

The FY 2012 Budget Request

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



February 2011

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Secretary for EERE

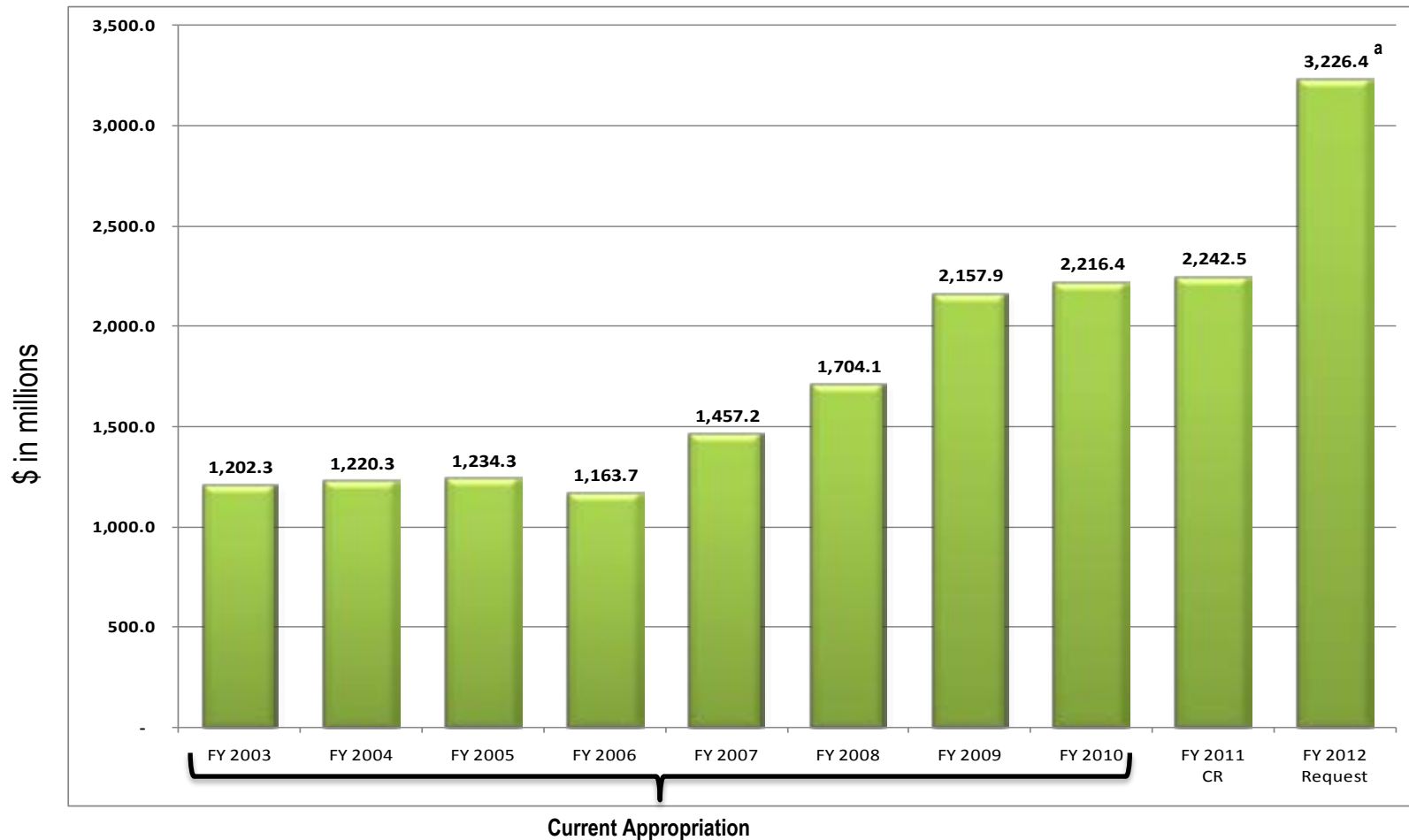
Clean Innovative Energy Solutions Securing America's Future



“This is our generation’s Sputnik moment. We’ll invest in ... clean energy technology — an investment that will strengthen our security, protect our planet, and create countless new jobs for our people. Maintaining our leadership in research and technology is crucial to America’s success.”

President Obama
State of the Union
January 25, 2011

EERE Budget Trend FY 2003 - 2012



^aExcludes (\$-26.4M) reduction in Prior Year Balances

Security:

- Advance domestic energy resources.
- Diverse supplies.



Environment:

- Achieve 80% reduction in Greenhouse Gas Emissions.
- Improve water and air quality (indoor and outdoor).



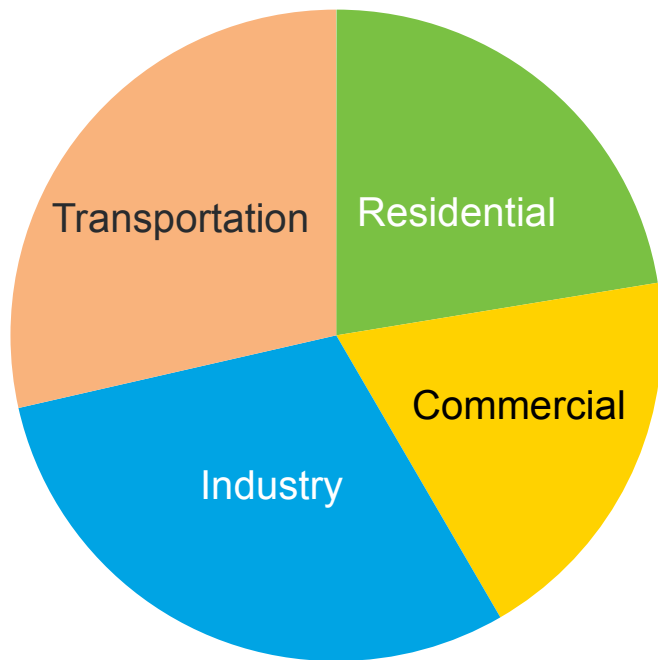
Economy:

- Low cost energy services.
- Clean energy business opportunities.
- Clean energy jobs.



