Written Statement of

David Danielson

Assistant Secretary

Office of Energy Efficiency and Renewable Energy

U.S. Department of Energy

Before the

Subcommittee on Energy and Water Development

Committee on Appropriations

United States House of Representatives

Office of Energy Efficiency and Renewable Energy

Fiscal Year 2015 Budget Request to Congress

March 25, 2014

INTRODUCTION

Chairman Simpson, Ranking Member Kaptur, and Members of the Subcommittee, thank you for the opportunity to testify on the President's Fiscal Year 2015 Budget Request for the U.S. Department of Energy's (DOE's) Office of Energy Efficiency and Renewable Energy (EERE).

The Department is pursuing an all-of-the-above approach to developing every source of American energy. EERE leads DOE efforts as the U.S. Government's primary clean energy technology organization—working with some of the Nation's best innovators and businesses to support high-impact applied research, development, and demonstration (RD&D) activities in the three sectors under our purview: sustainable transportation, renewable power, and energy efficiency. With Congress's support, we implement a range of strategies aimed at reducing U.S. reliance on oil, saving American families and businesses money, creating jobs, and reducing pollution. We work to ensure that the clean energy technologies of today and tomorrow are invented and manufactured in America.

Our Nation stands at a critical point in time in terms of the competitive opportunity in clean energy. In 2013, $254 billion was invested globally in clean energy, a 450% increase since 2004—and trillions more will be invested in the years ahead. China recently pulled ahead of the U.S. in clean energy investment after we gained the investment lead in 2011. As the world accelerates into a decades-long transition to clean energy, the United States faces a stark choice: the clean energy technologies of today and tomorrow can be invented and manufactured in America, or we can surrender global leadership and import these technologies from other countries like China, Germany, South Korea, and Japan. We can continue wasting hundreds of billions of dollars in unnecessary energy costs—money that we could reinvest into our economy—or we can strengthen our productivity and competitiveness by investing in more efficient American homes, buildings, and factories.

The United States has world-class innovation capacity, a unique culture of entrepreneurship, well-developed capital markets, and the finest scientists, engineers, and workers in the world. However, despite this tremendous opportunity, the U.S. energy industry is systematically underinvesting in research and development (0.4% of sales versus 12% in aerospace/defense and 20% in pharmaceuticals, according to one estimate).[1] This significant underinvestment in energy research and development by the private sector—in spite of the highly strategic importance of energy to American economic growth, energy security, and the environment—makes government support for applied clean energy RD&D crucial for our future competiveness and economic prosperity.

After four decades of investments in American innovation, a number of EERE-supported technological advancements are, for the first time in our Nation's history, showing a clear path to

1 Catalyzing American Ingenuity, 2011.

direct cost competitiveness with conventional forms of energy. Improvements in both cost and performance for an array of clean energy products have brought a number of these technologies to the brink of widespread cost-effective market adoption. For example, through EERE support of industry and laboratory RD&D, wind, solar photovoltaics (PV), LED lighting, and electric vehicles (EVs) have shown remarkable progress with regards to both lower costs and market barriers in recent years.[2] As we build on these successes and continue to invest in energy innovation over the next several years, we have the ability to accelerate the adoption of these technologies, in addition to a number of other clean energy technologies that are on the brink of large-scale market adoption. Now is the time to increase our efforts and continue supporting progress in these areas. Clean energy technologies are real, they are working, and with smart, targeted investments and effective public-private partnerships, they could provide us an opportunity to win one of the most important economic races of the 21st century.

EERE STRATEGIC PRIORITIES AND RETURN ON INVESTMENT

In order to position ourselves to seize this tremendous opportunity, EERE is developing a transparent framework and roadmap of EERE's RD&D strategies and priorities. We will soon release a five-year EERE Strategic Plan for 2014 to 2018 that clearly articulates EERE's vision and mission, our strategic goals and our strategies to achieve them, and the indicators we use to measure our success. The Strategic Plan describes our approach to making programmatic decisions with finite resources across our portfolio's three sectors—sustainable transportation, renewable power, and energy efficiency—and evaluates and projects the impact of our investments in the past and prospectively into the future. We detail the partnerships that make our work possible and how we execute our work in a manner that maximizes our effectiveness and accountability. It is my hope that the EERE Strategic Plan and FY 2015 President's Budget Request will provide this Committee with clear transparency into EERE's strategic priorities and how we effectively manage taxpayer resources to advance U.S. energy and economic goals.

Investment Prioritization

EERE supports members of U.S. industry, research institutions, and academia in innovating, developing, and demonstrating cutting-edge technologies and breaking down market barriers to deploying these technologies. We are committed to supporting RD&D that has a strong potential to transform large existing global energy markets and maximize the return on investment delivered to the taxpayer.

To support the highest-impact activities to achieve our clean energy goals, EERE prioritizes all of its investments according to our "Five Core Questions":

[2] Revolution Now: A Future Arrives for Four Clean Energy Technologies, 2013.

1. *Impact: Is this a high-impact problem?*
   EERE must focus its limited funds on clean energy challenges and solutions that, if successful, will have the highest-possible impact on the energy sector. If successfully developed and fully deployed, the technologies and approaches supported by these investments should make material contributions toward national energy goals—such as petroleum import reductions, greenhouse gas emission reductions, total energy cost reductions, and increased economic growth. Accordingly, EERE will emphasize investments that have the potential to have a greater than 1% impact on national energy metrics if successful.

