.9 million.

Since FY2012 the Fossil Energy Research and Development (FE R&D) program has emphasized coal, with a focus on carbon capture and storage (CCS) technologies. The CCS program intends to demonstrate advanced clean coal technologies on a commercial-project scale, and build and operate near-zero atmospheric emissions power plants that capture and store carbon dioxide (CO₂). The main activities are listed as bullets showing the decrease of the proposed amount for FY2015 compared to the FY2014 appropriation.

- A Carbon Capture sub-program focuses on separating CO₂ in both pre-combustion and post-combustion systems (-\$15 million).
- The Carbon Storage sub-program focuses on long-term geologic storage of CO₂, including small- and large-scale CO₂ injection tests. The Regional Sequestration Partnerships would be renamed Storage Infrastructure. No funding is requested for beneficial use/reuse of CO₂ (-\$28.7 million).
- An Advanced Energy Systems sub-program focuses on improving availability and efficiency of fossil energy systems integrated with CO₂ capture. The Advanced Energy Systems sub-program focuses on gasification, oxy-combustion, advanced turbines, and other energy systems (-\$48.5 million).
- The Cross-Cutting Research activity serves as a bridge between basic and applied research by fostering development and deployment of innovative systems (-\$6.6 million).
- National Energy Technology Laboratory (NETL) Coal R&D supports in-house research activities. The FY2015 request does not continue support for extracting rare-earth elements from coal and coal byproduct streams (-\$15 million).

New in the FY2015 request is a \$25 million CCS natural gas demonstration project that would fund work to capture and store more than 75% of the carbon emissions from a natural gas power system.

Other FE R&D activities in the budget proposal outside of the coal program are shown below as bullets.

- Natural Gas Technologies will focus on environmentally prudent development, emissions reduction, and gas hydrates (+\$14.4 million).
- Unconventional Fossil Energy Technologies from Petroleum activities would not be funded in FY2015 (-\$15.0 million).
- Program Direction provides funding for DOE headquarters, field offices, and contractor support (-\$5.8 million).

³⁰ This section was prepared by Peter Folger.

Table 10 shows proposed funding and changes compared to FY2014 for other FE R&D activities.

Table 10. Fossil Energy Research and Development
(\$ millions)

	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Coal						
Natural Gas CCS	0.0	0.0	25.0			
Carbon Capture	63.7	92.0	77.0			
Carbon Storage	106.7	108.8	80.1			
Advanced Energy Systems	92.4	99.5	51.0			
Cross Cutting Research	45.6	41.9	35.3			
NETL Coal R&D	33.3	50.0	34.0			
Coal Subtotal	341.9	392.2	302.4			
Natural Gas Technologies	13.9	20.6	35.0			
Unconventional Fossil Energy	4.6	15.0	0.0			
Program Direction	114.2	120.0	114.2			
Plant and Capital Equipment	16.0	16.0	15.3			
FE Environmental Restoration	7.5	5.9	7.9			
Special Recruitment Program	0.7	0.7	0.7			
Subtotal	498.7	570.4	475.5			
Use of Prior Year Balance	0.0	-8.5	0.0			
Total	498.7	561.9	475.5			

Source: FY2015 Budget Request.

Notes: Coal was formerly Carbon Capture and Sequestration Demonstration. Totals may not sum exactly due to rounding.

Strategic Petroleum Reserve³¹

The Strategic Petroleum Reserve (SPR), authorized by the Energy Policy and Conservation Act (P.L. 94-163) in 1975, consists of caverns formed out of naturally occurring salt domes in Louisiana and Texas. The SPR provides strategic and economic security against foreign and domestic disruptions in U.S. oil supplies via an emergency stockpile of crude oil. The program fulfills U.S. obligations under the International Energy Program, which avails the United States of

³¹ This section was prepared by Anthony Andrews.

International Energy Agency (IEA) assistance through its coordinated energy emergency response plans, and provides a deterrent against energy supply disruptions.

By early 2010, the SPR's maximum capacity reached 727 million barrels.³² The federal government has not purchased oil for the SPR since 1994. Beginning in 2000, additions to the SPR were made with royalty-in-kind (RIK) oil acquired by the Department of Energy in lieu of cash royalties paid on production from federal offshore leases. In September 2009, the Secretary of the Interior announced a transitional phasing out of the RIK Program.

In the summer of 2011, the President ordered an SPR sale in coordination with an International Energy Administration sale under treaty obligation because of Libya's curtailment. The U.S. sale of 30.6 million barrels reduced the SPR inventory to 695.9 million barrels. In April 2014, DOE conducted a 5 million barrel test sale of heavy crude oil. Energy Secretary Ernest Moniz was quoted by Reuters as saying that \$495 million from the test sale would be used to build emergency gasoline stocks and that half the oil involved in the sale had been delivered by mid-May.³³

The Bipartisan Budget Act of 2013 (P.L. 113-67) rescinded all available funds in the "SPR Petroleum Account," and permanently repealed the federal government's authority to accept oil through royalty-in-kind.

The Consolidated Appropriations Act of 2014 (P.L. 113-76) prohibited the waiver of the navigation and vessel-inspection requirements under the Jones Act (46 U.S.C. 501(b)) for transporting crude oil distributed from the SPR until the Secretary of Homeland Security takes adequate measures to ensure the use of United States flag vessels.

For FY2015, the Administration requested \$205 million to operate the SPR, an 8.3% increase over the FY2014 appropriation of \$189.4 million.

Science³⁴

The DOE Office of Science conducts basic research in six program areas: advanced scientific computing research, basic energy sciences, biological and environmental research, fusion energy sciences, high-energy physics, and nuclear physics. Through these programs, DOE was the third-largest federal funder of basic research and the largest federal funder of research in the physical sciences, as well as the mathematical and computer sciences, in FY2012.³⁵ **Table 11** includes the FY2014 current plan and FY2015 request levels.

³² For details on the SPR see CRS Report R41687, *The Strategic Petroleum Reserve and Refined Product Reserves: Authorization and Drawdown Policy*, by Anthony Andrews and Robert Pirog.

³³ Cho, Meeyoung, and Sohee Kim, "U.S. to Buy Gasoline End-July or Early Aug to Build Reserve—Moniz," *Reuters*, May 13, 2014, <http://www.cnbc.com/id/101667100>.

³⁴ This section was prepared by Heather Gonzalez.

³⁵ Based on preliminary FY2012 data from Tables 29 and 22 of National Science Foundation, National Center for Science and Engineering Statistics, *Federal Funds for Research and Development: Fiscal Years 2010-12*, NSF 13-326 (July 2013).

Table II. Science

(\$ millions)

Program	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Advanced Scientific Computing Research (ASCR)	405.0	478.1	541.0			
Basic Energy Sciences (BES)	1,551.3	1,711.9	1,806.5			
Biological and Environmental Research (BER)	560.7	609.7	628.0			
Fusion Energy Sciences (FES)	377.8	504.7	416.0			
High Energy Physics (HEP)	727.5	796.5	744.0			
Nuclear Physics (NP)	507.2	569.1	593.6			
Workforce Development for Teachers and Scientists (WDTS)	17.5	26.5	19.5			
Science Laboratories Infrastructure (SLI)	105.6	97.8	79.2			
Safeguards and Security (S&S)	77.4	87.0	94.0			
Program Direction (PD)	174.9	185.0	189.4			
SBIR/STTR (Office of Science) ^a	n/a	n/a	n/a			
SBIR/STTR (DOE transfer) ^a	n/a	n/a	n/a			
Total	4,681,195	5,066.4	5,111.2			

Source: FY2015 DOE budget request.

- a. For more information about the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, see CRS Report 96-402, *Small Business Innovation Research (SBIR) Program*, by Wendy H. Schacht.

The Obama Administration seeks \$5.111 billion for the Office of Science in FY2015. This amount is 0.9% (\$44.8 million) more than the FY2014 current plan funding level of \$5.066 billion. Although the total Science allocation would stay relatively constant between FY2014 and the FY2015 request, the Administration seeks to change the distribution of funding within the account. Compared to FY2014, in FY2015 the percentage of total Science funding for ASCR and BES would increase, while the percentage of total Science funding for FES and HEP would decrease. (The percentage of total Science funding for BER and NP would stay about the same.) The following sections discuss some of these changes in greater detail.

Since FY2006, overall increases in the Office of Science budget have been at least partially driven by the “doubling path” policy. Under this policy, Congress and successive Administrations sought to double the combined funding for the Office of Science, the National Science Foundation, and the National Institute of Standards and Technology’s core laboratory and construction accounts (collectively “the targeted accounts”).³⁶ However, actual funding for the targeted accounts has not typically reached authorized levels. The most recent authorization of appropriations for the Office of Science ended in FY2013. It is unclear whether policy makers will renew the doubling path policy in FY2015.

³⁶ For further analysis of the doubling effort, see CRS Report R41951, *An Analysis of Efforts to Double Federal Funding for Physical Sciences and Engineering Research*, by John F. Sargent Jr.

Advanced Scientific Computing Research

The Administration seeks \$541 million—\$63 million or 13% more than the FY2014 current plan funding level of \$478 million—for ASCR in FY2015. Most of the requested increase is for exascale computing activities. According to the ASCR budget request, “Capable exascale computing, with a hundred to thousand fold improvement in true application performance over today’s systems, is the next frontier of development in High Performance Computing (HPC), extending capability significantly beyond today’s petascale computers to address the next generation of scientific, engineering, and large-data problems.”³⁷ Given its perceived importance to national security and economic competitiveness, exascale computing is a DOE priority. DOE leadership asserts that the department is on a path to have a capable machine by the early 2020s.³⁸

Basic Energy Sciences

The FY2015 request for BES, the largest Office of Science program, is \$1.807 billion. This amount is \$95 million (6%) more than the FY2014 funding level of \$1.712 billion. Most of the requested BES increase would fund scientific user facilities (\$34 million) or construction (\$37 million). For facilities, DOE plans to cease National Synchrotron Light Source (NSLS) operations—and transition NSLS-II from a construction project to operations—in FY2015. Construction increases would provide \$63 million for research and development activities, long-lead procurements, and prototyping for the Linac Coherent Light Source-II (LCLS-II).

Biological and Environmental Research

The Administration seeks \$628 million for Biological and Environmental Research (BER) in FY2015, an increase of \$18 million (3%) above the FY2014 current plan funding level of \$610 million. Within BER, DOE seeks to reduce funding for Biological Systems Science by \$12 million. Ten million dollars of this amount would come from a 66% decrease in funding for Radiological Sciences. The request indicates that the reduction in funding for Radiological Sciences represents a shift in focus from nuclear medicine research to bioenergy and environmental research within the Biological Systems Science portfolio.³⁹ The Administration’s request for the other major BER activity, Climate and Environmental Sciences, would increase funding by \$30 million in FY2015. Most of this increase would provide for a new activity, Climate Model Development and Validation (\$29 million), which seeks to improve existing models’ representation of extreme events, as well as their quantification of uncertainty.⁴⁰

³⁷ FY2015 DOE budget request, volume 4 (Science), p. 17.