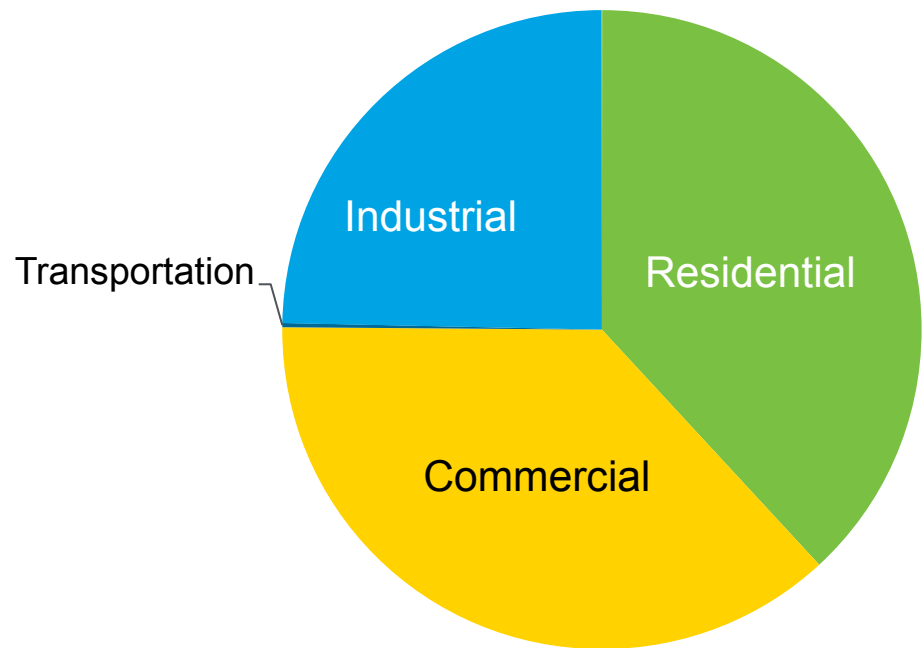
U.S. Energy Demand in 2009

Primary Energy Use by Sector



Total: 94.5 Quadrillion BTU

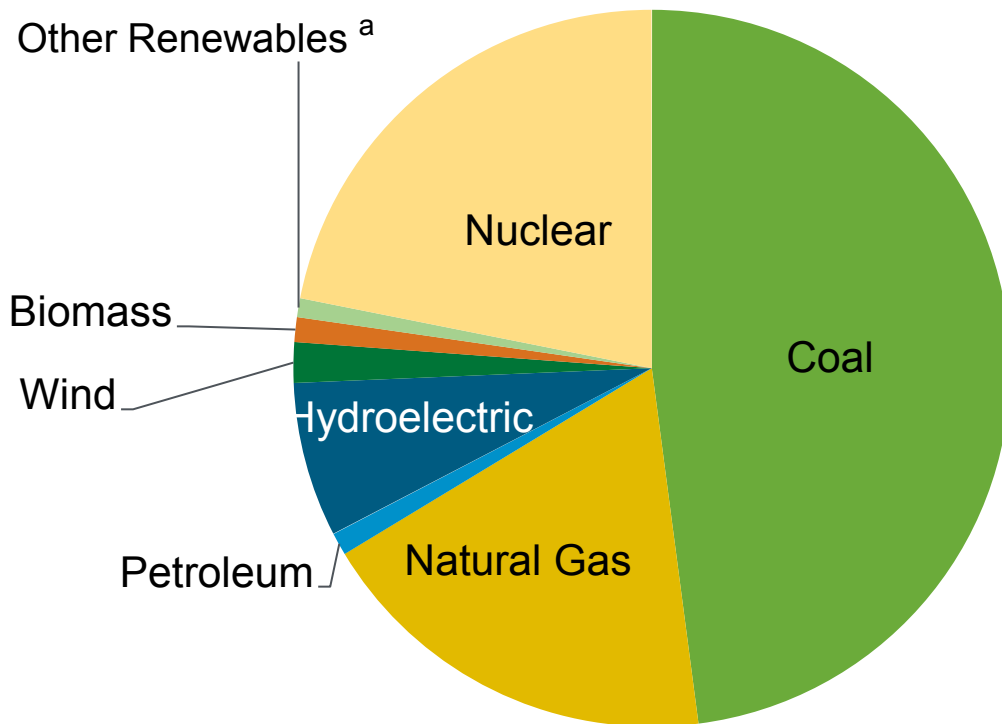
Electricity Use by Sector



Total: 3.6 billion kWh
(12.2 Quadrillion BTU delivered from 38.3 primary)