2. *Additionality: Will EERE funding make a large difference relative to existing funding from other sources, including the private sector?*
   In addition to focusing solely on high-impact opportunities, EERE must also ensure that its investments have a meaningful additional impact relative to ongoing funding from the private sector and other sources. Therefore, EERE should avoid investing in areas where other sources of funding—especially from the private sector—are significant relative to the levels of funding that EERE could provide.

3. *Openness: Are we focusing on the broad problem we are trying to solve and open to new ideas, approaches, and performers?*
   EERE's work is guided by well-developed, long-term roadmaps that are created in collaboration with its key stakeholders. However, in the context of this approach, EERE must create and sustain an internal culture that is always open and receptive to new solutions and partners. Accordingly, EERE must regularly update its roadmaps and provide mechanisms to quickly onboard promising new approaches into its portfolio.

4. *Enduring Economic Impact*: *How will EERE funding result in enduring economic impact for the United States?*
   As a steward of taxpayer funds, EERE must go the extra mile to develop strategic approaches to ensure that the technologies it supports—if successfully developed and deployed—will result in long-term economic benefits to the country, including growing the U.S. manufacturing base.

5. *Proper Role of Government*: *Why is this investment a necessary, proper, and unique role of government rather than something best left to the private sector to address?*
   The U.S. private sector is the primary engine that will drive the transition to a national clean energy economy. To maximize its impact, EERE must focus its investments on topics and activities where there is a unique federal role relative to the private sector.

Investment Strategies

EERE works with industry, academia, National Laboratories, and other partners to create technology-specific roadmaps—evaluating the future market potential and public benefits of clean

energy technologies by incorporating in-house expertise, market awareness, and knowledge of private investment. Once technology roadmaps and RD&D support strategies are established, EERE investment for these activities falls under three primary areas:

- Early stage research and development to enable **cost reduction and performance improvement**, working to accelerate the development and commercialization of technologies through applied research and development on components or whole technology systems;

- **Technology validation and risk reduction** activities to catalyze the wide-scale adoption of clean energy technologies and solutions by demonstrating the performance of technologies at increasing scales in controlled-laboratory and under real-world conditions, providing benchmarks for performance and durability to provide feedback into our research and development roadmaps, and reducing technology uncertainty to unlock private sector investment; and

- **Reducing market barriers** to the adoption of new technologies that are market ready—such as a lack of reliable information, inconsistent regulatory environments, and workforce training gaps—through activities that include providing best practice information, stakeholder outreach, sustaining and enhancing the clean energy workforce, and providing reliable, objective data.

While EERE strategically plans and evaluates its support of RD&D activities according to these technology roadmaps, we also recognize how dynamic innovators in the clean energy economy constantly integrate new ideas and discoveries to create competitive advantages. The FY 2015 EERE Budget Request includes a small fraction of its annual funding for "Incubator" programs within each of its technology offices. Focusing on technologies and solutions that are not currently significantly represented within EERE's RD&D portfolio and roadmaps, Incubator programs will allow EERE to develop, assess, and screen new "off-roadmap" technologies and solutions for their potential to be "on-ramped" into future program plans, roadmaps, and project portfolios.

Return on Investment

EERE takes its responsibility to deliver return on investment to the U.S. taxpayer very seriously. Accordingly, EERE performs ongoing return-on-investment tracking and analyses for the technologies it supports, which are vital to understanding the impact of the RD&D activities we support. To date, third-party evaluators have completed five evaluations covering EERE's research and development investments in solar photovoltaics, wind energy, geothermal technologies, advanced battery technologies for electric-drive vehicles, and vehicle combustion engines. The results of these evaluations found that, from 1976 to 2008, EERE taxpayer investments of $15 billion in these five areas resulted in an estimated economic benefit to the United States of $388

billion—a net return on investment of more than 24 to 1.[3] To elaborate on one specific example, from 1976 to 2008, EERE-supported combustion engine research investments of $931 million—backed by Congress—yielded a total benefit of $70.2 billion,[4] representing a return on investment of approximately 70 to 1 to the U.S. taxpayer. EERE is proud of this track record of returning value to the American taxpayer and driving and accelerating innovative clean energy technologies to commercial success.

EERE PROGRAMS, ACCOMPLISHMENTS, AND FY 2015 BUDGET REQUEST

In FY 2015, EERE is requesting $2.3 billion from Congress to continue its focus on reducing U.S. reliance on foreign oil, saving American families and businesses money, growing the domestic clean energy industry, creating jobs, and reducing carbon pollution. EERE will also sustain efforts to streamline and enhance its operations, conduct rigorous impact evaluations of its RD&D portfolio, and achieve the greatest possible efficiency and outcomes in each of the three sectors in which it invests and in key EERE-wide cross-cutting initiatives.

Sustainable Transportation Portfolio ($705 Million)

Through its sustainable transportation portfolio, EERE supports research, development, and demonstration work and efforts to break down market barriers for a variety of domestic and cost-effective sustainable transportation technologies. Broadly, the Vehicle, Bioenergy, and Fuel Cell Technologies Offices support two key parallel solution pathways: (1) using less energy to move people and freight and (2) replacing conventional fuels with cost-competitive, domestically produced, sustainable alternative fuels with lower greenhouse gas emissions. Because most petroleum use in the transportation sector occurs in personal vehicles and heavy trucks, EERE's portfolio emphasizes transportation technologies in these areas. EERE's vehicle efficiency focus includes: cost-effective plug-in hybrid, all-electric, and fuel cell electric powertrain components and systems; materials and technologies for lightweight, safe, and efficient vehicle structures; and advanced internal combustion engine technologies.

