FY 2013 Budget Request

U.S. Department of Energy, Energy Efficiency and Renewable Energy

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Henry Kelly, Acting Assistant Secretary

February 14, 2012

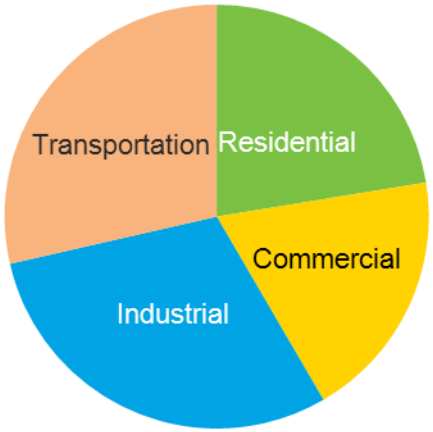
Message from the President

"… I will not walk away from the promise of clean energy. I will not walk away from workers … I will not cede the wind or solar or battery industry … It's time … to double down on a clean energy industry that has never been more promising."

- President Obama, State of the Union, 24 January 2012

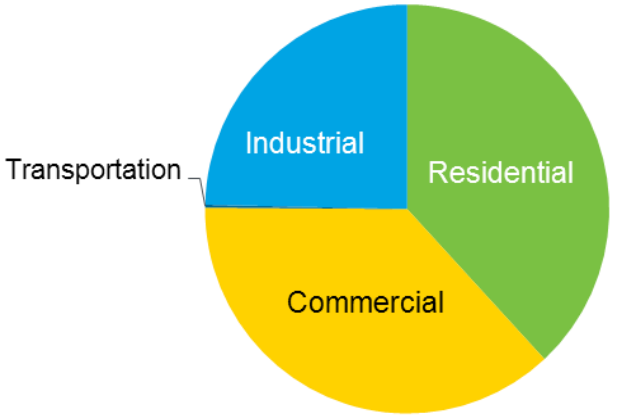
U.S. Energy Supplies and Demand in 2009

Primary Energy Use by Sector



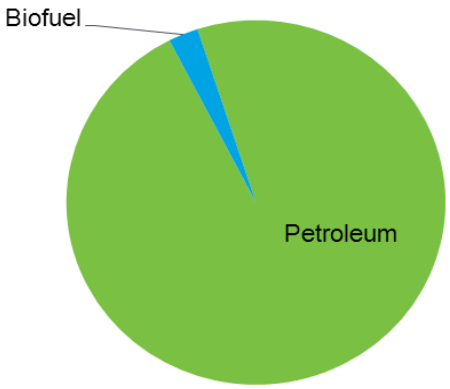
Total: 94.5 Quadrillion BTU, 2009

Electricity Use by Sector



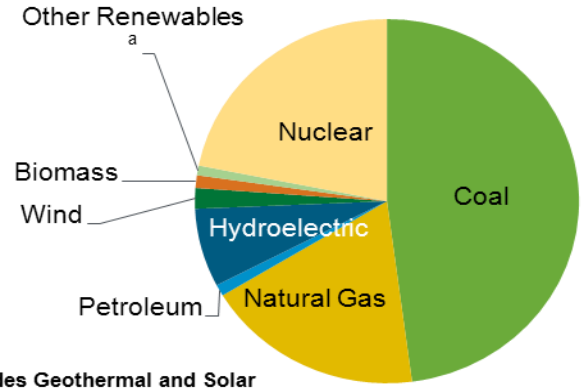
Total: 3.6 billion kWh
(12.2 Quadrillion BTU delivered from 38.3 primary)

Liquid Fuel by Source



Total: 36.1 Quadrillion BTU

Electricity Generation by Source



[a] Includes Geothermal and Solar

Administration Goals

Transport

- Reduce oil imports by 1/3 by 2025.
- Put 1 million electric vehicles on the road by 2015.

Buildings and Manufacturing

- Make non-residential buildings 20 percent more energy-efficient by 2020.

Clean Generation

- By 2035, generate 80 percent of electricity from a diverse set of clean energy sources.

Environmental

- Cut GHG emissions in the range of 17 percent below 2005 levels by 2020, and 83 percent by 2050.

Security:

- Advance domestic energy resources.
- Diverse supplies.

Environment:

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

Economy:

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

EERE Goals

Buildings

- Improve building energy efficiency 50 percent, in a cost-effective manner, by 2030.
- 1 million homes weatherized by 2013.

Industry

- Reduce energy consumption of manufactured goods across targeted product life-cycles by 50 percent or more.

Federal Sustainability

- Reduce federal energy demand by 30 percent by 2015 (2003 base).
- Reduce federal GHG emissions by 28 percent by 2020 (2008 base).