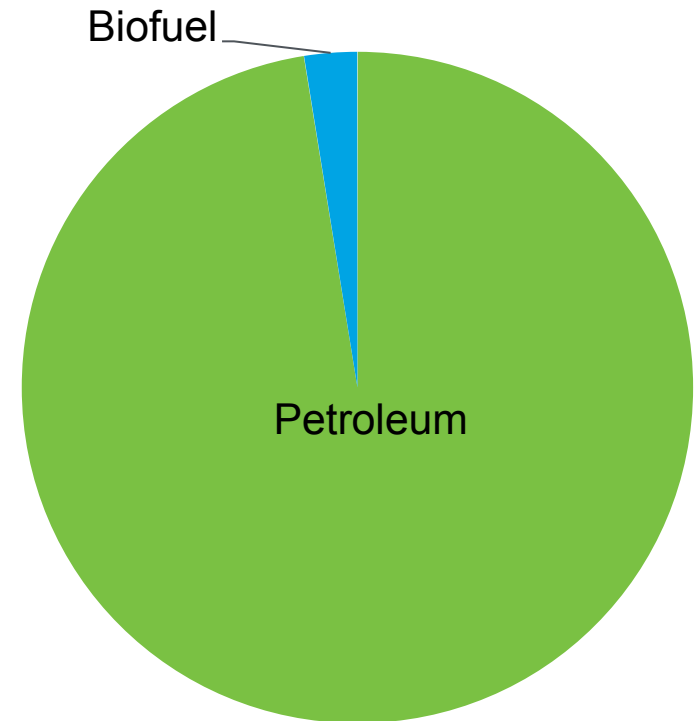
U.S. Energy Supplies in 2009

Electricity Generation by Source



^a Includes geothermal and solar

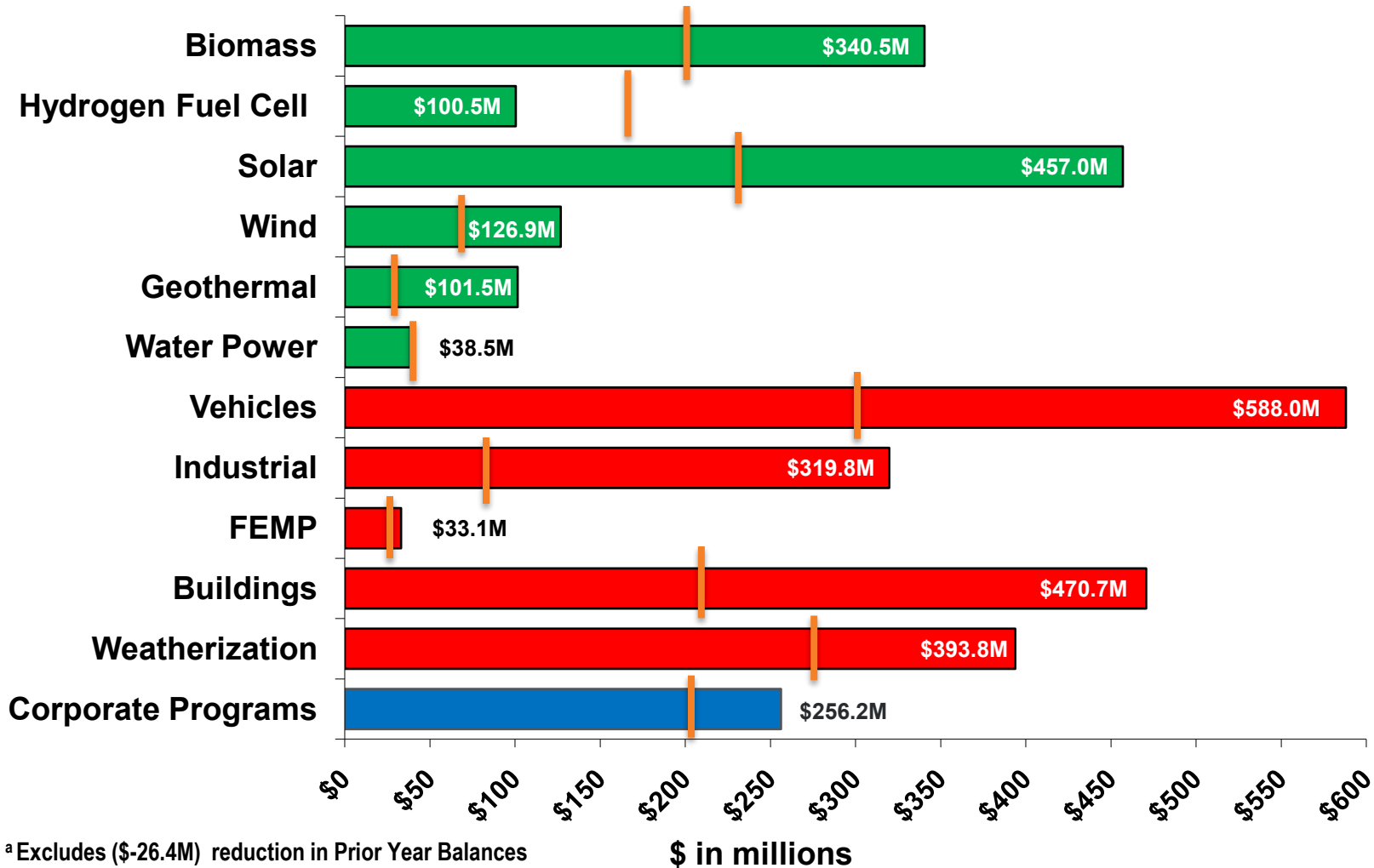
Liquid Fuel by Source



Total: 36.1 Quadrillion BTU

Funding by Program

FY 2012 Budget Request (\$3,226.4M)^a

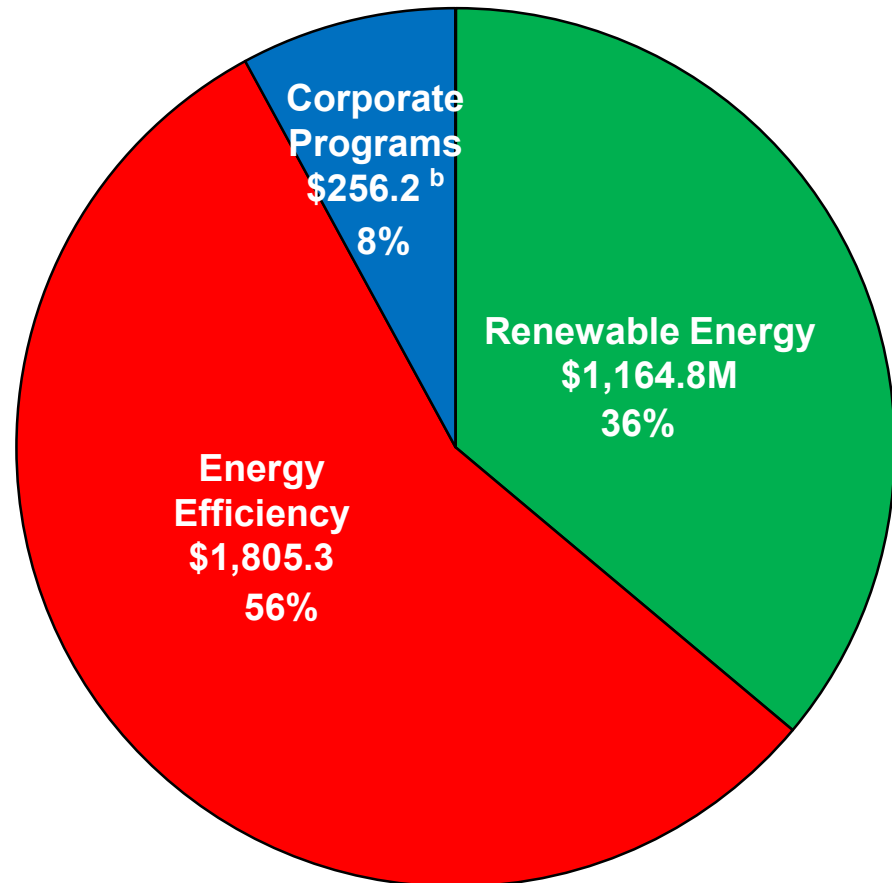


^a Excludes (\$-26.4M) reduction in Prior Year Balances

| = FY2010 Current Appropriation

Budget Request by Sector

FY 2012 Congressional Budget Request (\$3,226M)^a



Corporate Programs	(\$ in millions)
Program Direction	\$176.6
Strategic Programs	\$53.2
Facilities and Infrastructure	\$26.4
Total	\$256.2

^a Excludes (\$-26.4M) reduction in Prior Year Balances

^b Strategic Programs includes Planning, Analysis and Evaluation; Technology Advancement and Outreach; Strategic Priorities and Impact Analysis; Commercialization; and International.

Budget Table

Energy Efficiency and Renewable Energy FY 2010 - FY 2012 Comparison (\$ in thousands)				
Programs	FY 2010	FY 2012	FY12 Request vs FY10 Current Approp	
	Current Approp. ^a	Congressional Request	\$ Change	Percent Change
Buildings Technologies	219,046	470,700	+ 251,654	+ 114.9%
Industrial Technologies	94,270	319,784	+ 225,514	+ 239.2%
Vehicles Technologies	304,223	588,003	+ 283,780	+ 93.3%
Federal Energy Management Program	32,000	33,072	+ 1,072	+ 3.4%
Weatherization & Intergovernmental	270,000	393,798	+ 123,798	+ 45.9%
Solar Energy	243,396	457,000	+ 213,604	+ 87.8%
Wind Energy	79,011	126,859	+ 47,848	+ 60.6%
Geothermal Technology	43,120	101,535	+ 58,415	+ 135.5%
Water Power	48,669	38,500	- 10,169	- 20.9%
Hydrogen and Fuel Cell Technologies	170,297	100,450	- 69,847	- 41.0%
Biomass and Biorefinery R&D	216,225	340,500	+ 124,275	+ 57.5%
Total, Technology Development	1,720,257	2,970,201	+ 1,249,944	+ 72.7%
Facilities and Infrastructure	19,000	26,407	+ 7,407	+ 39.0%
Strategic Programs	45,000	53,204	+ 8,204	+ 18.2%
Program Direction	140,000	176,605	+ 36,605	+ 26.1%
Congressional-Directed Activities	292,135	0	- 292,135	- 100.0%
Adjustments	0	- 26,364	- 26,364	0.0%
Total, Other Activities	496,135	229,852	- 266,283	- 53.7%
Total, EERE	2,216,392	3,200,053	+ 983,661	+ 44.4%

Green = Renewable Energy
 Red = Energy Efficiency
 Blue = Corporate Programs
 Black = Other

^a F&I for South Table Mountain (STM) \$44M was transferred to Solar (\$22M) and Building Tech. (\$22M) for the Hubs.

STM was funded with ARRA approp. Also, \$26.1M was transferred to the Office of Science for SBIR/STTR.

Clean Energy Innovation Highlights

Energy Efficiency

- **Buildings** – Partner with industry to design cost-effective integrated building systems, including sensors, software, meters, and diagnostics for building owners and managers to use to save. Provide competitive grants to states and localities to dramatically accelerate energy-efficiency policies and upgrades to existing buildings that will more than pay for themselves. Engage organizations in energy savings practices. Bring better information to more home owners through the Home Energy Score program and meet all appliance standard deadlines.
- **Industry** – Research partnerships designed to accelerate growth in the energy productivity of American manufacturing and drive down the cost of clean energy technologies with innovations in manufacturing processes and advanced materials. New HUB on critical materials and rare earths to cut U.S. dependence on foreign sources. Partnership with NIST.
- **Vehicles** – Expand electric vehicle research and development to address cost competitive goals sooner (making them life cycle cost effective) and accelerate transportation clean vehicle infrastructure with competitive grants to local government and industry partners.