Sustainable Transportation Accomplishments

EERE-supported technological accomplishments continue to help U.S. families and businesses by reducing fuel costs and providing a range of fuel choices, and by lowering greenhouse gas

[3] Preliminary aggregate net benefits calculation by EERE Office of Strategic Programs, combining cost-benefit impact results from formal evaluation studies conducted for the Solar, Geothermal, Wind, Vehicles, and Advanced Manufacturing Offices.
[4] U.S. DOE, "Retrospective Benefit-Cost Evaluation of U.S DOE Vehicle Combustion R&D Investments: Impacts of a Cluster of Energy Technologies," May 2010. Value in undiscounted, inflation-adjusted 2008 dollars.

emissions. Key EERE accomplishments in the sustainable transportation sector include the following:

- **Reduced fuel costs for heavy duty trucks to help businesses save money.** Through the EERE-supported SuperTruck Initiative, EERE partners have demonstrated a 22% engine efficiency improvement in the laboratory and developed a full-scale, prototype class 8 heavy-duty truck that demonstrated a 61% improvement in freight efficiency during initial on-road testing (compared to a 2009 baseline truck model).

- **Lowered costs of batteries to make plug-in electric vehicles more affordable.** EERE-supported research and development helped reduce the projected high-volume production cost of high-energy, high-power batteries to $325 per kilowatt-hour (kWh) in 2013[5] from $1,000/kWh in 2008, and is on track toward program goals of $300/kWh by 2014 and $125/kWh by 2022—which would enable a range of plug-in electric vehicles to be directly cost competitive with conventional vehicles over the next 5 to 10 years.

- **Reduced cost and improved productivity of biofuel logistics.** In FY 2013, EERE-supported RD&D of five feedstock logistics projects demonstrated a 25% cost reduction for integrated systems that utilize agricultural residues, forest resources, and/or herbaceous and short-rotation energy crops—a $13 per ton cost reduction relative to conventional systems.

- **Dramatically reduced the cost of fuel cell technologies**. In FY 2013, EERE demonstrated technology capable of reducing the high-volume modeled cost of automotive fuel cell systems to $55 per kilowatt (kW), which is a reduction of more than 30% since 2008 and more than 50% since 2006—and is well on the way to achieving the 2020 target of $40/kW.

Program Description and FY 2015 Budget Highlights

Vehicle Technologies*:* The Vehicle Technologies Office supports research, development, and demonstration (RD&D), as well as efforts to reduce barriers to market introduction, for advanced highway transportation technologies that reduce petroleum consumption and greenhouse gas emissions while meeting or exceeding vehicle performance expectations.

EERE is requesting $359 million in FY 2015 to continue strong RD&D investment in efficient and alternative fuel vehicles. A significant component of the Request, the EV Everywhere Grand Challenge will support aggressive cost reduction and performance improvements in several areas, including in advanced batteries to help reach the goal of cutting modeled high-volume battery costs

[5] U.S. DOE, "Linkages of DOE's Energy Storage R&D to Batteries and Ultracapacitors for Hybrid, Plug-in Hybrid and Electric Vehicles," February 2008. Based on high volume manufacturing projection of prototypes that meet or exceed performance requirements using a peer-reviewed cost model, and on proprietary data from battery companies participating in the U.S. Advanced Battery Consortium.

to $125/kWh by 2022 from $325/kWh in 2013, thus making electric vehicles more cost-competitive. FY 2015 funding supports significant research and development of more efficient combustion engine technologies, with the goals of improving passenger fuel economy by 35% and diesel vehicle fuel economy by 50% by 2020 compared to 2009 gasoline vehicles; and improving heavy duty engine efficiency by 30% by 2020, from 42% to 55%. To break down market barriers to alternative fuel vehicles, FY 2015 funding initiates new alternative fuel vehicle community partner projects to demonstrate high-impact replicable models for communities that support deployment of innovative transportation technologies (e.g. compressed natural gas, electric-drive, biofuels, and hydrogen). Finally, the FY 2015 Request supports investment in a new research and development program to address technical barriers associated with compatibility between fuels, engines, and infrastructure, with a focus on natural gas and drop-in biofuels.

***Bioenergy Technologies**:* The Bioenergy Technologies Office supports targeted research, development, and demonstration activities to advance the sustainable, nationwide production of advanced biofuels that will displace a share of petroleum-derived fuels, mitigate climate change, create jobs, and increase energy security.

EERE is requesting $253 million in FY 2015 to support developing advanced biofuels—reducing consumption of petroleum-derived fuels and decreasing emissions through sustainable bioenergy sources. The FY 2015 Request places emphasis on the development of innovative processes to convert cellulosic and algal-based feedstocks to bio-based gasoline, jet, and diesel fuels at a cost of $3 per gallon of gasoline equivalent. EERE will jointly invest with the U.S. Departments of Navy and Agriculture to demonstrate commercial-scale bio-refineries to produce military-specification fuels. Additionally, requested funds will advance innovative technologies from research and development to pilot- and demonstration-scale, supporting EERE's goal of achieving $3 per gasoline gallon equivalent by 2022 with at least 50% greenhouse gas reduction (on a lifecycle basis) with several down-selected technologies in order to provide options and solutions across the Nation. In support of DOE's *Clean Energy Manufacturing Initiative*, FY 2015 funding also enables EERE to help develop technologies to produce high-value bio-chemicals for bio-based carbon fibers, which can be used in the production of lightweight vehicles, wind turbine blades, and novel insulation materials.