Transportation

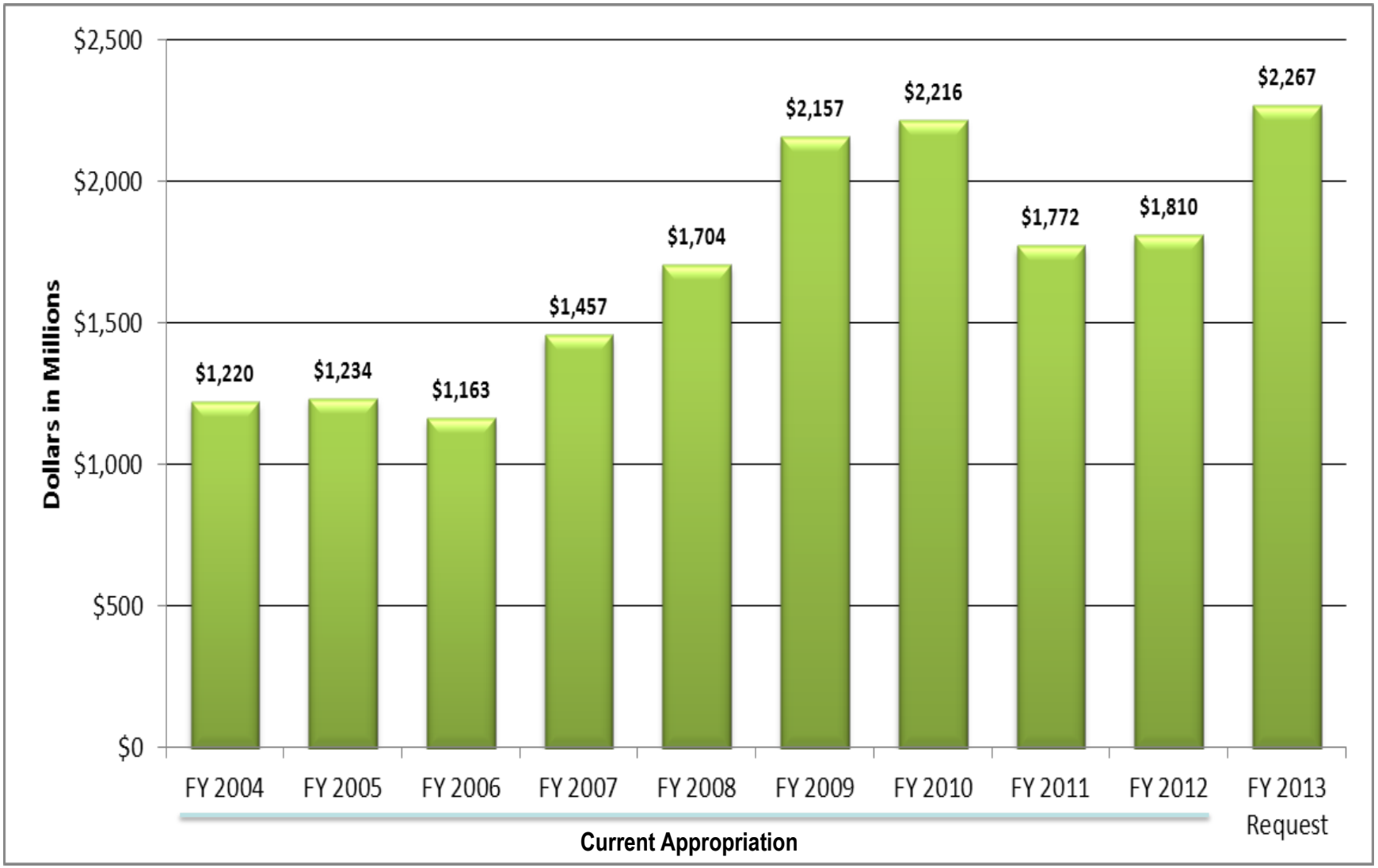
- Reduce oil imports 1/3rd by 2025 and diversify fuel mix:
  - Biomass – Less than $3/gallon (GGE) for drop-in fuels such as renewable gasoline, diesel, and jet fuel.
  - Cars able to achieve fuel economy >60mpg by 2025.
  - Batteries 1/2 today's price in 2015, 1/4 today's price in 2020.
  - Fuel cells for vehicles $30/kW; 5000 hour duration.

Clean Electricity: 80 percent by 2035

- Renewable electricity competitive with conventional sources without subsidies in:
  - Solar (SunShot initiative).
  - Wind - Offshore and Land Utility wind to contribute 20 percent by 2030 (300GW).
  - Water - Cost-competitive conventional hydropower and marine and hydrokinetic water power.
  - Geothermal.

Battery cost based on 2011 modeled cost of $600/kWh.

EERE Budget Trends: FY 2004 – FY 2013



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

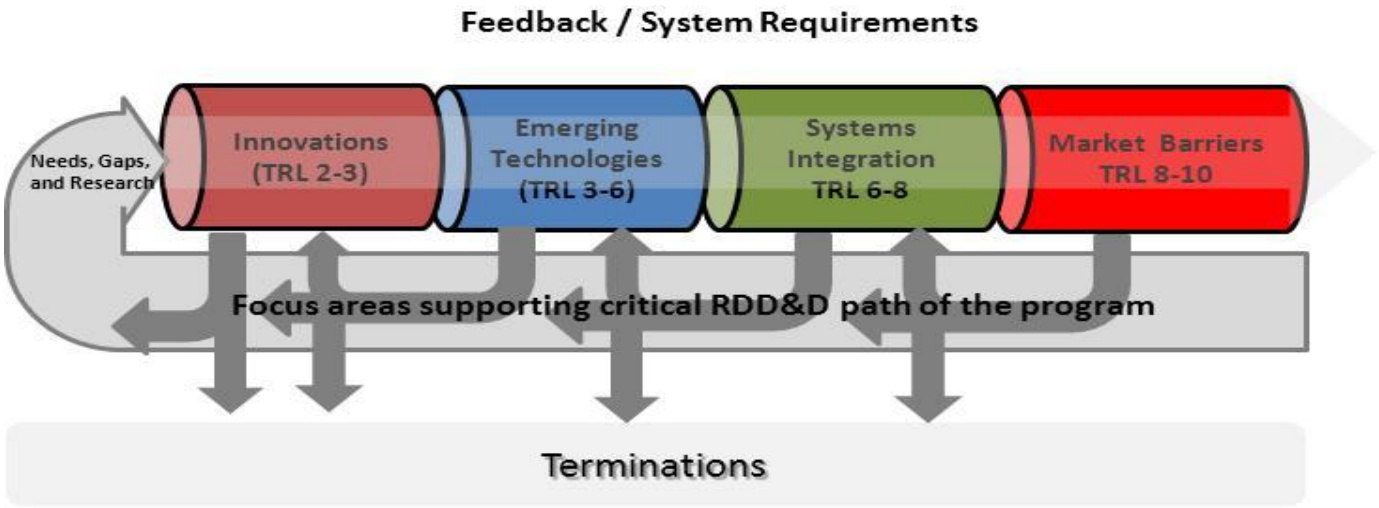
EERE Budget Summary

Programs	FY 2011 Current	FY 2012 Enacted	FY 2013 Request	FY13 vs FY12	
		(Dollars in Thousands)			
Renewable Energy				$ Change	% Change
Biomass and Biorefinery R&D	179,979	199,276	270,000	70,724	35.49%
Geothermal Technology	36,992	37,862	65,000	27,138	71.68%
Hydrogen and Fuel Cell Technologies	95,847	103,624	80,000	(23,624)	-22.80%
Solar Energy	259,556	288,951	310,000	21,049	7.28%
Water Power	29,201	58,787	20,000	(38,787)	-65.98%
Wind Energy	78,834	93,254	95,000	1,746	1.87%
Energy Efficiency					
Advanced Manufacturing	105,899	115,580	290,000	174,420	150.91%
Building Technologies	207,310	219,204	310,000	90,796	41.42%
Federal Energy Management Program	30,402	29,891	32,000	2,109	7.06%
Vehicle Technologies	293,151	328,807	420,000	91,193	27.73%
Weatherization & Intergovernmental	231,300	128,000	195,000	67,000	52.34%
Corporate					
Facilities and Infrastructure	51,000	26,311	26,400	89	0.34%
Program Direction	170,000	165,000	164,700	(300)	-0.18%
Strategic Programs	32,000	25,000	58,900	33,900	135.60%
Subtotal, EERE	1,801,471	1,819,547	2,337,000		
Use of Prior Year Balances	(29,750)	(9,909)	0		
Cancellation of Prior Year Balances	0	0	(69,667)		
Total, EERE	1,771,721	1,809,638	2,267,333		

Realignment of Budget Structure

EERE has aligned its budget structure to be consistent with the approach used to manage its investment portfolio

Technology Readiness Level Approach



- Manage the flow of technology development from research and innovation through the stages of product and process development necessary to bring a technology to private sector commercialization.
- Includes stage gates that result in new data which supports the movement of promising technologies to the next series of TRLs and/or feedback for the necessary revisions or added research, development and deployment.
- Identifies, prioritizes, and determines the critical path and performance necessary to achieve program goals.