³⁸ Testimony of Acting Director of the Office of Science Dr. Patricia Dehmer, in U.S. Congress, House Committee on Appropriations, Subcommittee on Energy and Water Development, *Budget Hearing – Department of Energy, Science*, hearings, 113th Cong., 2nd sess., March 25, 2014, at <http://appropriations.house.gov/calendararchive/eventsingle.aspx?EventID=373120>.

³⁹ U.S. Department of Energy, *FY2015 Congressional Budget Request, Science and Advanced Research Projects Agency-Energy*, vol. 4, March 2014, p.103.

⁴⁰ U.S. Department of Energy, Office of Science Acting Director Dr. Patricia Dehmer, “FY2015 Budget Request to Congress for DOE’s Office of Science,” PowerPoint presentation, March 4, 2014.

Fusion Energy Sciences

The FY2015 request for FES is \$416 million, or \$89 million (18%) less than the FY2014 current plan funding level of \$505 million. Among other things, FES provides funding for the U.S. contribution to the ITER project. ITER is an international effort to design and build an experimental fusion reactor, which is currently under construction in France.⁴¹ According to DOE, ITER “aims to generate fusion power 30 times the levels produced to date and to exceed the external power applied . . . by at least a factor of ten.”⁴² However, many U.S. analysts have expressed concern about ITER’s cost, schedule, and management.⁴³ Some policy makers and U.S. fusion researchers have also expressed concern about the impact of ITER’s funding on the availability of DOE resources for the domestic fusion program. The FY2015 request for the U.S. contribution to ITER is \$150.0 million, or \$49.5 million less than the FY2014 current plan funding level of \$199.5 million. In addition to the ITER project, the FY2015 FES budget request notes DOE’s intention to shutter MIT’s Alcator C-Mod facility in late FY2016⁴⁴ and seeks a 61% (\$11 million) reduction in funding for High Energy Density Laboratory Plasmas science.

High Energy Physics

The Administration seeks \$744 million, or \$53 million (7%) less than the FY2014 current plan funding level, for HEP in FY2015. The request seeks overall reductions in Energy Frontier Experimental Physics, Intensity Frontier Experimental Physics, Theoretical and Computational Physics, Advanced Technology R&D, and Construction; as well as overall increases in Cosmic Frontier Experimental Physics and Accelerator Stewardship. The FY2015 HEP request does not include funding for the Long Baseline Neutrino Experiment (LBNE), which received funding for design activities in FY2014. The request indicates that HEP intends to further develop LBNE program plans in FY2015.⁴⁵

⁴¹ According to the ITER agreement, the U.S. contribution to ITER is 9.09% of construction costs. However, more than 80% of U.S. ITER project funding is spent at universities and businesses within the United States. (For example, the United States is designing, engineering, and procuring ITER’s cooling water system as part of the U.S. contribution.) Other contributors include China, India, Japan, South Korea, the Russian Federation, and the European Union. In exchange for its contribution, the United States gains 100% access to ITER’s research output. More information about the U.S. ITER program is available at <https://www.usiter.org/index.shtml>.

⁴² U.S. Department of Energy, *FY2015 Congressional Budget Request, Science and Advanced Research Projects Agency-Energy*, vol. 4, March 2014, p. 137, http://energy.gov/sites/prod/files/2014/04/f14/Volume_4.pdf.

⁴³ In 2008, the cost for the U.S. share of ITER was estimated to be between \$1.45 billion and \$2.2 billion. Schedule delays, design and scope changes, and other factors have placed upward pressure on ITER costs. According to the FY2015 DOE budget request, the “present U.S. assessment of the project is that it cannot, under current conditions, meet the most recent schedule” (DOE, FY2015 budget request, volume 4, p. 137) and that the “best estimate” of the current total cost range is between \$4.0 and \$6.5 billion (Ibid., p. 146). DOE determined that it would seek to support an annual funding level of no more than \$225 million per year for ITER beginning in FY2014.

⁴⁴ The Obama Administration sought to eliminate funding for the Alcator C-Mod facility in FY2014. However, congressional appropriators included funding for the facility in the joint explanatory statement that accompanied the Consolidated Appropriations Act, 2014 (P.L. 113-76). See, “Joint Explanatory Statement,” *Congressional Record*, January 15, 2014, pp. H881-H893.

⁴⁵ The LBNE was initially conceptualized as an experiment that would beam certain particles (underground) from Fermilab in Batavia, Illinois, to the Sanford Lab in Lead, South Dakota. The project was determined to be too expensive as initially proposed. Scientists are considering whether to modify the experiment to an above-ground option that may make it less expensive (but perhaps less scientifically useful) or seek international partners to assist with the cost of the underground option. See Pallab Ghosh, “UK Backs Huge Neutrino Plan,” *BBC News*, February 14, 2104, at <http://www.bbc.com/news/science-environment-26017957>; and Adam Hurlburt, “Feds Support Underground Neutrino Experiment,” *Black Hills Pioneer*, January 23, 2014, at [http://www.bhpioneer.com/local_news/article_bdc8b8c8-8452-\(continued...\)](http://www.bhpioneer.com/local_news/article_bdc8b8c8-8452-(continued...))

Nuclear Physics

The FY2015 request for NP is \$549 million, \$24 million (4%) more than the FY2014 current plan funding level of \$569 million. The largest change in the FY2015 NP request is a \$35 million increase in construction funding for the Facility for Rare Isotope Beams at Michigan State University (FRIB). This increase would be partially offset by a \$9 million reduction in funding for the 12GeV CEBAF (Continuous Electron Beam Accelerator Facility) Upgrade project, which is reaching completion. Funding increases for the FRIB would support the continuation of planned construction activities and final technical design.

ARPA-E⁴⁶

The Advanced Research Projects Agency–Energy (ARPA-E) was authorized by the America COMPETES Act (P.L. 110-69) to support transformational energy technology research projects. DOE budget documents describe ARPA-E’s mission as overcoming long-term, high-risk technological barriers to the development of energy technologies. The FY2015 request for ARPA-E is \$325 million, an increase of \$45 million above the FY2014 current plan funding level.⁴⁷ As in FY2013 and FY2014, the FY2015 ARPA-E request includes two research thrust areas: Transportation Systems (\$148 million requested) and Stationary Power Systems (\$148 million requested).

Nuclear Waste Disposal⁴⁸

Funding for DOE’s civilian nuclear waste disposal activities is included under the Office of Nuclear Energy’s Fuel Cycle Research and Development Program, in the Used Nuclear Fuel Disposition subprogram. As noted in the Nuclear Energy section of this report, the Administration requested \$79 million for the Used Nuclear Fuel Disposition subprogram for FY2015, an increase of \$19 million from FY2014.

Through the Used Nuclear Fuel subprogram, DOE’s Office of Nuclear Energy is carrying out activities formerly conducted by the Office of Civilian Radioactive Waste Management (OCRWM), which was established by the Nuclear Waste Policy Act of 1982 (NWPA, 42 U.S.C. 10101 et seq.) to dispose of highly radioactive waste from nuclear power plants and defense facilities. OCRWM had been developing a permanent nuclear waste repository at Yucca Mountain, NV, as specified by an NWPA amendment in 1987. Funding for OCWRM ended after FY2010, so the office has been closed and activities at the Yucca Mountain site halted. No funding was requested for FY2015.

The Obama Administration “has determined that developing the Yucca Mountain repository is not a workable option and the Nation needs a different solution for nuclear waste disposal,” according to the DOE FY2011 budget justification. To develop alternative waste management strategies, the Administration established the Blue Ribbon Commission on America’s Nuclear

(...continued)

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⁴⁶ This section was prepared by Heather Gonzalez.

⁴⁷ FY2013 current plan funding levels reflect the effects of sequestration and applicable rescissions.

⁴⁸ This section was prepared by Mark Holt.

Future, which issued its final report to the Secretary of Energy on January 26, 2012.⁴⁹ The Blue Ribbon Commission recommended that future efforts to develop nuclear waste facilities follow a “consent based” approach and be carried out by a new organization, rather than DOE. The commission said the new nuclear waste entity should have “assured access” to the Nuclear Waste Fund, which holds fees collected from nuclear power plant operators to pay for waste disposal. Under NWPA, those funds cannot be spent without congressional appropriations.

DOE released its *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste* in January 2013 in response to the Blue Ribbon Commission report. The strategy calls for a pilot interim storage facility for spent fuel from closed nuclear reactors to open by 2021 and a larger storage facility, possibly at the same site, to open by 2025. A site for a permanent underground waste repository would be selected by 2026, and the repository would open by 2048. Storage and disposal sites would be selected by a new waste management organization through a consent-based process, as recommended by the Blue Ribbon Commission.⁵⁰

Much of the nearly one-third funding boost for Used Nuclear Fuel Disposition in FY2015 would go for R&D on long-term storage of high-burnup fuels—nuclear fuel rods that have been irradiated much longer than was typical in the past. The higher funding request would also pay for deep borehole demonstration tests, as well as continuing evaluations of crystalline rock, clay/shale, and salt as potential repository media, according to the DOE budget justification.

The FY2015 budget request includes a proposal to change the nuclear waste funding system along the lines proposed by the Blue Ribbon Commission. Discretionary funding (annual appropriations by Congress) would continue to pay for “regular and recurring” expenses of the nuclear waste program. In the past, discretionary appropriations for the program have come from both the Nuclear Waste Fund, to pay for disposal of commercial reactor waste, and from the General Fund, to pay for defense waste disposal. The FY2015 request for the Used Nuclear Fuel subprogram proposes \$30 million to develop preliminary processes for storage, transportation, disposal, and consent-based siting—of which \$24 million would come from the Nuclear Waste Fund.

Beginning in FY2018, under the Administration proposal, the discretionary appropriations for spent nuclear fuel management would be supplemented by mandatory appropriations, first from incoming nuclear waste fee revenues and eventually from past fees and interest that have accumulated in the Waste Fund. If Congress enacted such mandatory appropriations, the specified funding would be automatically provided to the waste program without the need for annual congressional approval. A similar proposal in FY2014 was not approved by Congress.

DOE’s proposal to pay for nuclear waste activities with annual waste fee collections has been jeopardized by a ruling by the U.S. Court of Appeals for the District of Columbia Circuit that DOE must stop collecting the fees. NWPA requires the Secretary of Energy to adjust the fees as

⁴⁹ Blue Ribbon Commission on America’s Nuclear Future, *Report to the Secretary of Energy*, January 2012, http://brc.gov/sites/default/files/documents/brc_finalreport_jan2012.pdf.

