STATEMENT OF

DR. HENRY KELLY

ACTING ASSISTANT SECRETARY FOR
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

MARCH 27, 2012

Mr. Chairman, Ranking Member Visclosky, Members of the Subcommittee, thank you for the opportunity to testify on the President's Fiscal Year 2013 (FY13) budget request for the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE).

In his State of the Union speech, President Obama presented his plan for a U.S. economy built to last. Central to this effort is the President's commitment to safely and responsibly harness America's domestic energy resources in an "all of the above" energy strategy. Renewable energy and energy efficiency play key roles in this strategy, and EERE supports research, development, demonstration and deployment activities for innovative technologies and practices in those fields.

To further ensure that EERE directly supports the President's portfolio approach to energy and the Nation's ability to compete in an increasingly global and competitive marketplace, EERE has explicitly designed its portfolio so that all work done by the program is directly applicable to at least one of three broad energy challenges: 1) to reduce the Nation's dependence on petroleum-based fuels for transportation by developing affordable fuels from renewable sources, vehicles capable of using electricity and hydrogen, and highly efficient conventionally fueled vehicles; 2) to find ways to make the unsubsidized cost of electricity derived from renewable resources competitive with other sources of electricity; and 3) to optimize the efficiency of our homes, buildings, and factories. In doing work that addresses these three challenges, EERE will help address our Nation's economic, energy security, and environmental goals: spurring economic growth and job creation in the U.S.; reducing dependence on oil; and minimizing the environmental impact associated with energy production and use.

Over the last seven years, the global investment in clean energy market has increased dramatically. The United States cannot afford to relinquish leadership in this increasingly critical market. The FY 2013 budget request will enable EERE to build on its long record of driving innovation for the development of clean energy industries. In the last thirty years, investments in EERE technologies have played a part in many important commercial successes, including, but not limited to:

- Nearly every hybrid electric vehicle sold in the U.S. today uses battery technology developed in part with Energy Department support.
- As of 2009, refrigerators were half the price they were in 1972 and 75 percent more efficient; EERE investments in refrigerator-freezer compressors have saved Americans more than $7 billion since the early 1980's.
- EERE investment in low emission (low-e) coatings for windows has played an important role in developing cost-effective windows three times more efficient than those from the 1970s. First introduced to the market in 1983, windows with low-e coatings now account for nearly 75% of home windows sold.
- Innovations in wind turbines developed with the support of EERE's Wind Energy Technology Program have reduced costs and increased reliability. According to one industry assessment, the U.S. currently has 47 GW of installed wind capacity in the U.S. and 35 percent of all new installed capacity over the last 4 years.
- Over the past ten years, breakthroughs in biomass feedstock logistics, pretreatment, enzymatic saccharification, and fermentation have helped reduce the costs of cellulosic ethanol produced via biochemical conversion from over $9.00 per gallon in 2001 to a minimum modeled cost for mature technology of $2.62 per gallon gasoline equivalent in fiscal year 2011. This trend is expected to continue, with a minimum modeled cost for mature technology of $2.15 per gallon gasoline equivalent projected by the end of fiscal year 2012.
- Advanced vehicle technology R&D sponsored by the Vehicles Technology Program helped enabled engine manufacturers to improve diesel engine efficiency, which has improved diesel engine efficiency by 5 percent since 2002, saving businesses an estimated $7 billion in diesel costs from 2002 to 2008 and helping manufacturers increase fuel economy.
- Hydrogen and Fuel Cell Technologies Program-funded efforts have helped reduced the cost of automotive fuels cells by more than 80 percent since 2002, assuming high-volume manufacturing of 500,000 units per year from state-of-the-art components.
- EERE investments in reciprocating engines used in combined heat and power facilities led to improved engine efficiencies across the market, by supporting R&D with engine manufacturers that later accounted for a sizable majority of U.S. natural gas engine sales in 2010. The number of CHP facilities has increased nearly 6 times

since 1970, helping manufacturers with these facilities to nearly double the combined efficiency of their heat production and electricity generation.