Realignment of Budget Structure

Budget Structure

Innovations

RD&D initiatives to identify innovative breakthrough technical concepts in energy technology.

Emerging Technologies

RD&D initiatives to convert innovations into practical technologies and products.

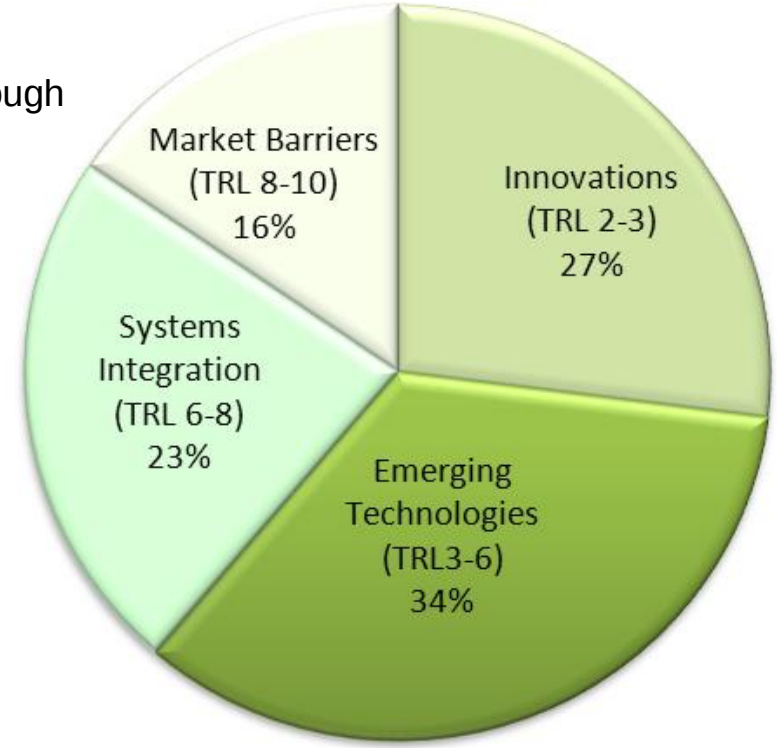
Systems Integration

RD&D initiatives to integrate technologies into functional and efficient energy systems.

Market Barriers

RD&D initiatives to accelerate the adoption of energy technologies into the market (codes and standards; streamlined regulations).

Technology Readiness Level (TRL)*



* Does not include EERE Corporate Programs or Weatherization and Intergovernmental Activities