⁵⁰ DOE, *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste*, January 2013, <http://energy.gov/sites/prod/files/Strategy%20for%20the%20Management%20and%20Disposal%20of%20Used%20Nuclear%20Fuel%20and%20High%20Level%20Radioactive%20Waste.pdf>.

necessary to cover the waste program's anticipated costs, but the Court ruled that DOE's current waste plans are too vague to allow a reasonable estimate to be calculated.⁵¹

DOE had filed a license application with the Nuclear Regulatory Commission (NRC) for the proposed Yucca Mountain repository in June 2008 but filed a motion to withdraw the application on March 3, 2010. An NRC licensing panel rejected DOE's withdrawal motion June 29, 2010, on the grounds that NWA requires full consideration of the license application by NRC. The full NRC Commission deadlocked on the issue September 9, 2011, leaving the licensing panel's decision in place and prohibiting DOE from withdrawing the Yucca Mountain application. However, the commission ordered at the same time that the licensing process be halted because of "budgetary limitations."⁵² No funding was provided in FY2012 through FY2014 or requested for FY2015 to continue Yucca Mountain licensing activities. However, the U.S. Court of Appeals for the District of Columbia Circuit ruled on August 13, 2013, that NRC must continue work on the Yucca Mountain license application as long as funding is available. The Court determined that NRC has at least \$11.1 million in previously appropriated funds for that purpose.⁵³

NWA required DOE to begin taking waste from nuclear plant sites by January 31, 1998. Nuclear utilities, upset over DOE's failure to meet that deadline, have won two federal court decisions upholding the department's obligation to meet the deadline and to compensate utilities for any resulting damages. Utilities have also won several cases in the U.S. Court of Federal Claims. DOE estimates that liability payments would eventually exceed \$20 billion if DOE were to begin removing waste from reactor sites by 2020, the previous target for opening Yucca Mountain.⁵⁴ (For more information, see CRS Report R42513, *U.S. Spent Nuclear Fuel Storage*, by James D. Werner; CRS Report RL33461, *Civilian Nuclear Waste Disposal*, by Mark Holt; and CRS Report R40996, *Contract Liability Arising from the Nuclear Waste Policy Act (NWA) of 1982*, by Todd Garvey.)

Loan Guarantees and Direct Loans⁵⁵

DOE's Loan Programs Office provides loan guarantees for projects that deploy specified energy technologies, as authorized by Title XVII of the Energy Policy Act of 2005 (EPACT05, P.L. 109-58), and direct loans for advanced vehicle manufacturing technologies. No funding for additional loans and loan guarantees was requested for FY2015. However, \$42 million was requested for loan guarantee program administrative expenses, the same as the FY2014 level. The FY2015 funding request would be offset by \$35 million in fees, for a net appropriation of \$7 million. An

⁵¹ U.S. Court of Appeals for the District of Columbia Circuit, *National Association of Regulatory Utility Commissioners v. U.S. Department of Energy*, No. 11-1066, decided November 19, 2013, [http://www.cadc.uscourts.gov/internet/opinions.nsf/2708C01ECFE3109F85257C280053406E/\\$file/11-1066-1466796.pdf](http://www.cadc.uscourts.gov/internet/opinions.nsf/2708C01ECFE3109F85257C280053406E/$file/11-1066-1466796.pdf).

⁵² Nuclear Regulatory Commission, "In the Matter of U.S. Department of Energy (High-Level Waste Repository)," CLI-11-07, September 9, 2011, <http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2011/2011-07cli.pdf>.

⁵³ U.S. Court of Appeals for the District of Columbia Circuit, *In re: Aiken County et al.*, No. 11-1271, writ of mandamus, August 13, 2013, [http://www.cadc.uscourts.gov/internet/opinions.nsf/BAE0CF34F762EBD985257BC6004DEB18/\\$file/11-1271-1451347.pdf](http://www.cadc.uscourts.gov/internet/opinions.nsf/BAE0CF34F762EBD985257BC6004DEB18/$file/11-1271-1451347.pdf).

⁵⁴ *Ibid.*, p. 80.

⁵⁵ This section was prepared by Mark Holt. For more details on loan guarantees, see CRS Report R42152, *Loan Guarantees for Clean Energy Technologies: Goals, Concerns, and Policy Options*, by Phillip Brown.

additional \$4 million, with no offsets, was requested for vehicle manufacturing loan program administrative expenses, \$2 million below the FY2014 level.

Two major loan guarantee programs are currently administered by the DOE Loan Programs Office:

- *Section 1703 innovative clean energy technology loan guarantees.* Loan guarantees are provided for “new or significantly improved technologies,” as compared to existing commercial technologies, that “avoid, reduce, or sequester” air pollutants and greenhouse gas emissions. Eligible technology categories include renewable energy, advanced fossil energy, advanced nuclear energy, energy efficiency, and pollution control.
- *Section 1705 renewable energy, electric transmission, and advanced biofuels loan guarantees.* Established by Section 406 of the American Recovery and Reinvestment Act (ARRA, P.L. 111-5), the Section 1705 program was designed as a temporary economic stimulus measure available through the end of FY2011. Unlike the Section 1703 program, which is limited to innovative technologies, loan guarantees were provided to already-commercialized renewable energy and electric transmission technologies.

Title XVII allows DOE to provide loan guarantees for up to 80% of construction costs for eligible energy projects. Under such loan guarantee agreements, the federal government would repay all covered loans if the borrower defaulted. This would reduce the risk to lenders and allow them to provide financing at below-market interest rates. Energy Secretary Ernest Moniz signed agreements on February 20, 2014, for the first Section 1703 loan guarantees, totaling \$6.5 billion for two nuclear reactors in Georgia.⁵⁶ (For more about the Georgia loan guarantees, see CRS Insights, *DOE Section 1703 Vogtle Nuclear Project Loan Guarantees: How Can Credit Subsidy Fees Be Zero?*, <http://www.crs.gov/pages/Insights.aspx?PRODCODE=IN10054>.) Under Section 1705, final loan guarantees have been issued for 24 projects, totaling about \$14.4 billion.⁵⁷

DOE’s first loan guarantee under Section 1705 was issued in September 2009 to Solyndra Inc., a manufacturer of photovoltaic equipment. Solyndra’s bankruptcy announcement on August 31, 2011, prompted strong congressional criticism of the Administration’s management of the loan guarantee program.⁵⁸ Solyndra’s DOE loan guarantee totaled \$535 million, and the company’s bankruptcy placed most or all of that amount at risk. (For details, see CRS Report R42058, *Market Dynamics That May Have Contributed to Solyndra’s Bankruptcy*, by Phillip Brown.)

⁵⁶ Mirshak, Meg, “Energy Secretary Moniz Visits Vogtle to Finalize Loan Guarantee,” *Augusta Chronicle*, February 21, 2014, <http://chronicle.augusta.com/news/metro/2014-02-20/energy-secretary-moniz-visits-vogtle-finalize-loan-guarantee>.

⁵⁷ U.S. Department of Energy Loan Programs Office, “The Financing Force Behind America’s Clean Energy Economy,” <https://lpo.energy.gov/>. For a critique of the loan guarantee process, see U.S. Government Accountability Office, *DOE Loan Guarantees: Further Actions Are Needed to Improve Tracking and Review of Applications*, GAO-12-157, March 2012, <http://www.gao.gov/products/GAO-12-157>.

⁵⁸ Opening Statement of the Honorable Cliff Stearns, Chairman, Subcommittee on Oversight and Investigations.

“Solyndra and the DOE Loan Guarantee Program,” September 14, 2011, <http://republicans.energycommerce.house.gov/Media/file/Hearings/Oversight/091411/Stearns.pdf>.

Subsidy Costs

Title XVII requires the estimated future government costs resulting from defaults on guaranteed loans to be covered up-front by appropriations or by payments from project sponsors (borrowers). These “subsidy costs” are calculated as the present value of the average possible future net costs to the government for each loan guarantee, on a case-by-case basis. If those calculations are accurate, the subsidy cost payments for all the guaranteed projects together should cover the future costs of the program. However, the Congressional Budget Office has predicted that the up-front subsidy cost payments will prove too low by at least 1% and is scoring bills accordingly.⁵⁹ As a result, appropriations bills that provide loan guarantee authorizations include an adjustment totaling 1% of the loan guarantee ceiling.

Subsidy costs for Section 1703 loan guarantees must usually be paid by project sponsors, because no appropriations for that program were provided before FY2011 (as described below). However, ARRA appropriated \$6 billion to cover the subsidy costs of Section 1705 loan guarantees, so subsidy cost payments were not required from project sponsors under that program. However, \$2 billion of the Section 1705 subsidy cost appropriation was subsequently transferred to the “cash for clunkers” automobile trade-in program by P.L. 111-47, and another \$1.5 billion was rescinded to help pay for the Education Jobs and Medicaid Assistance Act (P.L. 111-226), leaving \$2.5 billion. Of the \$2.5 billion available for subsidy costs, \$1.9 billion was obligated by the end of FY2011.⁶⁰

Authorized Loan Guarantee Amounts

Under the Federal Credit Reform Act (FCRA), federal loan guarantees cannot be provided without an authorized level in an appropriations act or an appropriation for the subsidy costs. Pursuant to FCRA, the FY2007 continuing resolution (P.L. 110-5) established an initial cap of \$4 billion on loan guarantees under the Section 1703 program, without allocating that amount among the various eligible technologies. Additional loan guarantee authority was subsequently provided for specific technologies and then further modified as described below.

Unobligated appropriations for subsidy cost payments under the Section 1705 loan guarantee program were no longer available after FY2011, as noted above. However, the FY2011 Continuing Appropriations Act provided \$170 million, with no expiration, to pay subsidy costs for renewable energy and efficiency projects under the Section 1703 program. The act also provided authority for up to \$1.183 billion in loan guarantees for those renewable energy and efficiency projects, in addition to the \$32.8 billion in Section 1703 authority remaining from earlier appropriations acts for all technologies. The additional loan guarantee authority and subsidy cost appropriation provided by the FY2011 Continuing Appropriations Act is available to projects that applied under the expiring Section 1705 before February 24, 2011.

Following is a summary of the various elements of the current DOE loan guarantee program, as modified by the FY2011 Continuing Appropriations Act (CR):

⁵⁹ Congressional Budget Office, *S. 1321, Energy Savings Act of 2007*, CBO Cost Estimate, Washington, DC, June 11, 2007, pp. 7-9, <http://www.cbo.gov/ftpdocs/82xx/doc8206/s1321.pdf>; and CBO, *Fair-Value Accounting for Federal Credit Programs*, Issue Brief, March 2012, <http://www.cbo.gov/publication/43027>.

⁶⁰ DOE Weekly Financial and Activity Report, September 30, 2011, http://www.recovery.gov/transparency/agency/reporting/agency_reporting2.aspx?agency_code=89&dt=09/30/2011.

- \$8.3 billion ceiling in CR on non-nuclear technologies under Section 1703, reduced from ceilings set in FY2009.
- \$2 billion for unspecified projects from FY2007 under Section 1703, not affected by CR.
- \$18.5 billion ceiling for nuclear power plants (\$6.5 billion finalized; \$1.8 billion conditionally committed).
- \$4 billion allocated for loan guarantees for uranium enrichment plants (\$2 billion conditionally committed).
- \$1.183 billion ceiling for renewable energy and energy efficiency projects under Section 1703, in addition to other ceiling amounts, which can include pending applications under Section 1705.
- An appropriation of \$170 million for subsidy costs for renewable energy and energy efficiency loan guarantees under Section 1703. If the subsidy costs averaged 10% of the loan guarantees, this funding could support loan guarantees totaling \$1.7 billion.
- \$2.5 billion for Section 1705 subsidy costs appropriated by ARRA. As noted above, about \$1.9 billion of this funding was used to pay the subsidy costs for \$14 billion in loan guarantees with final commitments under Section 1705, for which the deadline was September 30, 2011.⁶¹ Therefore, the remainder is not currently available to the program.