- Through its Federal Energy Management Program, EERE has provided the services, tools, and expertise to Federal agencies to help them achieve their Federal energy management goals. Through guaranteed cost savings achieved through its Indefinite Delivery, Indefinite Quantity Energy Savings Performance Contracts, FEMP has saved Federal facilities over $5 billion in energy costs since 2006.

And recently, we have made strides in the following:

- *Appliances:* Standards issued since 2009 will save consumers up to hundreds of billions of dollars through 2030; building on this, EERE plans to issue nine new standards through 2013 that aim to deliver net consumer savings of hundreds of billions additional dollars over the next three decades.
- *Solar:* Since 2007, SunShot's Incubator program has successfully leveraged $60M in EERE research funding to secure more than $1.6B in private capital.
- *Weatherization:* Since 2009, the Weatherization Assistance Program has improved the energy performance of approximately 860,000 homes for low-income families and other Americans. On average, these upgrades save these households more than $400 on their heating and cooling bills in the first year after implementation alone. At the height of the Recovery Act, these activities directly supported more than 15,400 new full time jobs, as well as additional indirect jobs throughout the supply chain.
- *Batteries*: Argonne National Lab licensed EERE-sponsored battery technology to private industry. This technology can pack 50-100 percent more energy into the same space compared to conventional cathodes, enabling smaller, lighter batteries.
- *Fuel Cells*: Following EERE demonstration funding for around 400 fuel cell lift trucks, industry placed orders for over 3,000 additional fuel cell lift trucks with no further DOE funding.

Retaining our leadership role in this increasingly competitive global market will require significant public and private sector investment in next generation renewable energy technologies and energy efficiency solutions. Domestic job creation and economic growth have historically been driven by inventing, manufacturing, and deploying innovative technologies and the same will be true in the growing clean energy sector.

EERE's strategic investments complement those of the private sector. The EERE portfolio consists of competitively selected projects with the largest potential to help achieve economic, strategic and environmental goals and for which federal funds are most critical. It balances investments in higher-risk, early-stage research with private-public partnerships that accelerate the transfer of innovations into the marketplace. The diverse set of technologies supported by EERE helps ensure that the U.S. has many options for meeting its energy needs. To that end, since 2007, EERE investments have resulted in the issuance of hundreds of patents supporting innovative clean energy research. EERE management is dedicated to building on these successes by providing a framework wherein highly innovative projects are competitively selected from the Nation's top universities, companies, and national laboratories to address the Nation's critical energy challenges and tap opportunities presented by new technologies.

Transportation Portfolio:

The Vehicle Technologies Program's R&D seeks technology breakthroughs that will enable the U.S. to greatly reduce transportation petroleum use and greenhouse gas emissions while enhancing vehicle performance. The Program focuses on a suite of technologies that ranges from transportation electrification and lightweight materials to advanced combustion engines and lubricant technologies and non-petroleum fuels interactions and utilization. The FY 2013 budget request includes a more than 25 percent increase for the Program compared to FY 2012, mainly in its Battery and Electric Drive Technology activities. In FY 2013, the program will support the launch of *EV Everywhere*, a new clean energy grand challenge to make electric-powered vehicles as affordable and convenient as gasoline-powered vehicles for the average American family within a decade. By emphasizing accelerated R&D on advanced battery and electric drive technologies, *EV Everywhere* will enable companies in the United States to produce electric vehicles at lower cost, with an improved vehicle range and an increased fast-charging ability. Major concentrations will be on advanced battery design optimization and innovative battery manufacturing processes.

Additional research will focus on developing high performance, low cost power electronics and electric motors that require reduced or no rare earth materials. The program also supports early demonstration, field validation, and deployment of advanced technologies and efforts to reduce the vehicle miles traveled by the public.