***Hydrogen & Fuel Cell Technologies*:** The Fuel Cell Technologies Office develops technologies to enable fuel cells to be cost competitive in diverse applications, especially light-duty vehicles, and to enable renewable hydrogen to be cost competitive with gasoline.

EERE is requesting $93 million in FY 2015 to support RD&D to reduce the cost and increase the durability of fuel cell systems, with a targeted modeled cost of $40/kW and durability of 5,000 hours, equivalent to 150,000 miles, by 2020. EERE's Request supports research and development opportunities for technologies that can bring the cost of hydrogen from renewable resources to less than $4 per gallon of gasoline equivalent, dispensed and untaxed, by 2020. In FY 2015, EERE will also support fuel cell research and development, emphasizing areas such as stack component

research and development, systems, and balance of plant components. The Request would help advance hydrogen fuel research and development that focuses on technologies and materials that will reduce hydrogen production, compression, transport, and storage costs. Finally, the Budget Request supports targeted early market fuel cell demonstrations and addresses codes and standards to overcome barriers to commercialization.

Renewable Power Portfolio ($521 Million)

EERE's renewable power portfolio supports developing near-, medium-, and long-term solutions to significantly increase the amount of cost-competitive electric power that is generated from renewable resources across the Nation. The Solar, Geothermal, and Wind and Water Power Technologies Offices help advance technology RD&D to cost-effectively harness the United States' abundant and diverse supply of renewable resources. While each renewable power technology has unique tradeoffs, EERE seeks to enable the development of multiple renewable power technology options for every region of the country, enabling the U.S. to diversify its energy portfolio and better protect our environment and respond to the threat of climate change.

Renewable Power Accomplishments

By supporting renewable power technologies development and demonstration, EERE helps U.S. homes and businesses take advantage of clean, affordable renewable energy. Key EERE accomplishments in the renewable power sector include the following:

- **Supported development of the U.S. offshore wind industry**. In FY 2013, through a 5-year initiative with multiple competitively awarded projects, EERE awardees began preliminary engineering and project development for the first U.S. offshore wind energy projects. In 2014, EERE will down-select and fund three of seven projects to move to final design, construction, and installation. These demonstration projects are anticipated to be operational by the end of 2017—representing an opportunity to leapfrog global competition and advance the creation of a new U.S. energy industry.

- **Enabled the first U.S. grid-connected Enhanced Geothermal System (EGS) project**. In FY 2013, the Desert Peak demonstration project in Nevada completed an 8-month, multi-stage stimulation of an existing well—making it the first grid-connected EGS project in America to generate commercial electricity by providing an additional 1.7 megawatts (MW) at the existing well field.

- **Accelerated the solar industry's technological progress by an estimated 12 years.** EERE's research and development efforts are helping to drive down the costs of solar power. Without EERE involvement, the average solar photovoltaic (PV) module production cost per watt would have been $5.27 in 2008, rather than $1.92, based on a retrospective benefit-cost evaluation

that included a counterfactual assessment.[6] Today, PV modules are sold for less than $1 per watt.

Program Description and FY 2015 Budget Highlights

Solar Energy*:* The Solar Energy Technologies Office supports activities targeted at achieving the SunShot Initiative's goal of making solar energy technologies cost competitive with conventional energy sources by 2020.

In this area, EERE is requesting $282 million in FY 2015 to dramatically lower technology and manufacturing costs of solar power, as well as for activities that break down non-hardware market barriers. Only three years into the 10-year SunShot Initiative, EERE has tracked progress at 60% toward 2020 goals, which include reducing the total installed cost for utility-scale solar electricity to roughly $0.06/kWh without subsidies. The FY 2015 Budget Request builds on this progress by supporting: development and demonstration of innovative manufacturing technologies to increase U.S. competitiveness (part of DOE's *Clean Energy Manufacturing Initiative*), research and development that enables seamless integration of higher levels of solar penetration into the electricity grid, and solar PV activities that enable a 50% reduction in non-hardware "soft costs." The FY 2015 Request also supports the development of advanced thermal storage and supercritical CO_2 power cycles so that concentrated solar power (CSP) can achieve base-load grid parity and the office's goal of achieving a levelized cost of electricity for CSP of $0.06/kWh.

Wind Energy*:* The Wind Energy Technologies Office accelerates U.S. deployment of clean, affordable, and reliable domestic wind power through research, development, and demonstration.

In this area, EERE is requesting $115 million in FY 2015 to support RD&D on land-based wind power, offshore wind power, and advanced wind turbine manufacturing activities. The FY 2015 Request will enable EERE to support three advanced offshore wind demonstration projects that are planned to be operational by 2017, as well as an "Atmosphere to Electrons" Initiative that is focused on optimizing whole wind farms as a system to lower the cost of land-based and offshore wind energy. In support of DOE's *Clean Energy Manufacturing Initiative*, FY 2015 funding also enables the pursuit of new designs, materials, and manufacturing processes to develop longer blades to capture greater wind resources and to address transportation barriers, all of which support the office's goal of reducing the unsubsidized levelized cost of energy for utility-scale land-based wind energy systems from $0.074/kWh in 2012 to $0.057/kWh by 2020 and $0.042/kWh by 2030.