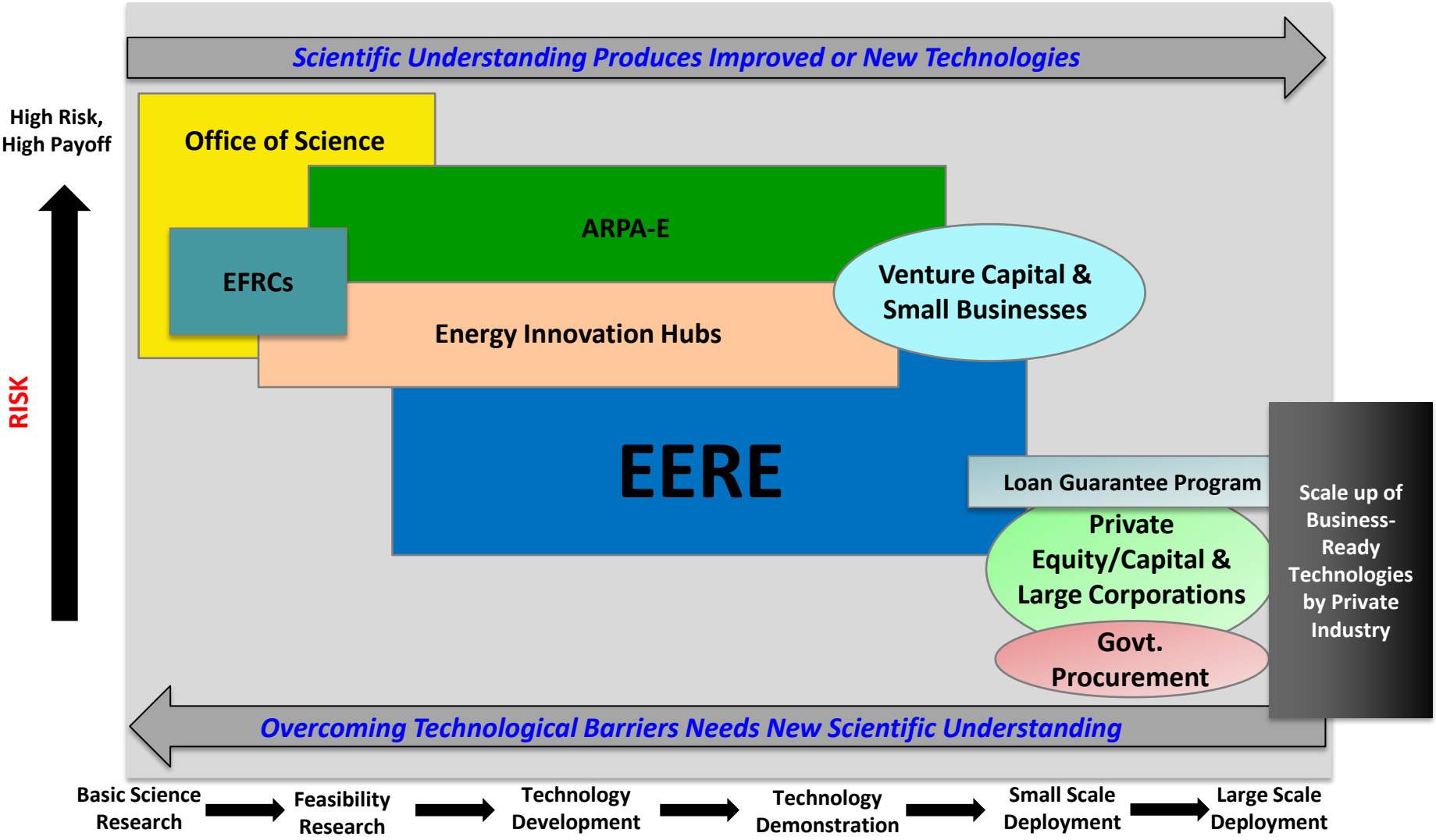
Technology Crosscut: Energy Efficiency

Program	Category	Innovations (Research)	Emerging Technologies (Development)	Systems Integration (Demonstration)	Market Barriers (Deployment)	Total
		(Dollars in Thousands/Does Not Include SBIR/STTR)				
Advanced Manufacturing						
	Materials	15,000	19,000	0	0	34,000
	Processing	20,500	82,000	102,500	0	205,000
	Technology Deployment	0	0	0	31,000	31,000
	Hub: Energy Innovation for Critical Materials	9,695	9,695	0	0	19,390
Building Technologies						
	Better Buildings	0	0	5,000	10,000	15,000
	Buildings Integration	0	0	81,000	0	81,000
	Codes and Standards	0	0	0	98,250	98,250
	Energy Star	0	0	0	2,000	2,000
	Hub: Building Innovation Hub	750	3,000	10,450	9,383	23,583
	Solid State Lighting	6,778	6,773	2,819	8,700	25,070
Vehicle Technologies						
	Battery/Energy Storage	91,460	68,030	0	3,510	163,000
	Power Electronics and Electric Motors	30,727	15,285	0	988	47,000
	Advanced Combustion Engines (minus SuperTruck)	30,309	19,010	0	2,713	52,032
	Vehicle and Systems Simulation and Testing (minus SuperTruck)	2,014	28,381	9,393	9,463	49,251
	Supertruck	0	12,717	0	0	12,717
	Fuels Technologies	7,575	3,700	675	50	12,000
	Materials Technologies	26,244	22,708	0	1,048	50,000
	Outreach, Deployment & Analysis	55	3,505	3,975	26,465	34,000

Technology Crosscut: Renewable Energy

Program	Category	Innovations (Research)	Emerging Technologies (Development)	Systems Integration (Demonstration)	Market Barriers (Deployment)	Total
		(Dollars in Thousands/Does Not Include SBIR/STTR)				
Biomass and Biorefinery Systems RD&D						
	Advanced Feedstocks	1,600	8,700	6,700	0	17,000
	Algae Feedstock	5,000	25,000	0	0	30,000
	Biochemical	44,590	13,910	0	0	58,500
	Thermochemical	22,325	35,175	0	0	57,500
	Integrated Biorefineries	0	0	56,380	37,620	94,000
	Analysis and Sustainability	2,320	2,880	0	4,800	10,000
	Biopower	1,500	1,500	0	0	3,000
Geothermal Technology						
	Enhanced Geothermal Systems	21,154	21,339	1,134	0	43,627
Hydrogen and Fuel Cell Technologies						
	Fuel Cell Systems R&D	27,740	8,360	1,900	0	38,000
	Hydrogen Fuel R&D	22,410	4,590	0	0	27,000
	Manufacturing R&D	940	1,060	0	0	2,000
	Technology Validation	0	250	4,750	0	5,000
	Systems Analysis	1,950	600	330	120	3,000
	Safety, Codes and Standards	1,050	1,550	0	2,400	5,000
Solar Energy						
	Photovoltaic R&D	25,993	40,913	0	0	66,906
	Innovations in Manufacturing / Validation for SunShot	12,000	24,000	75,000	0	111,000
	Concentrating Solar Power	21,072	19,900	4,800	0	45,772
	Systems Integration (Hard BOS)	3,672	25,650	14,500	0	43,822
	Market Transformation (Soft BOS)	8,375	8,375	0	25,750	42,500
Water Power						
	Conventional Hydropower	0	0	2,939	1,673	4,612
	Marine and Hydrokinetic Technology	3,080	6,783	4,129	786	14,778
Wind Energy						
	Distributed	845	532	578	257	2,212
	Offshore	13,675	8,603	9,358	4,157	35,793

EERE Guiding Principles: Leveraging Technology Investments



EERE Design Principles

- Rigorous review of all projects and programs based on consistent analysis and the best available data:
  - Is the problem worth solving (will a solution contribute significantly to meeting national goals)?
  - Is there a realistic opportunity of success (commercial products far from theoretical potential; major market failure)?
  - Is work by other organizations (public and private) adequate?
  - Is it time for EERE to stop (is it time to move on to new areas)?

- Core Strategies
  - Core R&D goal is clean technologies that can compete without subsidies.
  - Core deployment goal: identify market barriers, use tools available to EERE effectively to address them.

- Optimize the portfolio: EE vs. RE, TRL level.

- Form partnerships with business, academic, government groups where appropriate.

Management…efficient, transparent, flexible…continuously improved

- Streamlined procurement and personnel processes.
- Built strong program teams with program officers empowered to develop creative program solicitations, and manage them effectively. Managers empowered to follow projects closely and terminate projects that are failing to meet goals.
- Increased the amount of work selected through open solicitations and peer review.
- Strengthened and streamlined the peer review process.
- In FY10 and FY11, EERE discontinued or terminated funding for 25 financial assistance awards due to lack of technical progress resulting in over $50 million in "recovered funds."
- The Strategic Programs Office manages crosscutting activities efficiently, avoiding duplication, and ensuring consistency in analytical approaches including:
  - Strategic analysis;
  - International programs;
  - Training and education (curricula and tools);
  - Research management policy;
  - Innovation and deployment activities; and
  - Communications and outreach.

National Renewable Energy Laboratory: EERE's National Lab

- FY13 Focus
  - Enhancement of scientific capabilities
    - Strategically build on strong areas, such as, solar, biomass, and wind.
    - Phase out non-core mission areas.
    - Strong management to ensure quality products and close coordination with DOE goals.
  - Effective use of
    - User facilities.
    - CRADAs and other partnerships with industry and universities.

EERE Impact

Strategic EERE and private sector innovation and investments have led to wider clean energy deployment and better products now commonly used or near market entry:

- *Refrigerators:* Half the price and 75 percent more efficient.
- *Windows:* 3x better performance (insulation) widely available; 5x better now on the market.
- *Lighting:* 75 percent+ lower cost to operate (LEDs and CFLs).
- *Batteries:* 35 percent cost reduction for hybrid and EV car batteries; Nearly every hybrid electric vehicle sold in the U.S. today uses battery technology initially developed with Energy Department support.

EERE Impact

Solar: Innovations contributing to 10x PV cost reduction up to 2010.

Wind: Nearly 47 GW of installed capacity in the U.S.; wind energy installations represent over 35 percent of all new installed capacity over the last 4 years.

Biofuels: Cellulosic (non-food) biofuels are becoming close to cost-competitive with other fuels.

Vehicles: Technologies that saved businesses more than $7.5 billion and helped manufacturers meet fuel economy standards.

Fuel Cells: R&D contributing to more than 80 percent estimated cost reduction of automotive fuel cell technologies since 2002.