The Biomass Program funds a portfolio of projects to provide the Nation with domestically grown alternatives to fossil fuels that are compatible with our existing infrastructure. In FY 2013 Biomass funds will build on prior year successes in producing low-cost lignocellulosic sugars for ethanol. These advances can also be leveraged to develop cost-competitive transportation fuels such as renewable gasoline, diesel, and jet fuel from lignocellulosic material through biological or catalytic conversion routes. In addition, DOE is seeking authority to transfer funds under the Defense Production Act to more closely coordinate drop-in biofuel development for military applications with the Navy and USDA. Projects supported by the Biomass program are enabling scientists and engineers to overcome challenges across the bioenergy supply chain – from the development of a sustainable and economically viable feedstock logistics system; to the conversion of biomass into a variety of end uses, including biofuels and bioproducts. Laboratory-scale research projects are advancing the science of novel technologies, while first-of-a-kind biorefineries are validating and assisting in the commercialization of integrated technologies.

The Fuel Cell Technologies Program aims to enable the widespread commercialization of an alternative energy system to power cars, trucks, and off-road vehicles. While the emphasis is on transportation technologies, cross-cutting activities will have stationary applications as well. The Program's R&D portfolio is designed to improve the durability of fuel cells, reduce costs, and improve the performance of hydrogen production, delivery, and storage technologies. The Program aims to enable fuel cells technologies capable of achieving cost-parity with internal combustion engines for vehicles by 2017 and to enable renewable hydrogen technologies capable of being competitive with conventional fuels by 2020, based on modeled costs projected from component technologies to systems in high-volume production. In addition to technological advancements, the program seeks to reduce institutional and market barriers to the commercial deployment of hydrogen and fuel cell technologies.

Renewable Electricity Generation Portfolio:

The Solar Program will continue to focus on the SunShot effort in FY 2013 and is on target to achieve $1/Watt installed costs by the end of the decade. This work includes continued efforts to drive down the cost for module manufacturing and investments in reducing balance-of-system costs – both hardware components and "soft costs" such as permitting. The Program's photovoltaic (PV) technology activities focus on lowering the cost of PV through increased conversion efficiency and manufacturing improvements. The concentrating solar power (CSP) technology activities support development of thermal storage and the systems research and optimization to enable CSP to provide base-load power on demand. Additionally, the Program will work on systems integration and market transformation to support cost goals for the deployment of solar technologies by addressing grid integration issues, balance-of-systems, non-hardware installation costs and other market barriers.

The Wind Energy Program develops technology to improve the reliability and affordability of land-based and offshore wind energy systems. FY 2013 activities will increase the focus on advanced technologies and designs and on offshore wind demonstration projects that will help inform applied R&D priorities and reduce the costs and technical risks of offshore wind power plants in U.S. waters. The Program also supports wind resource assessments, advanced turbine and system modeling, and improved approaches to systems interconnection and integration to the electric transmission grid. It also helps to reduce market barriers that impede investment and development such as wildlife, siting, and other market challenges.

The Geothermal Technologies Program (GTP) conducts RD&D in partnership with industry, academia, and the National Laboratories to discover new geothermal resources, to develop innovative methods of accessing those resources for base-load electricity production, and to demonstrate high-impact technologies. The FY 2013 budget request increases GTP's budget by more than 70 percent compared to FY 2012. The increase in funding will support enhanced geothermal systems (EGS) field-test sites and projects and improved resource characterization efforts in EGS that offer the potential for widespread base-load renewable electricity. The Program will also concentrate on improving exploration technologies that offer the potential for reducing the

costs and risks associated with geothermal development by more efficiently and effectively identifying viable, economic geothermal resources.

The Water Power Program works to accelerate technology development for cost-effective and environmentally responsible renewable power generation from water. The reduction in funding reflects the substantial progress and completion of multiyear projects associated with Conventional Hydropower research and development. FY 2013 activities will focus primarily on marine and hydrokinetic (MHK) power, which includes a suite of technologies that harness the energy of wave, tidal, and current resources. Specifically, MHK research will focus on development and use of advanced open water test infrastructure for MHK devices and research into the costs and performance of innovative, early-stage MHK systems and components. The Program also supports resource assessments, cost assessments, environmental studies, and advanced modeling aimed at determining and demonstrating the viability of emerging water power technologies and reducing the market barriers to their deployment.