Advanced Technology Vehicle Manufacturing Loans

DOE also administers the Advanced Technology Vehicles Manufacturing (ATVM) Loan Program established by the Energy Independence and Security Act of 2007 (P.L. 110-140).⁶² The FY2009 Continuing Resolution appropriated \$7.5 billion to allow DOE to issue up to \$25 billion in direct loans. The program was designed to provide loans to eligible automobile manufacturers and parts suppliers for making investments in their plant capacity to produce vehicles with improved fuel economy. Along with the EPACT loan guarantee programs, the ATVM Loan Program is administered by the DOE Loan Programs Office. DOE reports that five ATVM loans have been issued, totaling \$8.4 billion. Two of those projects, totaling \$579 million, are no longer active.⁶³

Nuclear Weapons Stockpile Stewardship⁶⁴

Congress established the Stockpile Stewardship Program in the FY1994 National Defense Authorization Act (P.L. 103-160). The goal of the program, as amended by the FY2010 National Defense Authorization Act (P.L. 111-84, §3111), is to ensure “that the nuclear weapons stockpile is safe, secure, and reliable without the use of underground nuclear weapons testing.” The

⁶¹ DOE Loan Programs Office, “Our Projects,” <http://lpo.energy.gov/our-projects>.

⁶² For more details, see CRS Report R42064, *The Advanced Technology Vehicles Manufacturing (ATVM) Loan Program: Status and Issues*, by Bill Canis and Brent D. Yacobucci.

⁶³ U.S. Department of Energy Loan Programs Office, “The Financing Force Behind America’s Clean Energy Economy,” https://lpo.energy.gov/?page_id=45.

⁶⁴ This section was prepared by Jonathan Medalia.

program is operated by the National Nuclear Security Administration (NNSA), a semiautonomous agency within DOE that Congress established in the FY2000 National Defense Authorization Act (P.L. 106-65, Title XXXII).

Stockpile stewardship consists of all activities in NNSA's Weapons Activities account, as described below. **Table 12** presents Weapons Activities funding. NNSA manages two programs outside of that account: Defense Nuclear Nonproliferation, discussed later in this report, and Naval Reactors.

Most stewardship activities take place at the nuclear weapons complex (the "complex"), which consists of three laboratories (Los Alamos National Laboratory, NM; Lawrence Livermore National Laboratory, CA; and Sandia National Laboratories, NM and CA); four production sites (Kansas City Plant, MO; Pantex Plant, TX; Savannah River Site, SC; and Y-12 National Security Complex, TN); and the Nevada National Security Site (formerly Nevada Test Site). NNSA manages and sets policy for the complex; contractors to NNSA operate the eight sites.

Table 12. Funding for Weapons Activities, FY2013-FY2015

(\$ millions)

Program	FY2013 Enacted	FY2014 Enacted	FY2015 Request	House	Senate	Conf.
DSW	1,946.6	2,442.0	2,746.6			
Campaigns	1,556.7	1,658.3	1,841.3			
RTBF ^a	1,972.6	2,067.4	2,055.5			
Nuclear Programs	0.0	0	0			
Site Stewardship	72.8	87.3	82.4			
Site Ops & Maint	0.0	0	0			
Other ^b	1,422.1	1,525.9	1,588.9			
Total	6,970.8	7,781.0	8,314.9			

Source: FY2015 NNSA Congressional Budget Request.

Notes: Details may not add to totals due to rounding. DSW: Directed Stockpile Work; RTBF: Readiness in Technical Base and Facilities.

- a. For FY2014, NNSA proposed to eliminate RTBF and split its functions between Nuclear Programs (a new program) and Site Stewardship. P.L. 113-76 retained RTBF and Site Stewardship. Also for FY2014, NNSA proposed to shift Nuclear Counterterrorism Incident Response and National Security Applications from Weapons Activities to Defense Nuclear Nonproliferation. P.L. 113-76 retained Nuclear Counterterrorism Incident Response in Weapons Activities and made no mention of National Security Applications. P.L. 113-76 also moved Domestic Uranium Enrichment Research, Development, and Demonstration into Weapons Activities from Defense Nuclear Nonproliferation, a separate account. See text for details.
- b. For FY2013, "other" includes Secure Transportation Asset, Nuclear Counterterrorism Incident Response, NNSA CIO Activities, Defense Nuclear Security, Legacy Contractor Pensions, and National Security Applications. For FY2014, in P.L. 113-76, "other" includes Secure Transportation Asset, Nuclear Counterterrorism Incident Response, Defense Nuclear Security, Information Technology and Cyber Security, Legacy Contractor Pensions, Domestic Uranium Enrichment Research, Development, and Demonstration, and a rescission. For FY2015, "other" includes Secure Transportation Asset, Nuclear Counterterrorism Incident Response, Counterterrorism and Counterproliferation Programs, Defense Nuclear Security, Information Technology and Cyber Security, and Legacy Contractor Pensions.

Table 13. Weapons Activities: FY2015 Request and FY2016-FY2019 Plan
(\$ millions, except bottom row: \$ billions)

	FY2015	FY2016	FY2017	FY2018	FY2019
DSW	2,746.6	2,833.5	2,969.5	3,325.7	3,408.8
Campaigns	1,841.3	1,966.9	1,905.3	1,913.6	1,977.7
RTBF	2,055.5	2,458.9	2,770.4	2,645.4	2,764.4
Site Stewardship	82.4	84.4	84.5	84.5	85.2
Other ^a	1,588.9	1,563.7	1,531.8	1,507.5	1,466.1
Total	8,314.9	8,907.2	9,261.4	9,476.6	9,702.3
Nov. 2010 “1251 report” projection	8.7	8.9	8.9-9.0	9.2-9.3	9.4-9.6

Source: FY2015 NNSA Congressional Budget Request for rows through Total; bottom row, U.S. White House. “November 2010 Update to the National Defense Authorization Act of FY2010 Section 1251 Report: New START Treaty Framework and Nuclear Force Structure Plans,” p. 9, http://www.lasg.org/CMRR/Sect1251_update_17Nov2010.pdf.

Notes: Details may not add to totals due to rounding. DSW, Directed Stockpile Work; RTBF, Readiness in Technical Base and Facilities.

- a. “Other” includes Secure Transportation Asset, Nuclear Counterterrorism Incident Response, Counterterrorism and Counterproliferation Programs, Defense Nuclear Security, Information Technology and Cyber Security, and Legacy Contractor Pensions.

Nuclear Weapons Complex Reconfiguration

The nuclear weapons complex currently consists of eight sites, but had many more personnel and sites during the Cold War. Despite the post-Cold War reductions, many in Congress have for years wanted the complex to change further, in various ways: fewer personnel, greater efficiency, smaller footprint at each site, increased security, and the like. After numerous exchanges between DOE and the appropriating and authorizing committees, such issues still remain.

According to a White House document of May 2010, the President provided Congress with a classified report (the “1251 report”) required by the FY2010 National Defense Authorization Act, Section 1251, “on the comprehensive plan to: (1) maintain delivery platforms [that is, bombers, missiles, and submarines that deliver nuclear weapons]; (2) sustain a safe, secure, and reliable U.S. nuclear weapons stockpile; and (3) modernize the nuclear weapons complex.”⁶⁵ According to that document, “the Administration intends to invest \$80 billion in the next decade to sustain and modernize the nuclear weapons complex.” The Administration submitted a revised Section 1251 report in November 2010, projecting weapons stockpile and infrastructure costs for FY2011-FY2020 at between \$85.4 billion and \$86.2 billion. The requests for FY2013-FY2015 were below the 1251 report figures; in contrast, the projections for FY2016-FY2019 are at or above the figures in the 1251 report, as **Table 13** shows.

⁶⁵ U.S. White House. “The New START Treaty—Maintaining a Strong Nuclear Deterrent,” fact sheet, May 13, 2010, <http://www.america.gov/st/texttrans-english/2010/May/20100514114003xjsnommis0.6300318.html>.

Directed Stockpile Work (DSW)

This program involves work directly on nuclear weapons in the stockpile, such as monitoring their condition; maintaining them through repairs, refurbishment, life extension, and modifications; conducting R&D in support of specific warheads; and dismantlement. The FY2014 appropriation for DSW was \$2,442.0 million; for FY2015, the request was \$2,746.6 million. Specific items under DSW include the following:

Life Extension Programs (LEPs). These programs aim to extend the life of existing warheads through design, certification, manufacture, and replacement of components. An LEP for the W76 warhead for the Trident II submarine-launched ballistic missile is ongoing, as is an LEP for the B61 mod 12. (A “mod” is a modification or version of a bomb or warhead type.)

For FY2015, NNSA requested the following for LEPs:

- \$643.0 million for the B61-12 LEP, with the first production unit slipping to FY2020.
- \$259.2 million for the W76 LEP.
- \$165.4 million for the W88 Alt 370.
- \$9.4 million for an LEP for a cruise missile warhead. FY2015 is the first year for which NNSA requested funds for this warhead under the LEP heading. The LEP would seek to use common components from other LEPs and to improve warhead safety and security. The LEP will consider variations of two warheads, the W80 (currently deployed on air-launched cruise missiles) and the W84 (formerly deployed on ground-launched cruise missiles).
- No funds for IW-1 or the W78 LEP. NNSA “does not propose further funding for the W78 LEP.” In addition, NNSA has deferred IW-1, and projects the first production unit as FY2030.

Stockpile Systems. This program involves routine maintenance, replacement of limited-life components, surveillance, assessment, and the like for all weapon types in the stockpile. The FY2013 appropriation was \$518.8 million. For 2014, the W78/W88 study and the Alt 370 advanced sufficiently to move to Life Extension Programs. As a result, Stockpile Systems funding requested declined to \$454.5 million for FY2014; that amount was appropriated. The FY2015 request was \$531.1 million.

Weapons Dismantlement and Disposition (WDD). The number of warheads has fallen sharply since the end of the Cold War, and continues to decline. WDD involves interim storage of warheads to be dismantled; dismantlement; and disposition (i.e., storing or eliminating warhead components and materials). The FY2013 appropriation was \$40.7 million. For FY2014, the request was \$49.3 million and the appropriation was \$54.3 million. The FY2015 request was \$30.0 million.

Stockpile Services. This category includes Production Support; R&D Support; R&D Certification and Safety; Management, Technology, and Production; and Plutonium Infrastructure Sustainment. NNSA states, “Stockpile Services provides the foundation for the production capability and capacity within the nuclear security enterprise. All enduring systems, LEPs, and dismantlements rely on Stockpile Services to provide the base development, production and logistics capability needed to meet program requirements. In addition, Stockpile Services funds

research, development and production activities that support two or more weapons-types, and work that is not identified or allocated to a specific weapon-type.” The FY2013 appropriation was \$844.3 million. For FY2014, the request was \$910.2 million and the appropriation was \$940.3 million. The FY2015 request was \$1,108.5 million; much of the increase was for R&D for certification and safety of warheads (+\$50.3 million), and for preparations to increase tritium production (+\$60.1 million).