Renewable Energy

- **Solar** – “Sunshot,” accelerate R&D to reduce the installed cost of solar electricity by about 75%. With innovations in component design, performance, manufacturing, installation, and non-technical barriers (e.g., permitting processes), the installed costs for PV systems can be reduced to \$1 per Watt for large scale systems which is equivalent to a levelized cost of electricity of 5-6 cents per kilowatt hour — which makes solar without subsidies competitive with the wholesale rate of electricity nearly everywhere in the U.S.
- **Wind** – Accelerated R&D to increase reliability of existing land-based turbines and to develop innovative, low-cost, reliable wind turbine equipment for offshore installations.
- **Geothermal** – Develop a new generation of geothermal energy systems that use waste carbon dioxide instead of water to capture heat and make electricity.
- **Hydrogen and Fuel Cells** – Focus on critical R&D innovation to enable fuel cells for stationary, transportation and portable power applications. Increase fuel cell power output and reduce hydrogen cost.
- **Biomass** – Complete ethanol research and focus R&D on processes that can use cellulosic ethanol to produce “drop in” replacements for petroleum products (some can produce ethanol as well) at costs fully competitive with petroleum-based fuels. Use reverse auction production incentives to help finance “pioneer” biofuels plants. Scale up fabrication of fundamental biological components to support bio-manufacturing.

Key Deployment Goals

- Double non-hydro renewable energy generation by 2012.
- Support production of cellulosic biofuels through reverse auction. Support validation of commercial/demonstration scale advanced biofuels plants.
- Support advanced battery manufacturing capacity for production of 500,000 plug in hybrid vehicles per year by 2015.
- Demonstrate sustainable business models for residential, commercial, and industrial upgrades.
- Facilitate state adoption of energy efficiency policies that yield more than 1% improvement in at least 10 states.
- Facilitate Federal agencies meeting or exceeding Executive Order 13514 goal of 28% reduction in Federal GHG emissions by 2020.

Management Themes

- Rigorous zero-base review of investment priorities based on potential impact, review of private investments, and identification of key barriers to expanded adoption of clean energy technology.
- Core goal is clean technologies that can compete without subsidies: detailed cost analysis and roadmaps targeting key problems.
- Strengthened research management practices – rigorous peer review, expanded network of providers.
- Increased transparency and external review of programs including new Energy Efficiency and Renewable Energy Advisory Committee.
- Eliminated duplication and ensured consistency among programs using the new Office of Strategic Programs.
- Increased focus on highly innovative approaches that can lead to breakthroughs in products including photovoltaics, wind generators, lighting, biomass products and fuels.

Technology Readiness

Technology Readiness Level Definition

TRL 1	Basic Research: Initial scientific research begins. Principles are qualitatively postulated and observed. Focus is not on applications.
TRL 2	Applied Research: Initial practical applications are identified. Potential of material or process to satisfy a technology need is confirmed.
TRL 3	Critical Function or Proof of Concept Established: Applied research continues and early stage development begins. Studies and initial laboratory measurements to validate analytical predictions of separate elements of the technology.
TRL 4	Lab Testing/Validation of Alpha Prototype Component/Process: Design, development and lab testing of components/processes. Results provide evidence that performance targets may be attainable based on projected or modeled systems.
TRL 5	Laboratory Testing of Integrated/Semi-Integrated: System Component and/or process validation in relevant environment.
TRL 6	Prototype System Verified: System/process prototype demonstration in an operational environment (beta prototype system level).
TRL 7	Integrated Pilot System Demonstrated: System/process prototype demonstration in an operational environment (integrated pilot system level).
TRL 8	System Incorporated in Commercial Design: Actual system/process completed and qualified through test and demonstration (pre-commercial demonstration).
TRL 9	System Proven and Ready for Full Commercial Deployment: Actual system proven through successful operations in operating environment, and ready for full commercial deployment.

Crosscutting Activities – DOE

- **Office of Science:** EERE and Science are collaborating to develop synthetic-biology tools to enhance national capability in biomanufacturing. Advances in nanotechnology and other new materials developed in the Office of Science are moved to advanced product concepts in areas ranging from photovoltaic devices to solid state lighting. EERE works to ensure that the Office of Science is aware of areas where a fundamental breakthrough would be critical for cutting costs or improving the efficiency of key devices.
- **Advanced Research Projects Agency - Energy:** Working collaboratively to achieve SunShot objectives for power electronics and PV. Collaborating in the design of the buildings hub. Collaborations on advanced biofuels feedstock development.
- **Office of Electricity:** Close collaboration on utility policy and regulations for encouraging energy efficiency and on analysis showing how new transmission, smart grid technologies, energy storage, and other advances will facilitate introduction of renewable energy.
- **Fossil Energy:** Collaboration on design of facilities that burn mixtures of coal and biomass, induced seismicity on geothermal.
- **Federal Energy Management Program:** Plays a key role supporting all Federal Government plans to implement Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*.
- **Loan Guarantee:** Supports the research, development and deployment of renewable sources of energy like wind, biomass, geothermal and solar to bolster innovative renewable energy projects.

Crosscutting Activities - Interagency

- **EPA:** Collaborating on Energy Star and other issues. DOE testing provides essential data for E15 rule. Collaboration on advanced fuels/engine research and testing. Collaboration on siting of renewables on brownfields.
- **HUD:** MOU allows DOE to work closely with HUD energy retrofit efforts.
- **USDA:** Collaboration on biomass feedstock.
- **DOI:** Collaboration on permitting and other regulatory issues associated with siting renewables and transmission lines.
- **DOD:** Key collaborator on demonstrations and procurement. Collaborate on siting renewable energy projects in a manner compatible with military mission.
- **FERC:** Key partner for analyzing transmission and other needs associated with rapidly expanding use of wind and solar.
- **ACOE:** MOU on assessing renewable energy generation from Federal hydropower facilities and developing best practices to increase sustainable generation.
- **CEQ:** Collaboration on permitting and siting renewables and transmission lines.
- **NIST:** Partner on innovation in manufacturing and outreach to upgrade manufacturing enterprises.

Sample of 2010 Accomplishments

- **OWIP:** Trained 375,000 new workers through SEP.
- **OWIP:** Created over 15,000 jobs and completed retrofits on 300,000 low income homes.
- **OWIP:** Continuing to retrofit 25,000 homes per month.
- **BIOMASS:** Supported 29 integrated biorefineries in various stages of completion. Each DOE dollar leverages \$1.7 in private funding.
- **FUEL CELLS:** Lowered the cost for fuel cells sized for automobile use to \$51/kw (assuming volume production), down from \$275/kw in 2007.
- **GEOTHERMAL:** Demonstrated that geothermal brine can be a source of lithium and other strategic minerals that can be used in batteries.
- **SOLAR:** Set a world record: a 27% efficient single junction solar cell.
- **SOLAR:** Beat (by 6.5%) a previously held record by demonstrating a 18.5% efficient low-indium thin film (CIGS) solar cell.
- **WIND:** Completed advanced computer designs of 3 highly innovative deep off-shore wind designs.
- **WATER:** Launched 7 new hydroelectric facility upgrades – the first in 20 years.