Efficient Homes, Buildings and Manufacturing Portfolio:

The Advanced Manufacturing Office (AMO), formerly known as the Industrial Technologies Program (ITP), supports RD&D focused on innovative, energy-efficient manufacturing processes and materials technologies. AMO's requested FY 2013 budget of $290 million is more than double ITP's FY 2012 budget of $116 million. This increase reflects the Administration's commitment to enhancing innovation in the manufacturing sector and improving the competitiveness of U.S. industries. The Program pursues cross-cutting manufacturing process technologies and advanced industrial materials to enable reductions in energy costs for U.S. manufacturing while improving process quality and accelerating product development. To that end, the Program seeks to research, develop, and demonstrate at a convincing scale new energy-efficient manufacturing processes and materials technologies to reduce the energy intensity and life-cycle energy consumption of manufactured products. AMO also promotes a corporate culture of continuous improvement in energy efficiency among manufacturers and their facilities. The Critical Materials Energy Innovation Hub, initiated in FY 2012, is continued within this program in FY 2013.

The Building Technologies Program (BTP), in partnership with the buildings industry, develops, promotes, and integrates energy technologies and practices to make buildings more efficient, affordable and comfortable. The FY 2013 budget request includes a more than 40 percent increase in funding for BTP, which will enable BTP to position itself to meet the Department's goal of reducing building-related energy use by 50 percent by 2030, saving consumers tens of billions of dollars per year. The funding increases will largely go towards the development of emerging technologies, to move building technologies along the RDD&D continuum from lab testing to prototype validation; and towards equipment standards activities, to address market challenges or failures in the adoption of energy efficient technologies. The Program undertakes the following suite of activities 1) R&D on building components (such as lighting and advanced heating and cooling devices) and integrated building designs; 2) model building efficiency codes; 3) equipment and appliance standards; 4) market integration activities such as Better Buildings, Building America, and the ENERGY STAR partnership with EPA; and 5) the Energy Efficient Building and Systems Design Energy Innovation Hub.

The Federal Energy Management Program (FEMP) enables the Federal Government to meet the relevant energy, water, greenhouse gas, and transportation goals defined in existing legislation and Executive Orders by providing interagency coordination, technical expertise, training, financing resources, and performance contracting support.

The Office of Weatherization and Intergovernmental Activities (OWIP) supports clean energy deployment in partnership with State, local, U.S. territory, and tribal governments. The FY 2013 budget request increases OWIP's budget by about fifty percent compared to FY 2012. This increase goes to the Weatherization Assistance Program (WAP), which under the request receives $139 million in FY 2013, up from its historically low FY 2012 enacted funding of $68 million, but still below its FY 2011 enacted funding of $174.3 million. WAP lowers energy use and costs for low income families by supporting energy-efficient home retrofits through State-managed networks of local weatherization providers. OWIP also runs the State Energy Program, which provides technical and financial resources to States to help them achieve their own energy efficiency and renewable energy goals through policies,

strategies and public-private partnerships that facilitate adoption and implementation. Funding also supports energy efficiency and renewable energy projects that meet local needs. OWIP's Tribal Energy Program supports feasibility assessments and development of implementation plans for clean energy projects on Tribal lands.

The Office of Strategic Programs provides cross cutting services including the development of strategic planning, portfolio-wide analytical tools, shared tools and resources for public education and engagement, international programs, and cross-cutting programs in innovation and deployment. The FY 2013 budget request increases Strategic Programs' budget by almost $34 million, in large part through increased funding for innovation and deployment activities. This increase will allow for new collaborative work with DOE's Office of Science to accelerate the transition of novel scientific discoveries into innovative, prototype clean energy technologies. It will also accelerate deployment and adoption of EERE technologies through improved collaboration with education and training institutions.