Water Power*:* The Water Power Technologies Office supports research, development, and demonstration to accelerate technology development for cost effective and environmentally responsible renewable power generation from water.

[6] "Retrospective Benefit -Cost Evaluation of DOE Investment in Photovoltaic Energy Systems," U.S. DOE, August 2010.

EERE is requesting $62.5 million in FY 2015 to support innovative technologies for generating electricity from water resources, including both marine and hydrokinetic (MHK) and hydropower. HydroNEXT, a new EERE initiative, would conduct research and development that supports improvements in the performance, flexibility, and environmental sustainability of technologies applicable to existing hydropower facilities; would support developing and demonstrating technologies that will enable new low-impact fish-friendly hydropower development; and would support EERE's goal of doubling the contribution of hydropower to the U.S. electricity system by 2030 (an additional 300 TWh). The FY 2015 Budget Request also supports MHK activities to develop and validate open-source design tools and support testing of wave and tidal energy systems, which will help enable industry to develop robust next-generation systems. These RD&D efforts would help compress technology development timelines with the goal of reducing the levelized cost of energy for MHK devices to local coastal hurdle rates of $0.12/kWh to $0.15/kWh by 2030.

***Geothermal Technologies**:* The Geothermal Technologies Office accelerates research and development of clean, domestic geothermal energy in order to reduce the risks and costs of bringing geothermal power online.

In this area, EERE is requesting $61.5 million in FY 2015 to support RD&D to drive down the cost of enhanced geothermal systems (EGS), develop other geothermal resources, and support broad geothermal resource analyses. A key element of the FY 2015 Budget Request is for support of site characterization for the Frontier Observatory for Research in Geothermal Energy (FORGE), a critical step toward readying this site to test and validate cutting-edge EGS technologies and techniques. FORGE is a dedicated site focused on creating an accelerated commercial pathway to large-scale EGS power generation in the United States, and supports EERE's goal of demonstrating the capability to create and sustain a 5-MW greenfield EGS reservoir by 2020. The FY 2015 Request would also advance the validation of EERE's "Play Fairway Analysis" to assess exploration risk and the probability of finding new geothermal resources on a regional scale—resulting in maps and studies that help reduce industry's drilling and development risks. Finally, FY 2015 funding will advance DOE's Strategic Materials effort by transitioning its most successful feasibility studies of technologies to extract strategic materials from geothermal brines to technology prototype development or field demonstration projects.

Energy Efficiency Portfolio ($858 Million)

EERE's energy efficiency portfolio seeks to improve the energy efficiency of the Nation's homes, buildings, and industries. The Buildings Technologies, Advanced Manufacturing, Weatherization and Intergovernmental Programs, and Federal Energy Management Program Offices help provide businesses, consumers, and government agencies with innovative, cost-effective energy-saving solutions to improve their energy efficiency—from higher efficiency products, to new ways of designing homes and buildings, to new ways of improving the energy intensity and competitiveness

of American manufacturers. EERE's energy efficiency portfolio also supports better integrating the built environment with our energy system to combat costly peaks in energy demand and to increase the capabilities and value of buildings and facilities.

Energy Efficiency Accomplishments

EERE continues to support RD&D that helps U.S. consumers and businesses to save money and advance their energy productivity and global competitiveness. Key EERE accomplishments in the energy efficiency sector include the following:

- **Reduced energy intensity and costs for businesses.** As part of EERE's Better Plants Program, Program Partners representing close to 1,800 plants and about 8% of the total U.S. manufacturing energy footprint have committed to reducing their energy intensity by 25% over 10 years. As of October 2013, Program Partners—including leaders in the steel, automobile, aerospace, and paper industries—have together saved about 190 trillion British thermal units (Btu) and $1 billion since 2009.

- **Increased U.S. manufacturing competitiveness.** EERE has helped manufacturers increase their energy productivity, including providing technical support to 590 combined heat and power (CHP) projects between FY 2009 and FY 2013. Since 1979, EERE-supported RD&D has advanced 220 new manufacturing technologies that increase energy efficiency, and has received 78 R&D 100 Awards.

- **Driving innovation to enable cost savings in residential heating and cooling.** Oak Ridge National Laboratory (ORNL) and a private-sector partner developed a ground source integrated heat pump technology that can save up to 60% of annual energy use and cost for residential heating and cooling over conventional systems, and is up to 30% more efficient than other ground source heat pumps.

- **Provided critical funding for states to weatherize homes.** In FY 2013 alone, EERE helped improve the energy performance and comfort in the homes of 46,871 American low-income families across the Nation, resulting in an estimated 1.4 trillion Btu of first-year energy savings and $20 million in first-year energy cost savings.

Program Description and FY 2015 Budget Highlights

Advanced Manufacturing*:* The Advanced Manufacturing Office advances RD&D of critical industrial efficiency and clean energy manufacturing technologies, supports shared research facilities tackling cutting-edge, foundational technological challenges, and helps lower market barriers to energy-efficient manufacturing technologies and practices.