Sample of 2010 Accomplishments

- **BTP:** Supported the development of new standards for commercial buildings that are expected to result in a 22% reduction in the energy use of new commercial buildings.
- **BTP:** Supported the development of residential energy codes that are expected to reduce the energy used by new residential buildings by 30%.
- **BTP:** Issued eight appliance standards since January 2009 that will save customers \$260 billion dollars by 2030.
- **FEMP:** Set an all time federal record: Implemented \$589 million in federal energy savings performance contracts that will result in savings to the taxpayer of over \$1.1 billion over the contract lifetime.
- **ITP:** Verified a steel blast furnace using 30% less energy than conventional designs.
- **ITP:** Partnered with Yahoo to create a data center operating with 25% less energy than conventional designs.
- **ITP:** Set a world record by partnering with industry to build 35%-47% efficient small to medium gas engines for distributed power generation.
- **VTP:** Reduced cost of PHEV Lithium Ion battery to \$800 per kilowatt-hour, a 20% reduction from 2008 baseline of \$1000 per kilowatt-hour.

Program Detail Slides

- Buildings Technologies
- Industrial Technologies
- Vehicle Technologies
- Federal Energy Management Program
- Weatherization & Intergovernmental
- Solar Energy
- Wind Energy
- Geothermal Technology
- Water Power
- Hydrogen and Fuel Cell Technologies
- Biomass and Biorefinery R&D
- Facilities and Infrastructure
- Strategic Programs
- Program Direction

Program Focus/New Directions: Develop and scale up deployment of technologies, tools, and standards for making residential and commercial buildings and appliances more energy-efficient, affordable, and better performing.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Residential Buildings Integration	39,194	49,000
Commercial Buildings Integration	38,290	224,000
Emerging Technologies	84,562	102,700
Technology Validation and Market Introduction	22,000	25,000
Equipment Standards and Analysis	35,000	70,000
TOTAL	219,046	470,700

^a \$2,638 and \$316 were transferred to the Office of Science for SBIR and STTR.

Key Activities

- **Residential Buildings Integration (\$49.0M):** Integrate advanced building technologies to reduce the energy consumption of existing and new homes. The focus will be to continuously improve and replicate the results from Better Buildings and expand the Home Energy Score Pilot into a national program.
- **Commercial Buildings Integration (CBI) (\$224.0M):** DOE is requesting funds for a new major competitive program to demonstrate innovative approaches to improve the efficiency of the commercial sector and to launch a major initiative for cost effective energy efficient retrofits in commercial buildings. By 2020 reduce energy intensity of commercial buildings (energy use/unit area) by 20%..
- **Emerging Technologies (\$102.7M):** Research fills identified gaps in technical performance and/or cost reduction needed to accelerate market penetration including: Energy Efficiency Hub; study of climate impacts of cool roofs; solid state lighting (145 lumens per Watt); envelope and windows (highly insulating (R5)); heating ventilation and air conditioning (new cooling fluids); and analysis tools and design strategy.
- **Technology Validation and Market Introduction (\$25.0M):** Transform the market through the testing and verification of ENERGY STAR products. Increase the energy efficiency of both the residential code and commercial code by 50%, through high quality technical analysis and partnerships with the International Code Council, ASHRAE and stakeholder groups.
- **Equipment Standards and Analysis (\$70.0M):** DOE is committed to clearing the backlog of delayed actions, while simultaneously meeting all new requirements instituted by EPACK 2005 and EISA 2007. In FY 2012, BTP will complete 8 energy efficiency standards while working on 42 product classes.

Program Focus/New Directions: Research and develop advanced manufacturing and materials technologies and accelerate industrial adoption of energy efficient and clean energy technologies. Help U.S. producers to become global leader in the production of clean energy technologies.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Industries of the Future (Specific)	11,798	0
Next Generation Materials	0	100,784
Next Generation Manufacturing Processes	51,594	129,000
Industrial Technical Assistance	30,878	75,000
Manufacturing Energy System Partnerships	0	15,000
Total, Industrial Technologies	94,270	319,784

^a \$1,546 and \$184 were transferred to the Office of Science for SBIR and STTR.

Key Activities

- **Next Generation Materials (\$100.8M):** Initiate competitively selected R&D projects that focus on innovations in materials and materials processing technologies. Establish an Energy Innovation Hub for Critical Materials to fund R&D on novel approaches to reducing our dependencies on critical materials, and R&D leading to material and technology substitutes that will improve flexibility and help meet the material needs of the clean energy economy.
- **Next Generation Manufacturing Processes (\$129.0M):** Initiate competitively selected R&D projects that focus on innovation in manufacturing processes to achieve step-change reductions in energy and carbon footprints. Develop a suite of advanced manufacturing technologies that provide pathways for doubling the energy productivity of U.S. industry.
- **Industrial Technical Assistance (\$75.0M):** Conduct up to 300 energy audits of small and medium-sized manufacturing plants while providing training to 200 engineering students in energy efficiency. Continue development of and launch a credible, transparent industrial energy efficiency certification program. Initiate a partnership with NIST's Manufacturing Extension Program to help America's manufacturers upgrade existing facilities with energy efficient technologies.
- **Manufacturing Energy Systems Partnerships (\$15.0M):** Support three knowledge development and dissemination centers to help solve critical manufacturing issues and accelerate emergence of the most promising clean energy technologies into full-scale manufacturing.

Program Focus/New Directions: Strategic research, development and deployment activities supporting the goal of 1 million electric drive vehicles on U.S. roads by 2015.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Batteries and Electric Drive Technology	98,566	188,000
Vehicle and Systems Simulation and Testing	43,732	58,000
Advanced Combustion Engine R&D	55,987	49,000
Materials Technology	49,303	38,000
Fuels Technology	23,421	18,503
Outreach, Deployment & Analysis	33,214	236,500
TOTAL	304,223	588,003

^a \$6,377 and \$765 were transferred to the Office of Science for SBIR and STTR.

Pursuing advanced vehicle technologies to reduce petroleum use and carbon emissions.

Key Activities

- **Battery and Electric Drive Technologies (\$188.0M):** Develop next generation battery technology and prototype systems that provide full electric drive vehicle performance and reduce cost to \$300/kWh at high volume production. System level focus on advanced integrated motors and power electronics to achieve reduction of weight, volume, and cost. Emphasize motor designs that minimize or eliminate use of rare earth materials.
- **Vehicle and Systems Stimulation & Testing (\$58.0M):** Includes new focus on wireless charging of in-motion and stationary electric vehicles, high efficiency HVAC systems and vehicle thermal load reduction, comprehensive codes and standards for communications and power management between vehicles, chargers and the grid. Accumulate 112 million miles of plug-in hybrid and electric vehicle testing by 2015.
- **Advanced Combustion Engine R&D (\$49.0M):** Novel combustion regimes, advanced combustion engines, and thermoelectrics to improve passenger vehicle fuel economy by 25% to 40%, and 20% for commercial vehicles in 2015. In cooperation with the Office of Science, develop predictive simulation computer model to optimize engine efficiency & reduce emissions and cost.
- **Materials Technology (\$38.0M):** Multi-material vehicle validation of 50% weight reduction compared to 2002 mid-sized body and chassis. Develop non-rare earth element alloys for high performance lightweight magnesium extrusions.
- **Fuels Technology (\$18.5M):** Expand work on engine and transmission lubricants to demonstrate 2% fuel efficiency improvement from improved lubricants (2015). Demonstrate next generation biofuels in ultra-clean combustion regimes.
- **Outreach, Deployment & Analysis (\$236.5M):** Support community based EV deployment initiatives via Clean Cities focusing on competitive awards to establish EV infrastructure, local policy incentives and streamlined permitting processes, supporting the President's goal of a million electric drive vehicles on the road by 2015.