In closing, today the United States is poised to harness the ingenuity of American scientists, the industriousness of American workers, and the creativity of American entrepreneurs to help secure America's future prosperity and global energy leadership. This FY 2013 budget request of $2.337 billion reflects a balanced and diverse portfolio with the understanding that EERE's technologies will play a critical role in addressing the Nation's urgent energy and environmental challenges.

SIGNIFICANT FUNDING CHANGES – FY 2012 to FY 2013 Request ($ in millions)

Vehicle Technologies (FY 2012 $328.8; FY 2013 $420.0)..... +$91.2
In FY 2013, there will be increased emphasis on advanced battery technology as part of the *EV Everywhere* grand challenge, including specific concentrations on advanced battery design optimization and battery manufacturing to significantly improve performance and reduce system cost. Additional R&D will focus on high performance and low cost power electronics, improved motor drive technologies that require reduced or no rare earth materials, and technology that allows electric drive vehicles to charge from the electric grid conveniently and efficiently.

In addition, other R&D will focus on high-efficiency Heating Ventilation Air Conditioning (HVAC) system technologies, and lightweight materials. The materials research will be targeted to high performance light-metal joints, manufacturing of low-cost carbon fiber composite components, and application of modeling and simulation techniques to the design of lightweight vehicle structures.

Biomass and Biorefinery Systems R&D (FY 2012 $199.3; FY 2013 $270.0)……. +$70.7
The overall increase in funding will support expanding efforts in research to produce hydrocarbon fuels from biomass, as well as the innovative pilot program that will support the transition of promising new technologies for the production of drop-in hydrocarbon fuels into pilot-scale biorefineries. In addition, DOE is seeking authority to transfer funds under the Defense Production Act to more closely coordinate drop-in biofuel development for military applications with the Navy and USDA. FY 2013 activities also include an increased focus on bio-oil and downstream process technologies to produce final products. The FY 2013 request provides an additional installment for the full-fledged construction of demonstration and commercial scale integrated biorefinery projects that were competitively awarded in 2007 and 2008 and that will be operational in 2014

Hydrogen and Fuel Cell Technologies (FY 2012 $103.6; FY 2013 $80.0)…….…. ..... -$23.6
The reduction in funding reflects substantial progress made in research innovations in the areas of fuel cells and hydrogen fuel production, delivery, and storage. A robust R&D program remains in fuel cells and renewable hydrogen production. In addition, FY 2013 activities will focus on some high impact fuel cell deployments, such as ground-support equipment and other early market fuel cells, with industry and government partners.

Solar Energy (FY 2012 $289.0; FY 2013 $310.0)…….…..... +$21.0
Under the Solar program, innovative research on photovoltaic (PV) and concentrated solar power (CSP) energy technologies continues, to drive the advancements that will make solar energy cost competitive, across the Nation and without subsidies, before the end of the decade. In FY 2013, efforts to address PV module manufacturing cost drivers will be increased since modules make up 50 percent of the cost structure for this $1/W goal. There will also be increased effort to address "soft" market barriers such as the permitting time and costs associated with solar installation.

Wind Energy (FY 2012 $93.3; FY 2013 $95.0)…….…..... +$1.7
With the commercial success of on-shore wind energy, EERE's efforts will now focus on the next generation of wind technologies and on capturing America's enormous offshore wind resources at a competitive price. The FY 2013 request reflects the shift from on-shore toward offshore wind technology research. FY 2013 activities will increase the focus on advanced technologies and designs and on offshore wind demonstration projects that will help inform applied R&D priorities and reduce the costs and technical risks of offshore wind power plants in U.S. waters.

Geothermal Technology (FY 2012 $37.9; FY 2013 $65.0)…….…. ..... +$27.1
Geothermal work will concentrate on exploration capabilities and on developing new technologies for enhanced geothermal systems (EGS) that offer the potential for enormous resources for base-load power across America. The increase in funding in FY 2013 will support the EGS field test sites and projects and improved resource characterization efforts in EGS that offer the potential for round-the-clock renewable electricity. In addition, FY 2013 activities will focus on: safely accessing geothermal reservoirs faster and at lower costs, identifying and

characterizing blind hydrothermal resources, and innovative means by which EGS reservoirs can be created and monitored throughout their lifetime.