EERE is requesting $305 million in FY 2015 to support industrial energy efficiency and to support RD&D of advanced materials and manufacturing processes that cut across multiple EERE technology offices and increase U.S. manufacturing competiveness. The Budget Request would enable EERE to partner with U.S. manufacturers on high-impact research and development focused on advanced manufacturing and materials to realize significant gains in energy productivity, environmental performance, and product yields, with the ultimate goal of assisting U.S. industry in reducing its energy intensity by 2.5% per year.[7] The FY 2015 budget builds on the progress of EERE-supported projects that are already chipping away at this goal, like the development of one flash iron-making process that would help reduce energy consumption up to 20% over historical values. Another project is working to develop an advanced sheet metal forming tool which could reduce scrap metal generation by 70%, reduce energy consumption by 70%, and reduce costs for production by 90%.

The FY 2015 Request supports launching at least one new Clean Energy Manufacturing Innovation Institute, along with continued support of existing institutes, and these efforts will be discussed in more detail below. The Budget Request will also allow EERE to continue to partner with the best and brightest in industry, academia, and at research institutions to address critical manufacturing and supply chain challenges through EERE's advanced manufacturing RD&D facilities. Examples include activities such as the Critical Materials Hub at Ames National Laboratory, comprising over a dozen research universities and industrial partners, that tackles critical materials reduced use, alternatives, and recycling within the clean energy supply chain; and the Manufacturing Demonstration Facility at Oak Ridge National Laboratory.

Finally, FY 2015 funding will allow EERE to continue partnerships with industry in breaking down barriers to commercializing energy-efficient manufacturing technologies and practices, such as CHP, towards a national goal of 40 GW of new cost-effective industrial CHP by 2020.[8]

***Building Technologies**:* The Building Technologies Office supports development and demonstration of advanced building efficiency technologies and practices that support more efficient, affordable, and comfortable U.S. buildings.

EERE is requesting $212 million in FY 2015 to help homes and businesses become more energy efficient, to support energy efficiency innovation, and to work with stakeholders to develop equipment and appliance efficiency standards. The FY 2015 Budget Request supports research and development of several high-impact emerging technologies with the potential to increase United States energy savings and reduce greenhouse gas emissions from residential and commercial buildings. The Budget Request will also allow EERE to partner with home builders in constructing highly energy-efficient homes, and to partner with homeowners in order to improve their access to home energy improvement services. EERE will also partner with the commercial sector to improve

[7] EPACT 2005.
[8] E.O.13624.

the information, tools, and resources available for commercial buildings to reduce energy consumption and meet the goal of 20% energy savings in commercial buildings by 2020. The FY 2015 Request supports a consortium for building energy innovation to reduce energy use in small- and medium-size commercial buildings and demonstrate new market pathways for energy savings. Finally, the Request enables equipment and appliance standards that establish minimum efficiency requirements pursuant to federal statutes, towards the goal of reducing building source energy use and reducing carbon pollution by at least 3 billion metric tons cumulatively by 2030.

Weatherization and Intergovernmental Program*:* The Weatherization and Intergovernmental Programs Office partners with state and local organizations in order to make clean energy technologies more accessible to a wide range of government, community, and business stakeholders.

EERE is requesting $305 million in FY 2015 to support weatherization, state energy activities, and clean energy and economic development technical assistance. EERE's FY 2015 Budget Request in this area includes $228 million to support the Weatherization Assistance Program at levels that provide access to home weatherization services for more than 33,000 low-income households in jurisdictions across the country. The FY 2015 Budget Request also contains increased funding to enable EERE to support and expand innovative initiatives with its State Energy Office network in order to spur accelerated deployment of energy efficiency and clean energy technologies. These engagements include reducing state government energy use, with a goal of reducing state government facilities and operations energy use by 2% per year through 2020, and accelerating investment in state and local public-sector use of energy service performance contracting by $1 to $2 billion by 2016. Finally, the Budget Request will support Clean Energy and Economic Development Partnerships to assist regions in creating economic development roadmaps in sustainable shale gas growth zones and also to provide technical assistance to enable local governments and communities to leverage clean energy technologies to achieve local economic growth.

Federal Energy Management Program*:* The Federal Energy Management Program works across the federal government to provide individual federal agencies with technical expertise that enables the federal sector to lead by example and meet energy efficiency and clean energy goals.

In this area, EERE is requesting $36 million in FY 2015 to continue its progress in assisting the U.S. Government meet core energy efficiency, water conservation, and renewable energy utilization goals for government buildings. The FY 2015 Budget Request supports a center of expertise focused on Federal Data Center Energy Efficiency and Optimization, increased project tracking, and expanded development and implementation of critical tools for enhancing the effective use of project financing mechanisms. Through the continuation of the Federal Energy Efficiency Fund, EERE's Request would provide funding to leverage cost-sharing at federal agencies for capital projects, as well as other initiatives, that support government-wide goals to reduce federal facility

energy intensity by 30% by the end of FY 2015 compared to FY 2003, reduce water consumption intensity by 16% by the end of FY 2015 relative to a 2007 baseline, and utilize renewable electric energy equivalent to at least 7.5% of total electricity use by FY 2013 and 20% by 2020.