Federal Energy Management Program

Program Focus/New Directions: Facilitates the Federal Government's implementation of sound, cost effective energy management and investment practices resulting in lifecycle savings of over 52 trillion Btus. Increased funding for technical assistance will support Federal cost and GHG reduction efforts by developing guidance, technical assistance and GHG reporting protocols.

Key Activities

Project Financing (\$10.1M): Facilitates Federal agencies' access to private sector financing to fund energy efficiency improvements through its Energy Savings Performance Contracts (ESPCs), public benefit funds, and Utility Energy Service Contracts (UESCs) program support which results in lifecycle savings of about 33 trillion Btus. These projects will be financed with about \$290 million in investment from private sector and utility sources.

Technical Guidance and Assistance (\$12.0M): Provide unbiased, expert technical assistance in areas such as audits for buildings, new technology deployment or analytical software tools with projects resulting in lifecycle savings of about 19 trillion Btus. Increased funding will support Federal cost and GHG reduction efforts, technical assistance and GHG reporting protocols.

Planning, Reporting and Evaluation (\$5.0M): Required by statute to collect, verify, and report on progress by the Federal agencies (including the DOE) toward the Federal energy management goals of reducing energy intensity in buildings, reducing petroleum usage, and conserving water. Also, FEMP supports an awards program, strategic communications, training and greenhouse gas accounting, reporting and guidance development.

Federal Fleet (\$2.0M): Assist Federal agency with technical assistance and support to meet the goals for reducing petroleum use by 20 percent and to increase alternative fuel consumption by 10 percent between 2005 to 2015 in vehicles as set forth in Executive Order 13423.

DOE Specific Investments (\$4.0M): Includes activities designed to implement Federal sustainability goals throughout the DOE complex. Provides technical assistance and coordinates DOE sustainability efforts and progress toward energy, environment, water, sustainable buildings and associated goals. These activities support DOE's efforts to meet goals established by E.O. 13514 and 13423, and associated statutory requirements. Supports DOE in implementing its Strategic Sustainability Performance Plan (SSPP).

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation	FY 2012 Congressional Request
Project Financing	11,800	10,072
Technical Guidance and Assistance	8,000	12,000
Planning, Reporting and Evaluation	3,000	5,000
Federal Fleet	3,000	2,000
DOE Specific Investment	6,200	4,000
TOTAL	32,000	33,072

Weatherization and Intergovernmental Activities

Program Focus/New Directions: Accelerate deployment of energy efficiency and renewable energy technologies, policies, and practices by building on successful Recovery Act initiatives with State and local governments, utilities, and Native American tribal governments.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation	FY 2012 Congressional Request
Weatherization Assistance Grants	210,000	320,000
State Energy Program	50,000	63,798
Tribal Energy Activities	10,000	10,000
TOTAL	270,000	393,798

Key Activities

- **Weatherization Assistance Grants Program (\$320.0M):** The program will support over 48,000 residential energy retrofits and prepare of thousands of workers for “green” careers. Formula grants result in reduced national energy consumption and energy costs for low-income families. Thirty percent of the retrofits will be completed through the expanded innovative weatherization demonstrations.
- **State Energy Program (\$63.8M):** Formula grants support innovative State and local energy projects and protects the core capability of energy offices. “Special Projects” competitive grants have a significant energy impact by addressing “policy” and “financial” components of the technology deployment process. The program also supports grantees through outreach and technical assistance and performance management improvements.
- **Tribal Energy Activities (\$10.0M):**
 - The program builds partnerships with tribal governments to address Native American energy needs. Competitive financial support and technical assistance stimulate clean energy project planning and implementation on tribal lands.
 - Management of FY 2012 programs complement the \$11.5B in State and local energy efficiency and renewable energy projects initiated under the Recovery Act.

Program/Focus:

- “SunShot” - Enable grid parity before the end of the decade by achieving \$1/W installed price for PV (without subsidies).
- Develop new innovative materials and thermal storage to enable CSP to compete with intermediate and baseload power markets.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Photovoltaic R&D	125,778	336,600
Concentrating Solar Power	49,023	50,000
Systems Integration	23,055	43,400
Market Transformation	23,540	27,000
Fuels from Sunlight Hub^b	22,000	0
TOTAL	243,396	457,000

^a \$3,218 and \$386 were transferred to the Office of Science for SBIR and STTR.

^b Fuels from the Sunlight Hub is requested by DOE's Office of Science in FY 2011.

Key Activities

- **Photovoltaic R&D (\$336.6M):**
 - “SunShot” goal of \$1/W is mandatory (nominally 5-6 cents / kW-hr) if U.S. is to regain PV manufacturing competitiveness. Collaborative effort amongst Office of Science, ARPA-E and EERE to develop modules, power electronics.
 - Advanced PV R&D (long-term) to explore innovative concepts and materials in laboratory-scale devices to achieve transformational cost reductions.
 - Prototype cell development (mid-term) of commercially-relevant prototype designs which promise disruptive cost reductions. Provides means for “start-up” companies to scale to pilot manufacturing of innovative designs/processes. Improves manufacturing through use of NREL’s Process Development Integration Laboratory.
 - R&D for BIPV applications and PV supply chain critical to low cost material goals
 - Integration for \$/Watt demonstration and Product validation (near-term) at large scale including validation of manufacturing processes.
 - Measurements & Characterization and Test & Evaluation – standardized performance, diagnostics, and reliability measurements needed for technology validation.
- **Concentrating Solar Power (CSP) (\$50.0M):**
 - R&D to develop next generation components, thermal storage that can provide a up to a 75% capacity factor, and advanced high temperature technologies to enable CSP to compete in intermediate and baseload power markets.
 - Components and system development and demonstration.
 - Thermal storage, new concepts for thermal energy storage and implementation.
- **Systems Integration (\$43.4M):**
 - Component development including inverters, DC-AC converters, module racking, and other hardware. Modeling and simulation to address unique solar grid integration issues associated with high penetration (e.g., variability, voltage regulation, and reliability). Develop and implement codes and standards.
- **Market Transformation (\$27.0M):**
 - Increase domestic solar market penetration by removing and standardizing regulatory and financial market barriers
 - Reducing non-hardware balance of system costs (standards for siting, permitting, installation practices, etc.).
 - Support key implementation projects and partnerships with states, utilities, local governments and other stakeholders to assess policies and business models that accelerate adoption of solar energy.

Program Focus/New Directions: Improve cost, performance, and reliability of land and offshore utility wind; facilitate wind energy's rapid market expansion; and address potential barriers to integrating wind into the electric transmission system.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Technology Development and Testing (formerly Technology Viability)	46,167	107,825
Technology Application	32,844	19,034
TOTAL	79,011	126,859

^a \$881 and \$108 were transferred to the Office of Science for SBIR and STTR.