Manufacturing: Combined Heat and Power sites increased by 9x, reducing energy costs by up to 50 percent for some manufacturers.

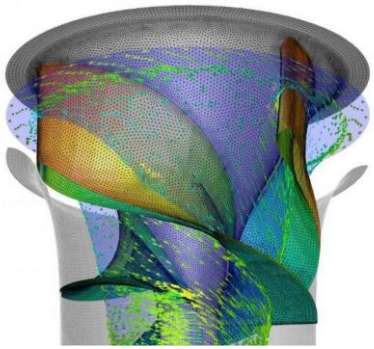
EERE Recent Accomplishments

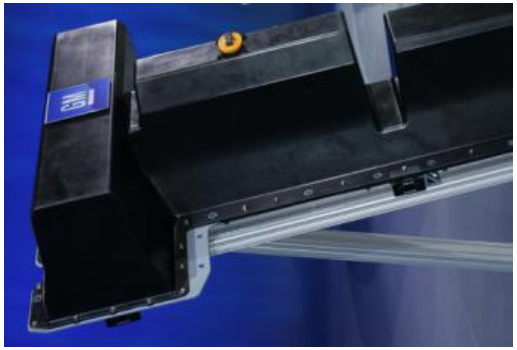
Batteries: Licensed technology that can pack 50-100 percent more energy into the same space compared to conventional cathodes, enabling smaller, lighter batteries.

Solar: $60M in EERE-funded research leveraged more than $1.6B in private capital since 2007.

Geothermal: First demo-scale facility to extract high-quality and cost-competitive battery materials from geothermal brines; potential to produce enough lithium for hundreds of thousands of vehicle batteries per year.

Water: Developed a fish-friendly water turbine with a 98 percent survival rate and no decrease in energy conversion performance.





Note: This chart was updated on Feb. 14, 2012.The SunShot (solar) Incubator program has now leveraged $1.6B in private capital since 2007. DOE budget documents reference $1.3B, an earlier total.

EERE Recent Accomplishments

Appliances: Standards issued since 2009 will save consumers hundreds of billions of dollars through 2030; plan to issue nine new standards through 2013 to save consumers an additional hundreds of billions over 35 years.

Renewables: Industry added enough non-hydro renewable generation in 2010 to power 2M homes; renewables now provide 10 percent of U.S. generation.

Weatherization: Improved the energy performance of 750,000 homes for low-income and other Americans since 2009, supporting more than 13,200 jobs in the quarter ending December 2011.

Program Request

Energy Efficiency

- Building Technologies
- Vehicle Technologies
- Advanced Manufacturing
- Federal Energy Management Program
- Weatherization & Intergovernmental

Renewable Energy

- Solar Energy
- Wind Energy
- Geothermal Technology
- Water Power
- Hydrogen & Fuel Cell Technologies
- Biomass & Biorefinery R&D

Corporate

- Strategic Programs

Building Technologies

Program Overview

- Accelerates the availability of innovative, highly efficient building technologies and practices through RD&D.
- Saves consumers money through increasing the minimum efficiency of new buildings and equipment through model building efficiency codes and the promulgation of national lighting and appliance standards.
- Encourages the use of energy-efficient and renewable energy technologies and practices in residential and commercial buildings and demonstrates them at a convincing scale through market integration activities such as Better Buildings, Building America, the ENERGY STAR partnership with EPA, and continuous improvement programs.

Budget Request

	Dollars in Thousands	
Activity	FY 2012 Enacted	FY 2013 Request
Innovations	10,894	17,567
Emerging Technologies	48,088	89,660
Systems Integration	88,709	98,068
Market Barriers	67,000	98,250
SBIR/STTR	4,513	6,455
TOTAL	**219,204**	**310,000**

Technology and Focus Areas

- **Residential Buildings Integration** will continue to develop technologies and practices to make new and existing homes 30-50 percent more energy-efficient than are deployed in the Building America, Better Buildings Neighborhood and Home Performance with ENERGY STAR activities. The program is near completion of analyzing business models and lessons learned by successful contractors for dissemination to stakeholders interested in developing retrofit programs.
- **Commercial Buildings Integration** will continue to develop a reliable/reputable national commercial building disclosure method and associated asset and operational ratings. Work with industry by providing technical support to stimulate demand for more efficient commercial building technologies such as commercial roof top units, lighting and refrigeration specifications, etc.
- **Codes and Standards** will increase the scope and effectiveness of its energy conservation standards by accelerating the test procedure and standards rulemakings that are currently scheduled and initiate approximately 6 new conservation standards rulemakings and the corresponding test procedure rulemakings.
- **Sensors and Control R&D** will direct competitive awards at projects within the emerging technology stage of development with topics such as the development of enhanced sensor networks and/or a superior controls platform to optimize building energy performance.
- **Solid-State Lighting** will conduct the applied R&D needed to fill technology gaps, provide enabling knowledge or data, and advance the technical knowledge base for Solid-State Lighting to be used for general illumination applications.

Vehicle Technologies

Program Overview

- Suite of technology RD&D includes transportation electrification to lightweight materials, advanced combustion engines, and non-petroleum fuels and lubricant technologies.
- Transportation electrification activities include emerging battery technologies and innovative battery manufacturing processes, power electronics, and electric motors.
- Early demonstration, field validation, and market barrier reduction of advanced technologies and efforts to reduce the vehicle miles traveled by the public.

Budget Request

	Dollars in Thousands	
Activity	FY 2012 Enacted	FY 2013 Request
Innovations	143,978	182,638
Emerging Technologies	113,567	168,209
Systems Integration	19,875	14,043
Market Barriers	43,545	44,237
SBIR/STTR	7,842	10,873
TOTAL	**328,807**	**420,000**

Technology and Focus Areas

- **Battery/Energy Storage** will focus on research in the areas of extremely high energy battery chemistries for use in Electric Vehicles (EVs), Plug-in Hybrid Electric Vehicles (PHEVs), and high power systems for Hybrid Electric Vehicles (HEVs), which offer the promise of significantly lower system costs by reducing the amount of material, processing costs and the number of cells needed. The focus in this area will be new materials and electrode couples that offer a significant improvement in either energy or power.
- **Advanced Combustion Engines** will focus on improving the fuel economy of passenger and commercial vehicles through improvements in engine efficiency. Research on advanced combustion regimes, including homogeneous charge compression ignition (HCCI) and other modes of low-temperature combustion, lean-burn gasoline, and multi-fuel operation, is aimed at achieving this objective.
- **Power Electronics and Electric Motors** will focus on advanced, low-cost technologies and topologies compatible with the high-volume manufacturing of motors, inverters, and DC/DC converters for electric drive vehicles with emphasis on R&D for advanced packaging, enhanced reliability, and improved manufacturability.
- **Materials Research** will focus on enabling the weight reduction of vehicles by addressing fundamental technical barriers and developing new materials such as advanced high strength steels, aluminum, magnesium, carbon fiber, and carbon fiber composites.