Campaigns

These are “multi-year, multi-functional efforts” that “provide specialized scientific knowledge and technical support to the directed stockpile work on the nuclear weapons stockpile.” Many campaigns have significance for policy decisions. For example, the Science Campaign’s goals include improving the ability to assess warhead performance without nuclear testing, improving readiness to conduct nuclear tests should the need arise, and maintaining the scientific infrastructure of the nuclear weapons laboratories. Campaigns also fund some large experimental facilities, such as the National Ignition Facility at Lawrence Livermore National Laboratory. The FY2014 and FY2015 requests included five campaigns:

Science Campaign. The FY2013 appropriation was \$321.2 million. For FY2014, the request was \$397.9 million, and P.L. 113-76 provided \$369.7 million. The FY2015 request was \$456.4 million. NNSA states that the increase provides capabilities to provide certain LEP options, provides improved diagnostic capabilities for certain nuclear experiments, and enables technologies to improve surety (safety, security, use control, use denial, etc.) for future LEPs.

Engineering Campaign. This campaign “funds activities that assess and improve fielded nuclear and non-nuclear engineering components without further underground testing.” For FY2013, \$127.7 million was appropriated. For FY2014, the request was \$149.9 million and the appropriation provided the requested amount. The FY2015 request was \$136.0 million. Some of these reductions reflect delays in portions of the nuclear weapons program.

Inertial Confinement Fusion Ignition and High Yield Campaign. This campaign is developing tools to create extremely high temperatures and pressures in the laboratory—approaching those of a nuclear explosion—to support weapons-related research and attract scientific talent to the Stockpile Stewardship Program. The centerpiece of this campaign is the National Ignition Facility (NIF), the world’s largest laser. While NIF was controversial in Congress for many years, controversy waned as the program progressed. NIF was dedicated in May 2009.⁶⁶ For FY2013, the appropriation for this campaign was \$446.7 million. For FY2014, the request was \$401.0 million and the appropriation was \$514.0 million. The FY2015 request was \$512.9 million.

Advanced Simulation and Computing (ASC) Campaign. This campaign develops computation-based models of nuclear weapons that integrate data from other campaigns, past test data, laboratory experiments, etc., to create what NNSA calls “the computational surrogate for nuclear testing to determine weapon behavior.” ASC also supports nonproliferation, emergency response, and nuclear forensics. Some analysts doubt that simulation can be relied upon to provide the confidence needed to certify the safety, security, and reliability of warheads, and advocate a return to testing. For FY2013, the appropriation was \$545.8 million. For FY2014, the

⁶⁶ Lawrence Livermore National Laboratory, “Dedication of World’s Largest Laser Marks the Dawn of a New Era,” press release, May 29, 2009, https://publicaffairs.llnl.gov/news/news_releases/2009/NR-09-05-05.html.

request was \$564.3 million and the appropriation was \$569.3 million. The FY2015 request was \$610.1 million. Much of the increase results from “beginning the transition of integrated codes to work efficiently on emerging high-performance computers,” developing codes, and maintaining computer resources and facilities.

Readiness Campaign. This campaign “operates the capability for producing tritium to maintain the national inventory needed for the nuclear weapons stockpile.” The FY2013 appropriation was \$115.3 million. The FY2014 request increased to \$197.8 million. The FY2014 appropriation provided no funds for one subprogram of the campaign, moved a tritium subprogram to Stockpile Services, and provided \$55.4 million for a third subprogram, Nonnuclear Readiness. The FY2015 request was \$125.9 million, all of which was for the latter subprogram, which “develops capabilities to manufacture components used for Directed Stockpile Work.”

Readiness in Technical Base and Facilities (RTBF)

This program funds infrastructure and operations at nuclear weapons complex sites. For FY2013, the appropriation was \$1,972.6 million. For FY2014, NNSA proposed transferring its programs to other programs for which the total request was \$2,450.5 million. The appropriation retained RTBF and provided \$2,067.4 million for it. For FY2015, the request was \$2,055.5 million.

RTBF has several subprograms. The largest is Operations of Facilities (FY2014 appropriation, \$984.5 million; FY2015 request, \$896.0 million). The second largest is Construction (FY2014 appropriation, \$422.1 million; FY2015 request, \$402.8 million).

The Construction subprogram has included controversial programs. As background, a modern nuclear weapon has two stages. Detonation of the “primary” provides the energy to detonate the “secondary,” which provides most of the weapon’s yield. The core of the primary is the “pit,” which uses plutonium; the secondary uses uranium and other materials. NNSA has encountered problems in building facilities to manufacture both components. The Rocky Flats Plant manufactured pits on an industrial scale, sometimes over 1,000 per year, during the Cold War. It ceased production in 1989; since then, NNSA has manufactured at most 11 pits in a year, and several larger-scale facilities have been rejected or deferred, in substantial part because of cost growth. Instead, NNSA is transferring some work to support pit fabrication to existing buildings. Secondaries are made in the Building 9212 Complex at the Y-12 National Security Complex, which was built during and shortly after World War II; one report called it “decrepit.” NNSA planned to replace it with the Uranium Processing Facility (UPF). However, recent projections of UPF cost exceeded \$6.5 billion, the top of the preliminary cost range, so the FY2015 request stated that NNSA is exploring alternatives intended to “deliver Building 9212 capabilities for not more than \$6.5 billion and no later than 2025.”

Other Programs

Weapons Activities includes several smaller programs, including:

Secure Transportation Asset provides for safe and secure transport of nuclear weapons, components, and materials. It includes special vehicles for this purpose, communications and other supporting infrastructure, and threat response. For FY2013, the appropriation was \$201.5 million. The FY2014 request was \$219.2 million; the appropriation was \$210.0 million. The FY2015 request was \$233.8 million.

The **Nuclear Counterterrorism Incident Response Program** “responds to and mitigates nuclear and radiological incidents worldwide and has a lead role in defending the Nation from the threat of nuclear terrorism.” For FY2014, NNSA proposed transferring this program to Defense Nuclear Nonproliferation “to align all NNSA funding for reducing global nuclear dangers in one appropriation.” Congress rejected this approach; P.L. 113-76 provided \$228.2 million and retained the program in Weapons Activities. For FY2015, NNSA requested \$173.4 million.

The **Counterterrorism and Counterproliferation Program** “sustain[s] and exercise[s] the U.S. Government’s ability to understand nuclear terrorism and to counter nuclear device proliferation.” It conducts “national and international outreach to strengthen nuclear counterterrorism capabilities” and is “a key nexus to coordinate and integrate other nuclear technical counterterrorism efforts existing within the Federal government.” FY2015 is the first year for which NNSA has requested funding, \$76.9 million, for this program in Weapons Activities.

Site Stewardship: This program seeks to “bring focus on environmental compliance, nuclear materials disposition and developing the needed skills and talent for NNSA’s enduring technical workforce at the laboratories and production plants.” The FY2014 appropriation for this program was \$87.3 million; the FY2015 request is \$82.4 million.

Defense Nuclear Security provides operations, maintenance, and construction funds for protective forces, physical security systems, personnel security, and the like. It “provides protection from a full spectrum of threats, especially terrorism, for NNSA personnel, facilities, nuclear weapons, and information.” Prior to FY2014, this program was a component of Safeguards and Security. In the FY2014 request, NNSA abolished Safeguards and Security and made Defense Nuclear Security a standalone program. The FY2014 appropriation was \$679.0 million; the FY2015 request was \$618.1 million.

Information Technology and Cybersecurity elements include cyber security, enterprise secure computing, and Federal Unclassified Information Technology. The latter will provide “commodity computing infrastructure” to support a “shift from a traditional, costly desktop support model to a cloud-provisioned virtualized desktop-based solution.” The FY2014 appropriation was \$145.1 million; the FY2015 request was \$179.6 million.

Legacy Contractor Pensions: For many decades, the University of California (UC) operated Los Alamos and Lawrence Livermore National Laboratories. Laboratory employees, as UC employees, could participate in the UC pension plan. When the two labs were privatized, the contracts between DOE and the laboratory operators included provisions that mirrored the pension that lab staff who were UC employees when the labs were privatized would have received had the labs remained with UC. These pensions were larger than those provided to employees hired after privatization. To make up the difference, NNSA paid into the pension plan for the UC employees. For Weapons Activities, the FY2014 appropriation for this payment was \$279.6 million. (NNSA requested an additional amount for this purpose under Defense Nuclear Nonproliferation.) The FY2015 request was \$307.1 million. Note that projected requests decline subsequently, with the projected request falling to \$87.4 million in FY2019.

Nonproliferation and National Security Programs⁶⁷

DOE's nonproliferation and national security programs provide technical capabilities to support U.S. efforts to prevent, detect, and counter the spread of nuclear weapons worldwide. These nonproliferation and national security programs are included in the National Nuclear Security Administration (NNSA).

Table 14. DOE Defense Nuclear Nonproliferation Programs
(\$ millions)

Program	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Nonproliferation and Verification R&D	\$420.5	\$468.9	\$360.8			
Nonproliferation and International Security	143.1	135.7	141.4			
International Materials Protection and Control (IMPC)	527.9	419.6	305.5			
Fissile Materials Disposition	663.8	585.3	311.1			
Global Threat Reduction Initiative	462.9	442.1	333.5			
Legacy Contractor Pensions	51.4	116.6	102.9			
Rescissions and Use of Prior Year Funds	-32.2	-214.1	0.0			
Total	2,237.4	1,954.0	1,555.2			

Source: FY2015 budget request.

Notes: Numbers may not add due to rounding.

Funding for these programs in FY2013 was \$2,237.4 million after the March 1, 2013, sequester. The appropriation for FY2014 was \$1,954.0 million. For FY2015 the Administration requested \$1,555.2 million. The request included reductions in virtually all nonproliferation programs, in particular the Fissile Materials Disposition program (see below).

The Nonproliferation and Verification R&D program was funded at \$468.9 million for FY2014. The request for FY2015 was \$360.8 million. The Administration proposed renaming the program Defense Nuclear Nonproliferation R&D.

Nonproliferation and International Security programs include international safeguards, export controls, and treaties and agreements. The FY2015 request for these programs was \$141.4 million, compared with \$135.7 million appropriated for FY2014.

⁶⁷ This section was prepared by Carl E. Behrens.

International Materials Protection and Control (IMP&C), which is concerned with reducing the threat posed by unsecured Russian weapons and weapons-usable material, was funded at \$527.9 million in FY2013 and \$419.6 million in FY2014; the FY2015 request was \$305.5 million. The decrease, according to DOE's FY2014 budget justification document, reflects a shift "to a sustainability phase with the Russian Federation" in which "security costs are increasingly transitioned to the Russian side." It also included a reduction in the so-called Second Line of Defense Activities, mostly border and port detection programs, from \$272.0 million in FY2013 and \$190.0 million in FY2014, to a requested \$117.7 million for FY2015. The decrease followed a strategic review of the Second Line of Defense program.