- By 2020, reduce the unsubsidized cost of energy from land based wind energy systems operating in Class 4 wind regimes from 9.0 cents/kWhr (2010 baseline) to 7.4 cents /kWhr
- By 2020, reduce the unsubsidized cost of energy from offshore wind energy systems operating in Class 6 wind regimes from 26.9 cents/kWhr (2010 baseline) to 10.0 cents /kWhr

Key Activities

- **Technology Development and Testing (\$107.8M):**
 - Research and Testing Targeted research and testing to improve the affordability, reliability, and performance of wind turbines:
 - Detailed testing and analysis of wind turbine drivetrains and blades to improve reliability, manufacturing processes and materials, aerodynamics and aeroacoustics.
 - Leverage National High Performance Computing assets to develop higher resolution capacity factor (Cf) prediction models to improve annual energy production (AEP) and lower the cost of energy.
 - Offshore Wind: Support and accelerate responsible deployment of the first U.S. offshore wind energy projects:
 - Prioritize R&D, including validation testing, on innovative integrated, direct drive turbines and deepwater platform systems needed to lower capital costs, increase energy capture, reduce risk and bring U.S.-developed technologies to the global market.
 - Partner with industry, states and research institutions on offshore demonstration projects to mitigate technical, environmental, commercial, and regulatory challenges.
- **Technology Application (\$19.0M):**
 - Systems Integration: Develop operational strategies to mitigate wind variability, support planning for new transmission facilities to access remote renewable resources, and develop enhanced wind resource characterization information and capabilities by: (1) Exploration of new methods to ensure power system reliability under high penetration wind scenarios. (2) Advance recently executed MOU with NOAA via public-private partnerships for improved wind energy forecasting and modeling of complex wind plant inflow.

Program Focus/New Directions: In FY 2012, the Program will **balance long-term high-risk and near term low risk** approaches to enable **nationwide** geothermal deployment - including low temperature and coproduced resources, permeable sedimentary resources and innovative exploration technologies. The use of **super-critical carbon dioxide** as a geofluid for enhanced geothermal systems (EGS) will also be explored.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Enhanced Geothermal Systems	43,120	61,535
Low Temperature and Coproduced Resources	0	14,000
Systems Analysis	0	5,000
Innovative Exploration Technologies	0	15,000
Permeable Sedimentary Resources	0	6,000
TOTAL	43,120	101,535

^a \$786 and \$94 were transferred to the Office of Science for SBIR and STTR.

Key Activities

- **Enhanced Geothermal Systems (EGS) (\$61.5MM):**
 - R&D of technologies that enhance reservoir performance and sustainability to decrease near-field EGS LCOE to 18 cents/kWh* in 2012.
 - Initiate R&D effort to validate tools, methodologies and predictive models.
 - Explore the use of carbon dioxide as a geofluid to decrease water consumption and improve conversion efficiency in areas where CO₂ is readily available for instance near natural CO₂ reservoirs.
- **Low Temperature Coproduced Resources (\$14.0M):**
 - Initiate R&D to improve heat exchanger, cooling and water usage efficiencies and continue system demonstrations to improve overall system power output.
 - Establish a LCOE baseline for resources coproduced with oil or gas with the aim of reducing LCOE to 8-10 cents/kWh by 2016.
- **Systems Analysis (\$5.0M):**
 - Complete the Geothermal Vision Study to determine impacts of a high geothermal deployment scenario and demonstrate that geothermal can play a major role in meeting the Nation's energy needs.
 - In partnership with the U.S. Geological Survey, complete the sedimentary basin resource assessment to establish valid resource estimates encouraging industry investment.
- **Innovative Exploration Technologies (\$15.0M):**
 - Advance technologies that can determine temperature at depth without drilling and remotely predict temperature to reduce high upfront exploration risks and costs for green field resources.
 - Conduct RD&D in remote sensing, geochemistry and advanced geophysical techniques and establish a baseline for site exploration costs.
- **Permeable Sedimentary Resources (\$6.0M):**
 - Assess feasibility of scalable innovative systems to achieve low risk energy production through modeling of reservoir thermal evolution and economics.
 - Design and validate component technologies.
 - Develop integrated subsurface and power conversion systems through field-scale projects.

* Based on NREL 2010 Analysis

Program Focus/New Directions: Establish baseline COE for each MHK technology platform by 2013; Support Development of 100 MW of new, environmentally sustainable hydropower generation by 2015.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Water Power	48,669	38,500
TOTAL	48,669	38,500

^a \$1,188 and \$143 were transferred to the Office of Science for SBIR and STTR.

- Test 20 marine and hydrokinetic devices and components to determine baseline cost, performance, and reliability by 2015
- Complete feasibility studies at facilities to identify opportunities for at least 5% increased conventional hydropower electricity generation through equipment additions and upgrades, powering existing non-powered dams, and adding new pumped storage hydropower facilities:
 - 25 Feasibility Studies completed by 2012
 - 125 Feasibility Studies completed by 2015

Key Activities

- **Conventional Hydropower (\$19.6M):**
 - Complete 25 facility upgrade feasibility studies that will lead to select detailed engineering studies to capture 100 MW of additional incremental hydropower by 2015.
 - Increase generation with small hydro and pumped storage hydro technologies, and sub-hourly grid modeling.
 - Complete and validate advanced fish friendly turbine designs.
 - Develop hydro-optimization toolbox to increase energy generation per fixed amount of water.
 - Continue basin scale planning initiative in support of DOE/DOI MOU.
- **Marine and Hydrokinetic (\$17.8M):**
 - Develop, deploy and test at least 10 wave, tidal, ocean current and/or river in-stream energy systems in open water conditions to establish baseline cost of energy and performance by FY 2013 and reduce cost of energy for all marine and hydrokinetic technologies.
 - Develop comprehensive standards governing device design and performance measurement, as well as test facilities, data acquisition instrumentation, and sensors measuring flow, load, and acoustics, to validate device performance, and provide high-quality economic and environmental performance data to enable developers to secure private sector financing for project development.

Hydrogen and Fuel Cell Technologies

Program Focus/New Directions: Develop cost competitive hydrogen and fuel cell technologies for diverse applications to meet long-term goals of \$30/kW for transportation, \$750/kW for stationary power, and \$2-4/gge for hydrogen production and delivery.

Key Activities

- **Fuel Cell Systems R&D (45.5M):** Consolidates the former Distributed Energy, Transportation Fuel Cell Systems, Fuel Cell Stack Component R&D, and Fuel Processor R&D subprograms. Key goals include:
 - Reduce costs by increasing PEM fuel cell power output per gram of platinum-group catalyst from 2.8 kW/g (in 2008) to 6.0 kW/g in 2012 and 8.0 kW/g by 2016.
- **Hydrogen Fuel R&D (\$35.0M):** Will focus on production and storage materials R&D to achieve a 25% reduction in electrolyzer capital cost by 2012, reducing the total hydrogen cost to less than \$5/gge compared to \$6/gge in 2009. Develop materials with photoelectrochemical conversion efficiency of 10% in 2012 compared to 4% baseline.
- **Manufacturing R&D (\$2.0M):** Will develop low-cost, high-volume, continuous in-line MEA quality control measurement technologies in 2012, on track to develop continuous fabrication and assembly processes for polymer electrolyte membranes by 2016.
- **Safety, Codes and Standards (\$7.0M):** Will determine and demonstrate hydrogen storage system testing procedures to enable publication of a Global Technical Regulation by 2012.
- **Systems Analysis (\$3.0M):** Will determine technology gaps, economic/jobs potential, and quantify 2012 technology advancement.
- **Technology Validation (\$8.0M):** Will collect real-world data from fuel cells operating in forklifts, backup power, vehicles, and buses including 2012 projects with DOD (e.g. Hawaii).

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Fuel Cell Systems R&D	75,609	45,450
Hydrogen Fuels R&D	45,750	35,000
Manufacturing R&D	4,867	2,000
Safety and Codes and Standards ^b	8,653	7,000
Systems Analysis	5,408	3,000
Technology Validation	13,005	8,000
Market Transformation ^c	15,005	0
Education ^{b,c}	2,000	0
TOTAL	170,297	100,450

^a \$3,307 and \$396 were transferred to the Office of Science for SBIR and STTR.