Advanced Manufacturing

Program Overview

- New RD&D program focus on innovative energy-efficient manufacturing processes and materials technologies.
- Accelerated activities to develop broadly applicable manufacturing process technologies and pervasive advanced industrial materials that will enable U.S. companies to cut the costs of manufacturing by using less energy while improving quality and accelerating product development.
- Demonstration of materials and processes at a convincing scale to prove reductions in energy intensity and in the life-cycle energy consumption of manufactured products.
- Promotes a corporate culture of continuous improvement in energy efficiency among existing facilities and manufacturers to improve competitiveness using today's cost-effective technologies.

Budget Request

	Dollars in Thousands	
Activity	FY 2012 Enacted	FY 2013 Request
Innovations	38,705	44,112
Emerging Technologies	55,916	107,614
Systems Integration	342	99,374
Market Barriers	17,730	31,000
SBIR/STTR	2,887	7,900
TOTAL	**115,580**	**290,000**

Technology and Focus Areas

- **Next Generation Manufacturing Processes R&D's** Innovative Manufacturing Initiative (IMI) will support cost-shared R&D of transformational manufacturing processes and materials technologies that advance the clean energy economy by increasing industrial and manufacturing energy efficiency. The IMI Funding Opportunity Announcement (FOA) generated an overwhelming response from industry that included over 1,400 Letters of Intent requesting a total $4.3 billion in support. Manufacturing Demonstration Facilities provide a multi-user R&D infrastructure around targeted technical areas that will facilitate the development and exploitation of energy-efficient, rapid, flexible manufacturing technologies and promote broad and rapid dissemination of manufacturing technologies.
- **Next Generation Materials R&D** will support the Energy Innovation Hub for Critical Materials (CM) and complements the Administration's Materials Genome Initiative (MGI). The CM will assess the functionality of critical materials in specific application domains and investigate scalable manufacturing technologies that reduce the need for or make the use of critical materials in these domains obsolete.
- **Technology Deployment** will support the Better Buildings, Better Plants program and the shift of the Clean Energy Application Centers into the Technology Deployment budget for a more integrated and consistent deployment effort. The Program will also continue to support the launch of credible, transparent industrial energy efficiency education and certification programs.

Federal Energy Management Program

Program Overview

- Facilitates the Federal Government's implementation of sound, cost-effective energy management and investment practices to achieve energy, water, GHG, and other sustainability goals.
- Helps Federal Government lock in lifecycle savings of over 47 trillion Btus each year.
- Will reinvigorate the Federal Energy Efficiency Fund to provide direct funding and leveraged cost-sharing at federal agencies for capital projects and other initiatives to increase energy efficiency, water conservation and renewable energy investments.
- Facilitates DOE meeting its sustainability goals.

Budget Request

	Dollars in Thousands	
Activity	FY 2012 Enacted	FY 2013 Request
Market Barriers	29,891	32,000
TOTAL	29,891	32,000

Technology and Focus Areas

- **Project Financing** will assist agencies to meet the goals set forth in the Presidential Memorandum on Performance Contracting (December 3, 2011) which tasks federal agencies to enter into a minimum of $2 billion in performance-based contracts in federal building energy efficiency by December 2013.
- **Technical Guidance & Assistance** will provide analytical support to federal agencies for implementation of more energy-efficient laboratories, new technology deployment, development of federal agency efficiency standards, specification of energy-efficient products for agency procurement, energy assessments, and assistance to help other agencies develop comprehensive planning and internal processes to reduce their energy use and to achieve federal water consumption goals.
- **Planning, Reporting & Evaluation** will provide services including the collection, tracking and verification of federal data (as required by Congress), managing recognition awards program, leading strategic communication and marketing.
- **Federal Fleet** will assist federal agencies with technical assistance to reduce the fleets' total consumption of petroleum products by two percent annually through the end of FY 2015, relative to their respective baselines for FY 2005.
- **Federal Energy Efficiency Fund** will be reinvigorated in FY 2013. This authorized program will provide government-wide assistance and grants to agencies to help them leverage federal and private sector funding to meet mandated energy efficiency and water requirements.
- **DOE Specific Investments** will ensure the integration, coordination and reporting of sustainability efforts across the Department. DOE is committed to reducing its Scope 1 and 2 GHG emissions by 28 percent and Scope 3 emissions by 13 percent by 2020.

Weatherization and Intergovernmental Activities

Program Overview

- Support clean energy deployment in partnership with State, local, U.S. territory, and tribal governments.
- Support energy-efficient home retrofits which lower energy use and costs for low income families while training the retrofit workforce and improving the quality of the workforce.
- Provide technical and financial resources to improve local utility, renewable energy, building code, and building retrofit policies.
- Support feasibility assessments and implementation plans for clean energy projects on Tribal lands.

Budget Request

Activity	Dollars in Thousands	
	FY 2012 Enacted	FY 2013 Request
Weatherization Assistance Grants	68,000	139,000
State Energy Program	50,000	49,000
Tribal Energy Activities	10,000	7,000
TOTAL	**128,000**	**195,000**

Key Deployment and Focus Areas

- **Weatherization Assistance Program (WAP)** funds formula grant projects, which reduce national energy consumption and energy costs for low-income families. FY 2013 support will result in over 21,000 residential energy retrofits. Additionally, in FY 2013 WAP will expand certified training programs for thousands of workers in residential energy retrofits and other energy-related fields.
- **State Energy Program (SEP)** will award 56 formula grants to maintain the viability and capacity of the State Energy Office network and upgrade energy emergency plans. Competitively selected cooperative agreements will support 15-20 state-wide highly leveraged clean energy projects in FY 2013. Furthermore, SEP will assist grantees with the design and implementation of sustainable energy programs through provision of policy and financial "best practice" tools.
- **Tribal Energy Activities** will award competitive grants for the assessment and planning of sustainable energy options, renewable energy installations, and cost-effective energy efficiency projects. Additionally, this activity will develop tools for leveraging existing public and private financing to accelerate the deployment of tribal energy projects.

Solar Energy

Program Overview

The Solar Energy Technologies Program supports the SunShot Initiative's mission to develop solar energy technologies through a collaborative national push to make solar photovoltaic (PV) and concentrated solar power (CSP) energy technologies cost-competitive with fossil fuel-based energy by reducing the cost of solar energy systems by 50 to 75 percent before 2020.