The goal of the Fissile Materials Disposition (FMD) program is disposal of U.S. surplus weapons plutonium by converting it into fuel for commercial power reactors, and a similar program in Russia. The U.S. side of the program originally included construction of three projects at Savannah River, SC: a facility to fabricate "mixed-oxide" (MOX) reactor fuel, a pit disassembly and conversion facility (PDCF), and a waste solidification facility. However, controversy developed over whether the pit disassembly project was necessary. The FY2012 request for the Fissile Materials Disposition program was \$892.2 million, including \$172 million for the PDCF, but the final bill appropriated \$685.4 million for the program, and included no funding for the PDCF project, because, the conference report stated, "NNSA has not completed a study of alternatives or a conceptual design report with a cost and schedule estimate."

The FY2013 request for FMD programs was \$921.3 million. No funding was sought for the PDCF; NNSA said it would use existing facilities for pit disassembly. The waste solidification facility was completed and no further funding was requested. The major cause of the increase was the planned cold start-up of the MOX facility. However, no funding increase for the MOX project was included in the FY2013 continuing resolution, and the start-up was delayed. The actual FY2013 MOX appropriation was \$401.0 million; the total FMD appropriation was \$631.6 million. In the meantime the estimated total cost for the facility was increased from \$4.8 billion to \$7.7 billion, in part to expand its capability to carry out the functions of the cancelled PDCF plant.

In its FY2014 budget request, NNSA decided to slow down completion of the MOX plant, and begin a process of "evaluating alternatives for a new and affordable plutonium disposition strategy." It asked for a total of \$502.6 million for FMD programs, including \$320 million for the MOX plant. The House bill would have appropriated the requested amount, but the House Appropriations Committee report said no additional funding would be provided to study alternatives to the MOX plant, since NNSA had not submitted any alternatives that had not been "exhaustively studied" or would likely cost less. The Senate Appropriations Committee rejected the pause in MOX construction, funding the facility at \$430.6 million and total FMD programs at \$669.2 million. The final appropriations bill, P.L. 113-76, provided \$343.5 million for MOX construction, and a total of \$526.1 million for the whole FMD program.

The FY2015 budget request continued the Administration's policy of maintaining the MOX project in cold stand-by "while we further analyze options to complete the plutonium disposition mission more efficiently." The request for the total FMD program was \$311.1 million. (For more details, see CRS Report R43125, *Mixed-Oxide Fuel Fabrication Plant and Plutonium Disposition: Management and Policy Issues*, by Mark Holt and Mary Beth D. Nikitin.)

The Global Threat Reduction Initiative is aimed at converting research reactors around the world from using highly enriched uranium, removing and disposing of excess nuclear materials, and

protecting nuclear materials from theft or sabotage. The FY2014 appropriation for this program was \$442.1 million. The FY2015 request was \$333.5 million.

Cleanup of Former Nuclear Weapons Production Sites and Civilian Nuclear Energy Research Sites⁶⁸

The development and production of nuclear weapons for national defense purposes for over half a century since the beginning of the Manhattan Project resulted in a legacy of wastes and contamination that continues to present substantial challenges today. In 1989, DOE established the Office of Environmental Management primarily to consolidate its responsibilities for the cleanup of former nuclear weapons production sites that had been administered under multiple offices.⁶⁹ These cleanup efforts are broad in scope and include the disposal of large quantities of radioactive and other hazardous wastes generated over decades; management and disposal of surplus nuclear materials; remediation of extensive contamination in soil and groundwater; decontamination and decommissioning of excess buildings and facilities; and safeguarding, securing, and maintaining facilities while cleanup is underway.⁷⁰ The Office of Environmental Management also is responsible for the cleanup of DOE sites that were involved in civilian nuclear energy research, which also generated wastes and contamination. These research sites add a non-defense component to the office's mission, albeit smaller in terms of the scope of their cleanup and associated funding.⁷¹

Efforts to clean up the environmental legacy of nuclear weapons production and nuclear energy research represent the single largest environmental liability of the United States, exceeding the cleanup liability of Department of Defense facilities. The need for annual appropriations of several billion dollars for ongoing cleanup efforts at nuclear weapons production sites and nuclear energy research sites has generated continuing interest within Congress about the long-term financial liability of the United States to address potential risks at these sites. How to ensure the protection of public safety, human health, and the environment in the most expedient and cost-effective manner has been a perennial issue in the appropriations debate.

DOE has identified in excess of 100 “geographic” sites in over 30 states that historically were involved in the production of nuclear weapons and nuclear energy research for civilian purposes.⁷² The geographic scope of these sites is substantial, collectively encompassing a land area of approximately 2 million acres. Cleanup remedies are in place and operational at the majority of these sites. The responsibility for the long-term stewardship of these sites has been

⁶⁸ This section was prepared by David Bearden.

⁶⁹ In 1989, DOE created the Office of Environmental Restoration and Waste Management, which later was renamed the Office of Environmental Management.

⁷⁰ The term “cleanup” often is used in reference to the remediation of risks at a site. Cleanup may be accomplished through various means to prevent potentially harmful levels of exposure to wastes and contamination. Cleanup may not necessarily entail the removal of all hazards from a site, but in some instances may involve the permanent containment of wastes or contamination to address exposure risks. If residual wastes or contamination remain on-site after cleanup is complete, long-stewardship may continue to monitor residual wastes or contamination and ensure that cleanup measures continue to operate effectively over the long term.

⁷¹ For additional information on the history, mission, and scope of the Office of Environmental Management, see DOE's website: <http://energy.gov/em/office-environmental-management>.

⁷² For an interactive map and listing of each site, see DOE's Office of Environmental Management website: <http://energy.gov/em/cleanup-sites>. There are links to separate maps for active and completed sites.

transferred to the Office of Legacy Management and other offices within DOE for the operation and maintenance of cleanup remedies and monitoring.⁷³ See the “Office of Legacy Management” section of this report. Some of the smaller sites for which DOE initially was responsible were transferred to the Army Corps of Engineers in 1997 under the Formerly Utilized Sites Remedial Action Program (FUSRAP). The cleanup of these sites is funded within the civil works budget of the Corps.⁷⁴ (See **Table 4.**) Once the Corps completes the cleanup of a FUSRAP site, it is transferred back to DOE for long-term stewardship under the Office of Legacy Management.

Much work remains to be done at the sites that are still administered by the Office of Environmental Management. DOE expects cleanup to continue for several years or even decades at some of these sites, necessitating billions of dollars to fulfill the cleanup liability of the United States. By the end of FY2014, the Office of Environmental Management expects to have completed the cleanup of 91 sites in 30 states and the Commonwealth of Puerto Rico, and to continue the cleanup of 16 sites in 11 states.⁷⁵

The Hanford site in the state of Washington has the lengthiest estimated time frame, with cleanup scheduled for completion in 2070.⁷⁶ DOE estimates that the costs to complete the cleanup of Hanford and the other remaining sites could range between \$180.9 billion and \$219.0 billion from FY2014 into the future, exceeding the past costs already incurred across the entire site inventory.⁷⁷ A substantial proportion of these funding needs and time frames is due to challenges in managing, treating, and disposing of millions of gallons of high-level radioactive wastes stored in hundreds of tanks at the Hanford site, the Savannah River Site in South Carolina, and the Idaho National Laboratory.

Over time, DOE periodically has revised its estimates as project baselines and assumptions change. These estimates have varied widely over the years by many billions of dollars. DOE typically estimates a range of costs, rather than a single dollar amount, to reflect uncertainties in the cleanup process. For example, final decisions have yet to be made at some sites to determine the actions that will be necessary to remediate contamination. Methods to dispose of vast quantities of wastes, and the scheduling of these actions, also could affect cleanup costs and time frames. The costs of long-term stewardship after the completion of cleanup also are excluded from the above cost estimates. Long-term stewardship entails an even greater degree of

⁷³ The Office of Legacy Management administers the long-stewardship of DOE sites that do not have a continuing mission once cleanup remedies are in place. Sites that have a continuing mission are transferred to the DOE offices that administer those missions, which are responsible for their long-term stewardship.

⁷⁴ Enacted October 13, 1997, the Energy and Water Development Appropriations Act for FY1998 (P.L. 105-62) directed DOE to transfer the cleanup of 21 FUSRAP sites to the Army Corps of Engineers. DOE has remained responsible for determining the eligibility of additional sites, and Congress has designated certain sites in legislation.

⁷⁵ Department of Energy, Office of Chief Financial Officer, *FY2015 Congressional Budget Request*, March 2014, Volume 5, Environmental Management, p. 5. See page 84 for a list of the 16 sites where cleanup is planned to continue in FY2015. One of these 16 sites, the Waste Isolation Pilot Plant in New Mexico, is not a cleanup site itself, but is a permanent, geologic repository for “transuranic” wastes that are removed from other DOE sites for disposal.

⁷⁶ *Ibid.*, p 84.

⁷⁷ *Ibid.*, p. 83. DOE reports that the Office of Environmental Management has incurred \$109.4 billion in past costs from FY1997 through FY2013. Including these past costs, the estimated total “life-cycle” costs of cleanup range from \$290.3 billion to \$328.4 billion. DOE has used FY1997 as the baseline, or starting point, for the time frame of these life-cycle estimates. Historically, DOE also has reported \$35 billion in past costs incurred since the establishment of the Office of Environmental Management in 1989 through FY1996, yielding a total of \$144.4 billion in past costs incurred from 1989 to FY2013. Comprehensive information on past costs incurred prior to the establishment of the Office of Environmental Management in 1989 is not readily available.

uncertainty, considering the lengthy time frames of maintenance and monitoring once cleanup remedies are in place and operational, especially at sites where the cleanup method may entail the permanent containment of radioactive wastes.

The President's FY2015 budget request for the Office of Environmental Management and Office of Legacy Management are discussed separately below.

Office of Environmental Management

Three appropriations accounts fund the Office of Environmental Management. The Defense Environmental Cleanup account is the largest in terms of funding, and it finances the cleanup of former nuclear weapons production sites. The Non-Defense Environmental Cleanup account funds the cleanup of federal nuclear energy research sites. Title XI of the Energy Policy Act of 1992 (P.L. 102-486) established the Uranium Enrichment Decontamination and Decommissioning (D&D) Fund to pay for the cleanup of three federal facilities that were used to enrich uranium for national defense and civilian purposes and to reimburse uranium and thorium licensees for their costs of cleaning up sites that supported these facilities.⁷⁸ These three facilities are located near Paducah, Kentucky; Piketon, Ohio (Portsmouth plant); and Oak Ridge, Tennessee. The President has requested a total of \$5.62 billion for these three accounts combined to fund the Office of Environmental Management in FY2015, \$208.6 million less than the FY2014 enacted appropriations of \$5.83 billion.