Water Power (FY 2012 $58.8; FY 2013 $20.0)…….…..... -$38.8
The reduction in funding reflects the substantial progress and completion of multiyear projects associated with Conventional Hydropower research and development. FY 2013 activities will focus primarily on marine and hydrokinetic (MHK) power, which includes a suite of technologies that harness the energy of wave, tidal, and current resources. Specifically, MHK research will focus on development and use of advanced open water test infrastructure for MHK devices and research into the costs and performance of innovative, early-stage MHK systems and components.

Advanced Manufacturing (formerly Industrial Technologies) (FY 2012 $115.6; FY 2013 $290).....+$174.4
In FY 2013, Advanced Manufacturing initiatives will support the important role the Department, and the U.S. Government as a whole, play in creating and maintaining a pipeline of innovative manufacturing ideas though its investments in research. Increased funding will support development and demonstration of innovative energy efficient manufacturing processes and materials technologies. It will allow the program to accelerate development of cross-cutting manufacturing process technologies and advanced industrial materials that will enable U.S. companies to cut the costs of manufacturing by using less energy while improving product quality and accelerating product development. Increased funding will include support for later stage scale up of manufacturing processes and advanced material technologies seeking to demonstrate these materials and processes at a convincing scale to prove reductions in energy intensity and in the life-cycle energy consumption of manufactured products.

The program will fund partnerships with industry to support these pre-competitive, high-risk, next generation innovations through the technology pipeline. Government support for these activities is critical due to the high cost and risk associated with the development and demonstration of complex technologies at relevant scales under time, quality and cost constraints. The transition to commercially-relevant manufacturing requires significant investments to create processing innovations, prototypes and ultimately produce the data that can support the case for commercialization.

Building Technologies (FY 2012 $219.2; FY 2013 $310.0)…….…… ..... +$90.8
In FY 2013, there will be increased emphasis on research for advanced building HVAC systems, the building envelope and windows, and enhanced sensor and control technologies for building energy management. Additional emphasis will be placed on demonstrating and testing new, cost-effective technologies in retrofitting commercial and residential buildings, to validate the significant energy savings that can be achieved in these sectors.

In addition, FY 2013 funding will increase the scope and effectiveness of energy conservation standards by accelerating the test procedure and standards rulemakings that are currently scheduled, allowing for the increased use of DOE's existing authorities to establish standards for additional products that have large energy savings potentials.

Federal Energy Management (FY 2012 $29.9; FY 2013 $32.0)…… ..... +$2.1
This increase will support the restart of the Federal Energy Efficiency Fund (FEEF), which has been authorized since 1992. The FEEF will provide direct funding and leveraged cost-sharing for other Federal agencies for capital projects and other initiatives to increase the energy efficiency, water conservation and renewable energy investments at agency facilities. Grants from the Fund will be competitively awarded based on criteria that include the life cycle cost effectiveness of each proposal, the amount of energy and cost savings anticipated to the Federal Government, and the overall return on investment.

Weatherization and Intergovernmental Activities (FY 2012 $128.0; FY 2013 $195.0) …..…+$67.0
In FY 2012, Congress provided the latitude to allocate weatherization appropriations reflecting the balances accumulated while States were drawing down Recovery Act awards. With the anticipated expenditure of accumulated balances, the increase in the FY 2013 request will sustain essential weatherization production,

training, and infrastructure for grantees as Recovery Act projects are completed and old balances are drawn down.

Strategic Programs (FY 2012 $25.0; FY 2013 $58.9)…….…… +$33.9
This substantial increase will allow for new collaborative work with the DOE Office of Science through joint solicitations to accelerate the transition of novel scientific discoveries into innovative, prototype clean energy technologies. It will also accelerate deployment and adoption of these technologies through improved collaboration with education and training institutions. The Program will also continue to guide, strengthen, and communicate work on EERE technologies, and to help build U.S. businesses' domestic and international competitiveness in these technologies.