^b Activities are funded under Market Transformation in FY 2011.

^c Due to deployments and ongoing data collection and analyses underway through the Recovery Act, these activities are deferred in FY 2012.

Program Focus/New Directions: Develop and transform domestic biomass resources into biofuels, bioproducts, and biopower, specifically: 1) Complete final steps to achieve a modeled cost of less than \$2.00/gal (by volume) of cellulosic ethanol in 2012 and progress toward \$3.00/gal for renewable hydrocarbon fuels by 2017 (both in 2007\$), 2) Collaborate with Office of Science to develop synthetic-biology tools to enhance national capability in biomanufacturing, 3) Validate 15 million gallons of annual advanced biofuel production capacity, and 4) Provide incentive for advanced biofuel production via a reverse auction.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation ^a	FY 2012 Congressional Request
Feedstocks	36,212	16,000
Conversion Technologies	82,115	117,000
Utilization of Platform	97,898	0
Integrated Biorefineries	0	25,000
Analysis and Sustainability	0	10,000
Biopower	0	22,500
Cellulosic Biofuels Reverse	0	150,000
TOTAL	216,225	340,500

^a \$3,369 and \$405 were transferred to the Office of Science for SBIR and STTR.

Key Activities

- **Feedstocks (\$16.0M):** Enable competitive feedstock supply by: 1) reducing dry herbaceous feedstock logistics cost from \$36.10 in 2011 to \$35 per dry matter ton (in \$2007) and 2) initiating algal feedstock, cultivation, and handling activities. FY12's budget reflects the expectation that USDA will lead in the area of sustainable feedstock production.
- **Conversion Technologies (\$117.0M):** Reduce cellulosic ethanol conversion cost to meet 2012 cost target via cost reductions in enzyme and pretreatment. Reduce the thermochemical conversion cost to produce advanced biofuels via improvements in syngas cleanup and pyrolysis technology. Launch an innovative biofabrication initiative to enhance American leadership in biomanufacturing based on synthetic biology.
- **Integrated Biorefineries (\$25.0M):** Validate 15 million gallons of annual advanced biofuel production capacity in demonstration- and commercial-scale biorefineries in support of RFS2 goals.
- **Analysis and Sustainability (\$10.0M):** Quantitative assessments including: feedstock resources, life-cycle GHG emissions, biofuel production costs, and water impacts to target Biomass Office R&D and provide guidance to programs at OSC, ARPA-e, USDA, NSF, and other offices and agencies.
- **Biopower (\$22.5M):** Initiate a competitive solicitation for co-firing biomass with coal and biomass densification RD&D, including a feedstock supply assessment to ultimately add 30MW new generation by 2016.
- **Cellulosic Biofuels Reverse Auction (\$150.0M):** Create a production incentive to reduce risk and encourage investment through demonstrated cash flow. Incentives such as this reverse auction are critical to the financing and initial economic performance of "pioneer" biofuel plants.

Program Focus/New Directions: EERE is responsible for stewardship of the National Renewable Energy Laboratory (NREL) and funds infrastructure related capital investments. These investments maintain and acquire strategic, supporting, and sustaining capabilities at NREL in support of EERE's mission and maintain safety and security standards.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation	FY 2012 Congressional Request
Operation and Maintenance	19,000	26,407
Construction	0	0
TOTAL	19,000	26,407

Key Activities

Operation and Maintenance: General Purpose Equipment/ General Plant Projects/Maintenance & Repair/Security (\$26.4M):

- **General Purpose Equipment (\$3.2M):** Annual investment to maintain and replace administrative support and shared research equipment at NREL.
- **General Plant Projects (\$11.5M):** Annual investment for improvements and upgrades to maintain the operability and safety of EERE real property assets at NREL. This investment is consistent with EERE's commitment to reinvest 2% of total asset replacement value annually to maintain the viability of EERE real property at NREL.
- **Maintenance and Repair (\$3.3M):** Annual funding for basic maintenance and repair of EERE real property assets at NREL.
- **Security (\$8.4M):** Annual funding for security services at NREL.
- **Construction:** No New Construction Requested in FY 2012

Program Focus/New Directions: Support activities that cut across all technology areas in advancing EERE's mission, including: legislative affairs; regulatory affairs; strategic priorities and analysis; innovation and deployment; education and training; communications and outreach; and international. Reduces duplication within programs and increases the effectiveness of each program.

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation	FY 2012 Congressional Request
Communication and Outreach	11,000	11,559
Innovation, and Deployment	7,000	15,145
International	10,000	12,500
Strategic Priorities and Impact Analysis	6,000	7,000
Planning, Analysis and Evaluation	11,000	7,000
TOTAL	45,000	53,204

Key Activities

- **Communication and Outreach (\$11.6M):** Will extend consumer outreach, engagement, and education on energy efficiency and renewable energy technologies to larger audience segments, through additional partnerships, additional targeted public service announcements, paid advertising, on-line content, seasonal campaigns, new media, in-person events, and other methods.
- **Innovation, Training and Deployment (\$15.1M):** Provides specialized expertise in research management, deployment, green jobs training, and other areas. Includes a green jobs training portal.
- **International (\$12.5M):** Funds targeted bilateral and multilateral projects that accelerate development and deployment of clean energy technologies. Includes support for the International Partnership for Energy Efficiency Cooperation (IPEEC), a 15-nation partnership that EERE helped to found and currently chairs.
- **Strategic Priorities and Impact Analysis (\$7.0M):** High impact analysis activities include planning for low carbon renewable energy, transportation, industry, and buildings future scenarios.
- **Planning, Analysis and Evaluation (\$7.0M):** Assesses energy, economic, and environmental benefits of the EERE portfolio. Includes a focus on evaluation capacity building.

Program Focus/New Directions: Provide executive leadership, technical expertise, project management and oversight for EERE technology development portfolio in pursuit of management excellence

Budget Request

Activity	Funding (\$ in thousands)	
	FY 2010 Current Appropriation	FY 2012 Congressional Request
Salaries and Benefits	106,051	131,254
Travel	3,992	2,691
Support Services	18,404	21,885
Other Related Expenses	11,553	20,775
TOTAL	140,000	176,605

Key Activities

Salaries and Benefits (\$131.3M): Supports a Federal workforce to effectively administer a \$3.2 billion base appropriation; execute prior years projects; and Recovery Act investments. EERE workload consists of more than 7,000 contracts, grants, agreements and congressionally-directed projects in various stages of the budget execution process. Federal staff provides executive direction, technical expertise, and business management tools necessary to accelerate the scale and pace at which activities are implemented, executed and closed out.

Travel (\$2.7M): Provides monitoring, project management and oversight for base appropriations and Recovery Act activities. The reduction in funding reflects the anticipation that electronic media will limit personal interface.

Support Services (\$21.9M): Provides contract support at headquarters and EERE field offices to assist in implementing and executing EERE technology development programs. Supports the maintenance and upgrade of DOE business intelligence systems, EERE Corporate Planning System, Performance Dashboards, and local area network.

Other Related Expenses (\$20.8M): Provides for GSA rent and commercial office space for 947 Federal employees and onsite contractors. It also funds building management, security, mail, office equipment, software and licenses, communications, printing, copy centers, supplies and materials, and other administrative services.

Clean Innovative Energy Solutions Securing America's Future



“Our future as a Nation depends on making sure that the jobs and industries of the 21st century take root here in America. And there is perhaps no industry with more potential to create jobs now – and growth in the coming years – than clean energy.”

President Obama

October 2010