Budget Request

	Dollars in Thousands	
Activity	FY 2012 Enacted	FY 2013 Request
Innovations	79,606	70,045
Emerging Technologies	126,446	117,055
Systems Integration	68,090	93,400
Market Barriers	10,551	25,589
SBIR/STTR	4,258	3,911
TOTAL	**288,951**	**310,000**

Technology and Focus Areas

- **PV Module** will continue to focus on innovation through R&D efforts, which remain a key focus of the program's activities. Increasing cell efficiency, improving reliability, and experimenting with new forms for novel applications are critical to the program's goals. The program has re-focused its efficiency goals for all conversion technologies. Each conversion technology has a 2-3 year R&D focus to track progress against long-term goals. For example, in FY 2013 CdTe R&D has an ambitious 23 percent goal.
- **Innovations in Manufacturing R&D** will focus on development of manufacturing processes which increase efficiency and reduce costs to improve competitiveness of U.S. companies. Two of the program's critical competitively awarded activities, PVMI and SUNPATH, focus on retaining intellectual property, stimulating domestic manufacturing of PV and its supply chain components, and increasing U.S. global competitiveness.
- **CSP Systems** will focus on the R&D to enable CSP to be competitive as a firm capacity power source. In order to achieve this, activities are focused on lowering costs and improving performance and reliability of heliostats and thermal storage, as well as other critical components. Work on higher temperature components will enable higher performance of CSP systems.
- **Power Electronics & Systems** will focus on developing technologies in power electronics that reduce overall system costs, enabling higher penetration of solar technologies onto the grid and enhancing the performance of the system.
- **BOS** will focus on streamlining permitting and inspection costs, identifying innovative new approaches to deploying solar energy, and reductions in hardware costs to drive down the overall BOS cost at the residential, commercial and utility scale.

Wind Energy

Program Overview

The Wind Energy Program conducts research, development, demonstration and deployment activities (RDD&D) in partnership with industry, academia and the National Laboratories for land-based utility-scale, offshore and small and midsize wind, to reduce wind cost of energy, improve wind integrated plant and turbine performance, and facilitate wind energy's rapid market deployment via reduction of market barriers including streamlining siting and permitting, addressing environmental concerns, and improving wind integration into the electric transmission system. The program's goals are for wind energy to compete, unsubsidized, with lowest cost fossil fuel - Natural Gas, projected as $.06/kWh and achieve 20 percent of U.S. electricity generation by 2030 (300 GW).

Budget Request

	Dollars in Thousands	
Activity	FY 2012 Enacted	FY 2013 Request
Innovations	27,279	35,480
Emerging Technologies	29,317	22,321
Systems Integration	24,186	24,280
Market Barriers	10,446	10,786
SBIR/STTR	2,026	2,133
TOTAL	**93,254**	**95,000**

Technology and Focus Areas

For all Wind market areas (Land-based Utility, Offshore Wind, and Small and Midsize Wind):

- **Innovation Concepts and Emerging Technologies** detail designs to reduce the cost of wind to compete unsubsidized with fossil-based alternatives (projected as $.06/kWh). Technology focus to lower wind turbine capital costs with lighter components, higher reliability and lower maintenance. Improve overall plant and turbine performance with higher capacity and lower plant losses.
- **System Integration** via testing and demonstrations to foster market development and private investment of Land and Offshore wind systems, including DOE Offshore wind demonstration project, and innovative land-based testing facilities for independent, industry-wide information.
- **Market Barriers** reductions needed to achieve 300 GW target, via strong intra-agency coordination and advanced, independent siting, radar and environmental studies, and optimized transmission integration. Market barriers will additionally provide annual market data and analysis of emergent policy, economic issues and proactive planning and siting practices.

Geothermal Technology

Program Overview

The Geothermal Technologies Program goal is to establish geothermal as a major baseload contributor to the U.S. energy mix. The Program will implement a balanced portfolio of investments in innovative emerging technologies, systems demonstrations, and activities to address market barriers. By 2020, the Program seeks to demonstrate that Enhanced Geothermal Systems are technically feasible by advancing critical technologies in reservoir creation, reservoir monitoring, and sustainability of sub-surface geothermal reservoirs. The Program focus is establishing EGS field sites, user test facilities, and developing game-changing reservoir creation and management technologies to expand the geothermal capacity more than 10 times from the current geothermal installed capacity of 3 GWe. The program will also aim to pursue technological innovation in finding, accessing, and developing "blind" geothermal resources.

Technology and Focus Areas

- **Enhanced Geothermal Systems (EGS)** activities will support the resource characterization of up to three geologically unique test sites; demonstrate high temperature and pressure drilling technology that could increase the rate of penetration (3x) and allow a high degree of control for monitoring and navigating drilling operations; and publish a scientific and engineering model of EGS.
- **Hydrothermal and Resource Confirmation (HRC)** activities will focus on developing and validating exploration technologies to effectively and efficiently find and access "blind" geothermal resources; continue funding low-temperature power generation projects; address geothermal high cost drilling systems; and develop in-situ logging tools for high temperature and pressure resources.
- **Resource Assessment** activities will release an EGS resource potential map for all 50 states.

Budget Request

	Dollars in Thousands	
Activity	FY 2012 Enacted	FY 2013 Request
Innovations	18,925	27,146
Emerging Technologies	10,056	26,661
Systems Integration	3,882	5,332
Market Barriers	4,000	4,000
SBIR/STTR	999	1,861
TOTAL	**37,862**	**65,000**

Water Power

Program Overview

The Water Power Program supports technology advancement of both emerging marine and hydrokinetic (MHK) technologies and novel conventional hydropower systems that present a pathway to be competitive with fossil fuel-based energy. Cost parity will be rapidly achieved through innovation, critical design improvements and demonstrations that will be accelerated through testing at marine centers of excellence, and through cost-effective demonstrations at our nation's existing hydropower infrastructure. These efforts will help re-establish American technological and market leadership in water power technologies by leveraging key research institutions, and our shipbuilding and naval marine industries; catalyzing economic development through enhanced utilization of our water power resources.

Budget Request

Activity	$ in thousands	
	FY 2012 Enacted	FY 2013 Request
Innovations	5,170	3,080
Emerging Technologies	23,000	6,783
Systems Integration	24,330	7,068
Market Barriers	4,546	2,459
SBIR/STTR	1,741	610
TOTAL	**58,787**	**20,000**

Technology and Focus Areas

- **Marine and Hydrokinetics (MHK) Technology** will focus on developing innovative technologies capable of tapping the vast and predictable energy of waves, tides, and currents. Through cost-shared technology development and demonstration grants, DOE assists this emerging industry with the design, manufacture, testing, and evaluation of leading concepts and designs to prove technical and economic performance. DOE is also concurrently addressing environmental and permitting challenges, and is developing a marine testing infrastructure to accelerate design improvements at a reduced cost to developers.
- **Conventional Hydropower Technology** will continue R&D to support innovation and optimization on small hydropower, pumped storage, and expanding existing hydropower capacity.
  - **Small Hydropower** will support the research, development and demonstration of innovative systems that can capture and convert the energy of water at existing non-powered dams and other conduits/water conveyance systems.
  - **Environmental Mitigation Technologies** will focus on enhancing environmental performance while increasing electricity generation, mitigating fish and habitat impacts, and enhancing downstream water quality.
  - **Pumped Storage Hydropower** will support the development of a world-class PSH system that can cost-effectively provide balancing, reserves and grid stability, to ease the greater integration of variable renewables.