EERE CROSS-CUTTING INTIATIVES

In addition to EERE's technology offices, we also work to break down silos across DOE and EERE offices to address critical, crosscutting energy initiatives that broadly impact our clean energy goals. Within our technology office budgets, EERE organizes and coordinates investments across our technology sectors around addressing common key themes to achieve maximum impact for the U.S. taxpayer.

Grid Integration Initiative

One of EERE's primary missions has been to drive down the costs of individual technologies related to energy efficiency, renewable power, and sustainable transportation. As these programs have become increasingly successful at driving down the cost of emerging technologies, more and more of these technologies are being integrated into the electrical power system. However, as these technologies are deployed in greater numbers, they introduce new challenges associated with the physical operation of the grid.

EERE's *Grid Integration Initiative*—in coordination with the Office of Electricity Delivery & Energy Reliability and other DOE offices—organizes activities across EERE's technology offices to holistically enable the seamless integration of EERE technologies into the electrical grid in a safe, reliable, and cost-effective manner. In FY 2015, EERE is requesting $126 million for this Initiative across our Buildings, Solar, Vehicles, Wind, Water, Fuel Cells Technology, and Advanced Manufacturing Offices. This amount also includes an increased investment of $30 million in base funding for the new Energy Systems Integration Facility (ESIF) at DOE's National Renewable Energy Laboratory to support full operation of the user facility.

Commissioned in September 2013, ESIF is a state-of-the-art facility designed for testing, simulation, data analysis, engineering, and evaluation techniques for integrated technologies in a risk-free environment. ESIF serves as the focal point for EERE grid integration activities and is providing unique research and development opportunities for utilities, advanced clean energy technology manufacturers, and system integrators that together will help reshape the energy system of the 21st century. This exceptional national resource supports scientists and engineers from the private and public sectors conducting critical research, development, testing, and validation. The efforts at ESIF will directly benefit and inform equipment providers, utilities, public utility commissions,

legislative bodies, and other entities working to integrate renewable energy and advanced efficiency technologies and approaches into the Nation's electricity grid.

ADVANCING U.S. MANUFACTURING COMPETITIVENESS

One of EERE's continued areas of strong emphasis across our technology offices—and one that I know is of great importance to this Committee as well as to the Administration—is supporting U.S. manufacturing competitiveness.

EERE recognizes the many benefits of U.S.-based manufacturing within the clean energy economy—including job creation and high-tech intellectual property generation—and leads the Department of Energy's *Clean Energy Manufacturing Initiative* (CEMI). CEMI is a comprehensive and coordinated DOE-wide effort created to increase U.S. competitiveness in clean energy manufacturing. CEMI supports the dual objectives of 1) increasing U.S. manufacturing competitiveness in the production of clean energy products and 2) boosting U.S. manufacturing competitiveness across the board by increasing energy productivity. In FY 2015, EERE is requesting $554 million for CEMI activities across our Advanced Manufacturing, Vehicles, Bioenergy, Solar, Wind and Water, Buildings, and Fuel Cell Technology Offices to increase the energy efficiency, productivity, and competitiveness of U.S. manufacturing.

Consistent with the President's vision for an interagency National Network for Manufacturing Innovation (NNMI), the FY 2015 CEMI Request continues support for crosscutting Clean Energy Manufacturing Innovation Institutes. These EERE-led Institutes are public-private partnerships focusing on RD&D of foundational technologies that are broadly applicable and pervasive in multiple industries and markets, and that have potentially transformational technical and manufacturing productivity impacts.

In January 2014, EERE announced the Next Generation Power Electronics Manufacturing Institute. The institute will bring together over 25 companies, universities, and state and federal organizations to invent and to develop the manufacturing processes for wide bandgap (WBG) semiconductor-based power electronics that are cost-competitive and significantly more efficient at high powers and temperatures than current silicon-based technology on the market—leading to more affordable products for businesses and consumers, billions of dollars in energy savings and high-quality U.S. manufacturing jobs.

In February 2014, EERE announced a new competition to establish an Advanced Composites Manufacturing Innovation Institute to develop high-speed and energy-efficient manufacturing and recycling processes that lower the cost and the amount of energy used to produce advanced fiber-reinforced polymer composites for clean energy applications. Advanced composites could help manufacturers deliver clean energy products with better performance and lower costs such as

lightweight vehicles with record-breaking fuel economy; lighter and longer wind turbines blades; high pressure tanks for natural gas- and hydrogen-fueled cars; and lighter, highly energy-efficient industrial equipment.

As part of the Department's *Clean Energy Manufacturing Initiative*, these Institutes will accelerate growth of and innovation in domestic clean energy products, and spur the creation of high-quality, high-paying U.S. manufacturing jobs.

CEMI both leverages and complements the new Institutes' efforts to develop and transition these foundational technologies into the commercial clean energy marketplace by coordinating and optimizing all research, development, and demonstration of WBG and advanced composites technology through two focused initiatives crosscutting our Technology Offices. In FY 2015, EERE will coordinate through the *Next Generation Power Electronics Initiative*—across the Vehicles and Advanced Manufacturing Technology Offices—to maintain U.S. leadership in WBG semiconductor technology by creating a U.S. manufacturing and research and development base for WBG power devices and power electronics systems. EERE will also coordinate through the *Carbon Fiber Composites for Clean Energy Initiative*—across the Vehicles, Bioenergy, Fuel Cells, Wind, and Advanced Manufacturing Technology Offices—to optimize RD&D investments across EERE to address challenges throughout the entire supply chain for carbon fiber composites.