The overall adequacy of funding for the Office of Environmental Management to attain cleanup milestones across the site inventory has been a recurring issue in the annual appropriations debate. Cleanup milestones are enforceable measures incorporated into compliance agreements negotiated among DOE, the Environmental Protection Agency (EPA), and the states. These milestones establish time frames for the completion of specific actions to satisfy applicable requirements at individual sites.⁷⁹ In its FY2015 budget justification, DOE noted its anticipation that the President's request would provide sufficient funds to meet enforceable cleanup milestones due in FY2015. However, DOE acknowledged that meeting these milestones may involve negotiations of compliance requirements with federal and state regulators.⁸⁰

Whether to reauthorize the federal payment to the Uranium Enrichment D&D Fund also has been a recurring issue. As for FY2014, the President's FY2015 budget request includes \$463 million within the Defense Environmental Cleanup account to resume the federal payment to the Uranium Enrichment D&D Fund. Congress ceased the federal payment in FY2012. This payment historically has been treated as an offset to the funding for the Office of Environmental Management because the payment does not become available to DOE until Congress subsequently appropriates it out of the Uranium Enrichment D&D Fund.

As in FY2014, the President also has proposed to resume assessments on nuclear utilities in FY2015 to generate additional revenues for the Uranium Enrichment D&D Fund, subject to the

⁷⁸ 42 U.S.C. §2297g.

⁷⁹ Compliance agreements for individual sites are available on DOE's Office of Environmental Management website: <http://energy.gov/em/compliance-agreements>.

⁸⁰ Department of Energy, Office of Chief Financial Officer, *FY2015 Congressional Budget Request*, March 2014, Volume 5, Environmental Management, p. 6.

enactment of reauthorizing legislation.⁸¹ The authority to collect these assessments expired in October 2007. As authorized in the Energy Policy Act of 1992, both federal payments and nuclear utility assessments originally financed the Uranium Enrichment D&D Fund based on the premise that the federal government and the nuclear utilities benefited from services provided by federal uranium enrichment facilities and that both therefore should share the costs of the cleanup of these facilities. Although nuclear utilities have asserted that they fulfilled their original obligations under the Energy Policy Act of 1992, the Obama Administration has observed that additional revenues eventually would be needed based on the remaining balance of the Uranium Enrichment D&D Fund compared to more recent estimates of cleanup costs.

The Office of Management and Budget (OMB) estimates that \$3.0 billion would be available for appropriation from the Uranium Enrichment D&D Fund at the beginning of FY2015, consisting of past utility assessments and federal payments that remain unexpended and interest accrued on the unexpended balance.⁸² The President has requested appropriations of \$531.0 million from the fund in FY2015, \$67.6 million less than the FY2014 enacted appropriations. DOE estimated in 2010 that the balance of the fund would be exhausted by FY2020 without additional revenues, leaving a shortfall of \$11.8 billion to complete the cleanup of federal uranium enrichment facilities over the long term.⁸³ If the Uranium Enrichment D&D Fund were fully expended, DOE still would be responsible for the cleanup costs under existing law, subject to appropriations by Congress.⁸⁴

Table 15 presents the President's FY2015 budget request for each of the three appropriations accounts that fund the DOE Office of Environmental Management, with a breakout by major site and program activity and a comparison to the enacted appropriations for FY2013 (post-sequestration) and FY2014. The table also presents the net total funding level for the Office of Environmental Management for the three accounts combined, accounting for offsets including the federal payment to the Uranium Enrichment D&D Fund that the President has proposed to resume in FY2015. As in past fiscal years, funding for the Hanford site in the state of Washington, the Idaho National Laboratory, and the Savannah River Site in South Carolina constitute the largest portions of the FY2015 request among the individual sites. The scope and complexity of wastes and contamination at these sites are among the greatest cleanup challenges addressed by the Office of Environmental Management.

⁸¹ Office of Management and Budget, *FY2015 Budget of the U.S. Government*, Analytical Perspectives, p. 178.

⁸² Office of Management and Budget, *FY2015 Budget of the U.S. Government*, Appendix, p. 408.

⁸³ Department of Energy, *Uranium Enrichment Decontamination and Decommissioning Report to Congress*, December 2010, p. 42.

⁸⁴ 42 U.S.C. §2297g-2(c).

Table 15. Appropriations for the Office of Environmental Management
(\$ millions)

Account/Site or Program Activity	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Defense Environmental Cleanup						
Closure Sites Administration	4.9	4.7	4.9			
Hanford	1,974.5	2,151.2	2,083.1			
- Richland Operations	877.1	941.0	848.1			
- Office of River Protection	1,097.4	1,210.2	1,235.0			
Idaho National Laboratory	355.8	387.0	367.2			
NNSA facilities and Nevada off-sites	279.2	314.7	293.6			
Oak Ridge Reservation	183.5	215.0	206.9			
Savannah River Site	1,094.7	1,134.2	1,150.1			
Waste Isolation Pilot Plant	197.8	216.2	216.0			
Program Direction	295.8	300.0	280.8			
Program Support	18.2	18.0	15.0			
Safeguards and Security	231.8	241.0	234.0			
Technology Development	9.8	18.0	13.0			
Federal Payment to Uranium Enrichment D&D Fund	0.0	0.0	463.0			
Defense Environmental Cleanup Subtotal	4,646.1	5,000.0	5,327.5			
Non-Defense Environmental Cleanup						
Fast Flux Test Reactor	2.6	2.5	2.6			
Gaseous Diffusion Plants	95.3	96.2	104.4			
Small Sites	66.0	71.2	60.2			
West Valley Demonstration Project	59.6	64.0	59.0			
Non-Defense Environmental Cleanup Subtotal	223.5	233.9	226.2			
Uranium Enrichment D&D Fund						
Gaseous Diffusion Plants	448.2	598.6	505.1			
- Oak Ridge	200.4	195.7	137.9			
- Paducah	92.5	265.2	207.2			
- Portsmouth	155.3	137.6	160.0			
Pension, Community, and Regulatory Support	—	—	25.9			
Uranium Enrichment D&D Fund Subtotal	448.2	598.6	531.0			
Use of Prior Year Defense Environmental Cleanup	-19.0	0.0	0.0			
Use of Prior Year Nondefense Environmental Cleanup	0.0	-2.2	0.0			
Offset for Federal Payment to Uranium Enrichment D&D Fund	0.0	0.0	-463.0			
Office of Environmental Management Total	5,298.7	5,830.3	5,621.7			

Source: Department of Energy, Office of Chief Financial Officer, *FY2015 Congressional Budget Request*, March 2014, Volume 5, Environmental Management, p. 11-14. FY2013 enacted appropriations reflect the application of sequestration and other rescissions, as reported by DOE. Numbers may not add due to rounding.

Notes: Amounts presented above in Table 15 of this report for the Defense Environmental Cleanup account in FY2013 and the Non-Defense Environmental Cleanup account in FY2014 differ from the amounts presented in **Table 8** of this report because of differences in DOE's presentation of the use of prior-year balances in these fiscal years. When accounting for offsets of these prior-year balances, the amounts presented in both tables are comparable.

Pension, Community, and Regulatory Support is broken out in the Uranium Enrichment D&D Fund in DOE's FY2015 budget justification, as a separate line-item. This activity received funding within the account total enacted for FY2013 and FY2014, but was not broken out for those fiscal years.

Office of Legacy Management

Once cleanup remedies are in place under the Office of Environmental Management, DOE's Office of Legacy Management administers the long-term stewardship of sites that do not have a continuing mission and at which residual contamination or wastes may remain. The Office of Legacy Management also is responsible for the long-term stewardship of sites that had been transferred from DOE to the Army Corps of Engineers under the FUSRAP program in 1997. Once the Corps completes the cleanup of a site under this program, it is responsible for the initial two years of operation and maintenance, after which time the site is transferred back to DOE's Office of Legacy Management for long-term stewardship.⁸⁵

The Office of Legacy Management also manages the payment of pensions and retirement benefits of former contractor personnel who worked at DOE sites that do not have a continuing mission,⁸⁶ among other supporting activities.⁸⁷ The federal role in the management of these former contractor pensions and benefits stems from the long-term nature of the projects and the associated length of employment for the personnel who performed the work for DOE. These pensions and benefits are earned and accrued by contractor employees while in active employment at DOE sites and are payable after their employment ends.⁸⁸

The Office of Legacy Management has been funded entirely within DOE's Other Defense Activities account since FY2009.⁸⁹ The President has requested \$172.0 million for the Office of Legacy Management within this account for FY2015, \$5.0 million less than the FY2014 enacted appropriations of \$177.0 million.⁹⁰ The requested reduction is mostly attributed to more recent

⁸⁵ Memorandum of Understanding Between the U.S. Department of Energy and the U.S. Army Corps of Engineers Regarding Program Administration and Execution of the Formerly Utilized Sites Remedial Action Program (FUSRAP), March 1999.

⁸⁶ Similar to long-term stewardship responsibilities, the payment of pensions and post-retirement benefits of workers at sites with a continuing DOE mission is assigned to the program office within DOE that is responsible for administering that mission, rather than the Office of Legacy Management.

⁸⁷ For more information on the history, mission, and scope of the activities of the Office of Legacy Management, see DOE's website: <http://energy.gov/lm/office-legacy-management>.

⁸⁸ For more information on DOE's management of former contractor pensions and benefits, see the Office of Legacy Management Post-Closure Benefits Program website: <http://www.lm.doe.gov/default.aspx?id=172>.

⁸⁹ Prior to FY2009, Congress appropriated funding for the relatively small number of non-defense sites administered by the Office of Legacy Management within a stand-alone account. The majority of the sites administered by this office were involved in the U.S. nuclear weapons program, but some of the sites were contaminated by civilian nuclear energy research activities.

⁹⁰ Department of Energy, Office of Chief Financial Officer, *FY2015 Congressional Budget Request*, March 2014, (continued...)

savings in pension and benefits costs. DOE also has established a performance target of lowering site long-term stewardship costs by at least 2% annually through cost-efficiencies while continuing to comply with all applicable regulatory requirements.⁹¹ However, funding needs for the Office of Legacy Management may increase over time as cleanup is completed at additional sites that are transferred from the Office of Environmental Management and the FUSRAP program for long-term stewardship. The Office of Legacy Management will be responsible for the long-term stewardship of 96 sites in FY2015.⁹² DOE projects that the number of these sites will increase to a total of 129 by FY2020.⁹³

Estimating the long-term funding needs for the Office of Legacy Management is inherently challenging because of the lengthy time horizons that are involved. For example, actions may be necessary for many decades to operate and maintain cleanup remedies and monitor contaminant levels to ensure the effectiveness of the remedies over time. At sites where the cleanup entails the permanent containment of radioactive wastes, long-term stewardship may continue indefinitely because of the time needed for radioactive elements to decay to acceptable levels. Enforcement of land use restrictions or other institutional controls also may be necessary in perpetuity at sites that are not cleaned up for unrestricted use, in order to prevent potentially harmful exposures. These and other factors make it difficult to reliably estimate the financial liability of the United States for long-term stewardship of sites contaminated from the historic production of nuclear weapons and civilian nuclear energy research in the 20th century.⁹⁴

Power Marketing Administrations⁹⁵

DOE's four Power Marketing Administrations (PMAs)—Bonneville Power Administration (BPA), Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA), and Western Area Power Administration (WAPA)—were established to sell the power generated by the dams operated by the Bureau of Reclamation and the Army Corps of Engineers.⁹⁶ In many cases, conservation and management of water resources—including irrigation, flood control, recreation, or other objectives—were the primary purpose of federal projects. (For more information, see CRS Report RS22564, *Power Marketing Administrations: Background and Current Issues*, by Richard J. Campbell.)