Hydrogen and Fuel Cell Technologies

Program Overview

The Hydrogen and Fuel Cells Technology Program develops technologies to enable fuel cells to be cost-competitive in diverse applications, including light-duty vehicles (at $30/kW) and stationary power (at less than $1,500/kW), and to enable renewable hydrogen (from diverse resources) to be cost-competitive with gasoline ($2 – 4/gge, delivered and dispensed).

Budget Request

Activity	Dollars in Thousands	
	FY 2012 Enacted	FY 2013 Request
Innovations	64,021	52,441
Emerging Technologies	19,465	15,909
Systems Integration	11,421	6,980
Market Barriers	6,180	2,520
SBIR/STTR	2,537	2,150
TOTAL	**103,624**	**80,000**

Hydrogen and Fuel Cell Technologies leverages other EERE program activities (e.g., Advanced Manufacturing and Vehicle Technologies in key areas such as carbon fiber cost reduction).

Technology and Focus Areas

- **Fuel Cell R&D** will improve the durability, reduce costs, and improve the performance of fuel cell systems, through advances in fuel cell stack materials and components, and in balance of plant components and subsystems. Goal:
  - Reduce costs by increasing PEM fuel cell power output per gram of platinum-group catalyst from 2.8 kW/g (in 2008) to 5.9 kW/g in 2013 and 8.0 kW/g by 2017.
- **Hydrogen Fuel R&D** will focus on production from renewable resources, delivery, and storage R&D to achieve a near-term 10 percent reduction in the delivered, untaxed hydrogen cost from the baseline of $8/gge, and develop hydrogen storage technologies to reduce costs by 10 percent in the near term from $17/kWh.
- **Safety, Codes and Standards** will develop and validate fast-fill models to optimize fueling protocols for SAE J2601.
- **Manufacturing R&D** will develop and demonstrate advanced manufacturing technologies and processes that will reduce the cost of fuel cell systems and hydrogen technologies. Goal:
  - Reduce cost of manufacturing membrane electrode assemblies (MEAs) by 25 percent, relative to 2008 baseline of $63/kW at 1000 units/year by 2013.
- **Systems Analysis** will determine technology gaps, economic potential, infrastructure cost reduction opportunities for early market penetration of fuel cells, crosscutting fuel cell applications and integration for EERE technology portfolio and technology advancement in 2013.

Biomass

Program Overview

The Biomass & Biorefinery Program fund research, development, and demonstration projects to advance biofuels and to validate and assist in the commercialization of integrated biorefinery technologies and the development of biomass conversion technologies. Additionally, the program works to produce a variety of biofuels, bioproducts, biopower and evaluate environmentally sustainable feedstocks.

Budget Request

	Dollars in Thousands	
Activity	FY 2012 Enacted	FY 2013 Request
Innovations	89,453	75,344
Emerging Technologies	57,709	84,629
Systems Integration	2,079	62,987
Market Barriers	44,135	42,283
SBIR/STTR	5,900	4,757
TOTAL	**199,276**	**270,000**

Technology and Focus Areas

- **Integrated Biorefineries** activities will continue to support the President's commitment to help entrepreneurs break ground for four next-generation biorefineries – supporting small scale innovative pilots through to larger scale commercial facilities.
- **Biochemical** activities will continue to focus on process integration including pretreatment, clean sugar production and fermentation and/or catalysis to hydrocarbon fuel intermediates and bio-based chemicals. A design case will be developed to target research toward the goal of <$3.00 gal fuel by 2017.
- **Thermochemical** pathway efforts will continue to focus on laboratory scale integration of bio-oil production and upgrading to hydrocarbon fuels. The design cases for fast pyrolysis to biofuels will be re-examined to ensure the optimal cost, carbon and energy-efficient process is chosen.
- **Algae** work include selection of three innovative algae production strains with the necessary traits to produce biofuels, as well as continuation of development of low energy intensity technologies for dewatering algal biomass.
- **Feedstock Logistics** will include the demonstration of using uniform-format densified solid feedstocks and its seamless interface with conversion technology.
- **Biopower** will continue to conduct RD&D on developing more efficient cookstoves with reduced emissions.

Strategic Programs

Program Overview

Strategic Programs supports crosscutting activities that guide, strengthen and communicate EERE technology development efforts. It helps EERE achieve its goals through a robust analytical framework and strong management, and with the greatest possible efficiency. Where appropriate, it encourages consistency of approaches and collaboration between programs.

Budget Request

Activity	Dollars in Thousands	
	FY 2012 Current	FY 2013 Request
Communication & Outreach	6,500	8,900
Innovation & Deployment	6,500	33,500
International	5,000	8,500
Strategic Priorities and Impact Analysis	7,000	8,000
Planning, Analysis and Evaluation	0	0
TOTAL	**25,000**	**58,900**

Key Focus Areas

- **Communications & Outreach** will disseminate information to broaden awareness and understanding of new energy solutions, and leverage new media tools and online multimedia to reach millions of consumers and stakeholders.
- **Innovation & Deployment** will work with the Office of Science to bridge the gap between basic and applied research through collaborative projects that overcome the underlying physical challenges to clean energy technologies and design and test next-generation devices; work with universities, small businesses, and national laboratories to accelerate the development of EERE technologies and their movement into the market; partner with utilities and local governments to validate EERE technologies in areas with unusually high energy costs; expand innovative, interactive training curricula and tools to help ensure a highly skilled workforce.
- **International** will collaborate with and leverage the resources of partner countries and international organizations by providing technical assistance and policy analysis that will accelerate clean energy technology development and deployment, develop global markets and create opportunities for the export of U.S. clean energy technologies and services, and promote energy security by helping to reduce global demand for oil. Partnerships include, for example, China, India, Brazil, and the European Union.
- **Strategic Priorities & Analysis** will provide integrated, crosscutting analysis to inform EERE corporate and program decisions, including: data resources for reliable, up-to-date information on the cost and performance of EERE technologies; systems analysis that assess the integration of multiple EERE technologies to cost-effectively achieve clean energy goals; and market analysis to identify financing structures and tools, supply chain bottlenecks, implications of market conditions, and private sector R&D investments.