In addition, EERE has made progress in how it treats intellectual property utilization for companies and universities receiving taxpayer resources for RD&D projects. Mindful of the objectives of related legislation, such as the Patent and Trademark Law Amendments Act ("Bayh-Dole"), EERE's efforts will help to advance innovation, commercialization, and manufacturing of clean energy technologies within the United States. Motivated in part by this Committee's report language, starting in FY 2014, EERE has successfully built into its standard operating procedures 1) the requirement that applicants to EERE competitive Funding Opportunity Announcements submit U.S. manufacturing plans—or agree that subject inventions be substantially manufactured in the U.S.—as a component of their applications; 2) the requirement that, where appropriate, EERE consider U.S. manufacturing plans when evaluating applications; and 3) the requirement that, where appropriate, EERE negotiate, track, and enforce U.S. manufacturing commitments as part of its cooperative agreements. These efforts will help foster U.S. innovation, strengthen manufacturing competitiveness, and provide our research partners the assurance that EERE is dedicated to leveraging the clean energy economy's competitive opportunity for the U.S.

EERE OPERATIONAL EXCELLENCE AND ORGANIZATIONAL IMPROVEMENTS

In FY 2015, EERE will maintain its strong focus on operational excellence. Building on early progress of recently initiated, multi-year comprehensive organizational reforms, EERE will conduct our work with greater speed, quality, and higher-impact results year by year.

Ensuring Program Planning, Prioritization, and Review Are Clear and Transparent

EERE will continue to articulate and communicate its future plans and program priorities, both internally and externally, through updates to our EERE Strategic Plan and to EERE technology office Multi-Year Program Plans (MYPPs). Specifically, MYPP activities and priorities will flow from the EERE Strategic Plan and will describe, in greater detail, the goals, program thrusts, roadmaps, and prioritization methodologies that drive them. Furthermore, office MYPPs are informed by extensive stakeholder engagement, such as through regular external expert peer reviews of our portfolios. By ensuring a process of regular updates to major plans and engaging in rigorous dialogue with experts and other stakeholders, EERE will responsively move into new and highly promising program areas, and we will terminate programmatic thrusts that are deemed to no longer be highly relevant or impactful.

Conducting Program Impact Evaluation and Tracking for a Majority of EERE's Portfolio

To inform EERE program planning and enable high-impact returns on investment to the U.S. taxpayer, EERE plans to perform a broader range of regular and rigorous impact evaluations. At the same time, EERE has taken steps to improve processes that establish, track, and aggregate project-level impact metrics, enabling a consistent methodology for analyzing and reporting on these metrics over the next several years. EERE's approach will increasingly involve quantifying and evaluating its contributions to creating knowledge, engineering solutions, validating new technologies, and accelerating the development of next-generation technologies. EERE will use these quantitative evaluations to inform its decision-making processes, expand or replicate highly effective activities, and curtail or eliminate ineffective investments.

Enhancing EERE's Stewardship of Project Portfolios through Active Management Approaches

In order to be an effective steward of taxpayer dollars and produce the highest impact from its investments, EERE is moving aggressively in implementing Active Project Management, inspired by Advanced Research Projects Agency–Energy's (ARPA-E) rigorous project management efforts. EERE has developed, and is beginning to execute, approaches that provide clearer accountability through:

- More clearly defined roles and responsibilities in project execution by establishing uniform position requirements across the organization;
- Enhanced project management standard operating procedures;
- Guidance to more effectively negotiate detailed statements of project objectives for each project, including quarterly progress reviews and annual "Go/No-Go" milestones; and
- End-of-project deliverables clearly oriented around accomplishments that can impact the energy marketplace.

By implementing rigorous Active Project Management principles, since March 2013, EERE has started the process of discontinuing approximately 17 projects due to performers not meeting technical requirements. This builds on EERE's commitment to be a good steward of taxpayer dollars. As I identified during my last budget hearing in front of this Committee, between FY 2005 and March 2013, EERE discontinued approximately 50 underperforming projects totaling about $113.3 million.

Forward Funding to Buy Down Mortgages

EERE continues to be responsive to this Committee's request to shift to forward funding of multi-year commitments wherever possible. In doing so, EERE continues to minimize the exposure of taxpayers to future mortgages in situations where the funding has yet to be appropriated, and remains highly responsive to the changing dynamics of the clean energy landscape. We have made significant progress towards this goal to date. By the start of FY 2014, EERE paid down mortgages totaling over $400 million since FY 2012. In FY 2014, we estimate paying down approximately $194 million more in mortgages. EERE remains committed to forward funding all projects it supports to the greatest extent possible, and looks forward to an open conversation with this Committee in the future on how to maximize the opportunity of clean energy for American families and businesses while also remaining an active steward of taxpayer resources.

CONCLUSION

In conclusion, allow me to reiterate the key points that I want to leave you with today. At EERE, we recognize the enormous opportunity that clean energy represents for the United States. Working in partnership with the private sector, we are optimistic that we can create and sustain American leadership in the global transition to clean energy, and in so doing grow high-paying jobs and strong market share for our workers and businesses. We stand behind EERE's track record of accomplishments and our efforts to make our organization even more effective and accountable to you and to the American taxpayer as we pursue our mission. We are privileged to play this role and to work with this Committee to help ensure that the United States wins the global clean energy race.