Priority for PMA power is extended to “preference customers,” which include municipal utilities, cooperatives, and other “public” bodies. The PMAs sell power to these entities “at the lowest

(...continued)

Volume 2, Other Defense Activities, p. 72.

⁹¹ Ibid., p. 77.

⁹² Ibid.

⁹³ Department of Energy, Office of Legacy Management, *2011-2020 Strategic Plan*, DOE/LM-0512, January 2011, p. 5, available on DOE's website: <http://energy.gov/lm/downloads/2011-2020-strategic-plan>.

⁹⁴ DOE annually estimates the financial liabilities of long-term stewardship as a portion of other environmental liabilities of the department, but does not report a separate estimate just for long-term stewardship alone. Furthermore, DOE estimates these liabilities only for the first 75 years and acknowledges that costs are likely to be incurred beyond this time frame that “cannot reasonably be estimated.” See Department of Energy, *Fiscal Year 2013 Agency Financial Report*, December 2013, “Environmental Cleanup and Disposal Liabilities,” p. 64-66, available on DOE's website: <http://www.energy.gov/sites/prod/files/2013/12/f6/2013parAFR.pdf>.

⁹⁵ This section was prepared by Charles V. Stern.

⁹⁶ Net funding for the Western Area Power Administration includes the Colorado River Basins Power Marketing Fund.

possible rates” consistent with what they describe as “sound business practice.” The PMAs are responsible for covering their expenses and for repaying debt and the federal investment in the generating facilities.

The Obama Administration’s FY2015 request for the PMAs was \$82 million. This is slightly less than the FY2014 enacted level of \$85 million.⁹⁷ The FY2015 budget request continues a change enacted in FY2010 that reclassified receipts from the PMAs from mandatory to discretionary. This change offsets many of the expenses of WAPA, SWPA, and SEPA that were previously paid for with discretionary appropriations. As a result of the change, two PMAs require discretionary funding in addition to their receipts: SWPA requests \$11.4 million and WAPA requests \$93.4 million. Receipts for SEPA are expected to offset all operating costs in FY2015. In addition, \$228,000 is requested for Falcon and Amistad operations and maintenance, and collections of \$23 million from Colorado River basins score as an additional offset toward the net discretionary appropriation for WAPA. In FY2014, the requested amount was appropriated for the PMAs, \$85 million.

BPA is a self-funded agency under authority granted by P.L. 93-454 (16 U.S.C. §838), the Federal Columbia River Transmission System Act of 1974, and receives no appropriations. However, it funds some of its activities from permanent borrowing authority with the Treasury, which was increased in FY2003 from \$3.75 billion to \$4.45 billion (a \$700 million increase). The American Recovery and Reinvestment Act (ARRA, P.L. 111-5) further increased the amount of borrowing that BPA conducts under the Transmission System Act by \$3.25 billion to the current authority for \$7.7 billion in bonds outstanding to the Treasury.

ARRA also provided WAPA borrowing authority for the purpose of planning, financing, or building new or upgraded electric power transmission lines to facilitate the delivery of renewable energy resources constructed by or expected to be constructed after the date of enactment. The authority to borrow from the United States Treasury had not previously been available to WAPA. It is now available on a permanent, indefinite basis, with the amount of borrowing outstanding not to exceed \$3.25 billion.

Title IV: Independent Agencies

Independent agencies that receive funding from the Energy and Water Development bill include the Nuclear Regulatory Commission (NRC), the Appalachian Regional Commission (ARC), and the Denali Commission.

⁹⁷ This total includes an offset to WAPA of -\$23 million from the Colorado River Basins Power Marketing Fund.

**Table 16. Energy and Water Development Appropriations
Title IV: Independent Agencies**

(\$ millions)

Program	FY2013 Approp.	FY2014 Approp.	FY2015 Request	House	Senate	Conf.
Appalachian Regional Commission	\$64.9	\$80.3	\$68.2			
Nuclear Regulatory Commission	987.3	1,055.9	1,059.5			
(Revenues)	-860.8	-930.7	-935.2			
Net NRC (including Inspector General)	126.5	125.2	124.2			
Defense Nuclear Facilities Safety Board	26.8	28.0	30.2			
Nuclear Waste Technical Review Board	3.2	3.2	3.4			
Denali Commission	10.0	10.0	7.0			
Delta Regional Authority	11.0	12.0	12.0			
Northern Border Regional Commission	1.5	5.0	3.0			
Southern Crescent Regional Commission	0.3	0.3	1.0			
Fed. Coord. Alaska Gas Projects	1.0	1.0	1.0			
Total	245.4	265.1	250.1			

Source: FY2015 budget request.**Notes:** Figures may not add due to rounding.

Key Policy Issues—Independent Agencies

Nuclear Regulatory Commission⁹⁸

For FY2015 the Nuclear Regulatory Commission (NRC) is requesting \$1.0595 billion (\$124.2 million net, including the inspector general's office). The total funding request is \$3.6 million above the FY2014 level but would constitute a net reduction of \$1.0 million because of higher offsetting fees. Major activities conducted by NRC include safety regulation and licensing of commercial nuclear reactors and oversight of nuclear materials users.⁹⁹

The NRC budget request includes \$237.9 million for new reactor activities, \$16.5 million above the FY2014 level. Until 2007, no new commercial reactor construction applications had been submitted to NRC since the 1970s. However, volatile fossil fuel prices, the possibility of controls on carbon emissions, and incentives provided by the Energy Policy Act of 2005 prompted electric utilities and other generating companies to apply for licenses for 30 new reactors. Several of those applications were subsequently withdrawn or suspended, though, as falling natural gas prices reduced the competitiveness of nuclear power. NRC issued combined construction and operating licenses for four new reactors at two sites in Georgia and South Carolina in early 2012. Nine

⁹⁸ This section was prepared by Mark Holt.

⁹⁹ U.S. Nuclear Regulatory Commission, *FY 2015 Congressional Budget Justification*, NUREG-1100, Vol. 30, March 2014, <http://pbdupws.nrc.gov/docs/ML1406/ML14064A167.pdf>.

license applications for new reactors are still under active NRC review, according to the FY2015 justification.

NRC's proposed FY2015 budget includes no funds for licensing DOE's previously planned Yucca Mountain nuclear waste repository. Because the Obama Administration wants to cancel the Yucca Mountain project and filed a motion to withdraw the license application on March 3, 2010, the NRC's FY2011 appropriation was used to close out its licensing activities. As discussed in the "Nuclear Waste Disposal" section of this report, the U.S. Court of Appeals for the District of Columbia Circuit ordered NRC on August 13, 2013, to continue reviewing the Yucca Mountain license application, using \$11.1 million in leftover funding.

For regulation of operating reactors, NRC's FY2015 budget request includes \$577.3 million, \$12.8 million below the FY2014 level. Those activities include reactor safety inspections, license renewals and modifications, collection and analysis of reactor performance data, and oversight of security exercises. The Fukushima nuclear disaster in Japan increased congressional and public concern about the safety of U.S. nuclear power plants. NRC established a task force 10 days after the accident to review NRC's regulatory system. NRC issued the first regulatory orders resulting from that review on March 12, 2012, and is currently working on additional regulations.¹⁰⁰ Regulation and oversight activities related to cyber security have also been increasing, according to the budget justification.

The Energy Policy Act of 2005 permanently extended a requirement that 90% of NRC's budget be offset by fees on licensees. Not subject to the offset are expenditures from the Nuclear Waste Fund to pay for waste repository licensing, spending on general homeland security, and DOE defense waste oversight. The offsets in the FY2015 budget request would result in a net appropriation of \$124.2 million.

¹⁰⁰ U.S. Nuclear Regulatory Commission, "Actions in Response to the Japan Nuclear Accident," <http://www.nrc.gov/japan/japan-info.html>. For a timeline of NRC actions, see <http://www.nrc.gov/reactors/operating/ops-experience/japan/japan-timeline.html>.

Author Contact Information

Carl E. Behrens, Coordinator
Specialist in Energy Policy
cbehrens@crs.loc.gov, 7-8303

Anthony Andrews
Specialist in Energy Policy
aandrews@crs.loc.gov, 7-6843

David M. Bearden
Specialist in Environmental Policy
dbearden@crs.loc.gov, 7-2390

Nicole T. Carter
Specialist in Natural Resources Policy
ncarter@crs.loc.gov, 7-0854

Peter Folger
Specialist in Energy and Natural Resources Policy
pfolger@crs.loc.gov, 7-1517

Heather B. Gonzalez
Specialist in Science and Technology Policy
hgonzalez@crs.loc.gov, 7-1895

Mark Holt
Specialist in Energy Policy
mholt@crs.loc.gov, 7-1704

Jonathan E. Medalia
Specialist in Nuclear Weapons Policy
jmedalia@crs.loc.gov, 7-7632

Fred Sissine
Specialist in Energy Policy
fsissine@crs.loc.gov, 7-7039

Charles V. Stern
Specialist in Natural Resources Policy
cstern@crs.loc.gov, 7-7786

Key Policy Staff

Area of Expertise	Name	Phone	E-mail
General	Carl Behrens	7-8303	cbehrens@crs.loc.gov
Corps of Engineers	Charles V. Stern Nicole Carter	7-7786 7-0854	cstern@crs.loc.gov ncarter@crs.loc.gov
Bureau of Reclamation	Charles V. Stern Betsy Cody	7-7786 7-7229	cstern@crs.loc.gov bcody@crs.loc.gov
Solar and Renewable Energy	Fred Sissine	7-7039	fsissine@crs.loc.gov
Nuclear Energy	Mark Holt	7-1704	mholt@crs.loc.gov
Science Programs	Heather B. Gonzalez	7-1895	hgonzalez@crs.loc.gov
Nuclear Weapons Stewardship	Jonathan Medalia	7-7632	jmedalia@crs.loc.gov
Nonproliferation	Carl Behrens	7-8303	cbehrens@crs.loc.gov
DOE Environmental Management	David Bearden	7-2390	dbearden@crs.loc.gov
Power Marketing Administrations	Charles V. Stern	7-7786	cstern@crs.loc.gov
Bonneville Power Administration	Charles V. Stern	7-7786	cstern@crs.loc.gov
Fossil Energy Research	Peter Folger	7-1517	pfolger@crs.loc.gov
Strategic Petroleum Reserve	Anthony Andrews	7-6843	aandrews@crs.loc.gov
Energy Conservation	Fred Sissine	7-7039	fsissine@crs.loc.gov