

Building Technologies
Funding Profile by Subprogram

(dollars in thousands)

	FY 2010 Current Approp ^a	FY 2012 Request
Building Technologies		
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, Building Technologies	219,046	470,700

Public Law Authorizations:

- P.L. 94-163, "Energy Policy and Conservation Act" (EPCA) (1975)
- P.L. 94-385, "Energy Conservation and Production Act" (ECPA) (1976)
- P.L. 95-91, "Department of Energy Organization Act" (1977)
- P.L. 95-618, "Energy Tax Act" (1978)
- P.L. 95-619, "National Energy Supply Policy Act" (NECPA) (1978)
- P.L. 95-620, "Power Plant and Industrial Fuel Use Act" (1978)
- P.L. 96-294, "Energy Security Act" (1980)
- P.L. 100-12, "National Appliance Energy Conservation Act" (1987)
- P.L. 100-357, "National Appliance Energy Conservation Amendments" (1988)
- P.L. 100-615, "Federal Energy Management Improvement Act" (1988)
- P.L. 102-486, "Energy Policy Act of 1992"
- P.L. 109-58, "Energy Policy Act of 2005"
- P.L. 110-140, "Energy Independence and Security Act of 2007"

Mission

The mission of the Building Technologies Program (BTP) is to develop and promote efficient, environmentally friendly, and affordable technologies, systems, and practices for our Nation's residential and commercial buildings that will lower greenhouse gas (GHG) emissions, foster economic prosperity and increase National energy security while providing the energy-related services and performance expected from our buildings.

Benefits

Buildings account for approximately 40 percent of U.S. energy use and more than 70 percent of the electric energy consumed in the U.S.^b By helping to reduce this significant demand, the program aligns with DOE's goal to provide clean, secure energy by developing reliable, affordable, and

^a Per P.L. 111-85, DOE exercised the option to fund the NREL Ingress/Egress project with Recovery Act funds. The use of this option provided \$22.0 million in funding for the Energy Efficient Building Systems Design Energy Innovation Hub.

^b U.S. DOE Energy Efficiency and Renewable Energy, *2009 Buildings Energy Databook*. November 2009:
<http://buildingsdatabook.eren.doe.gov/Default.aspx>.

environmentally sound energy efficiency technologies, which significantly reduce the energy consumption of both new and existing residential and commercial buildings.

The FY 2012 President's Budget includes a major new initiative – the Better Buildings Initiative – that seeks to achieve a 20 percent improvement in commercial building energy efficiency by 2020. This initiative will catalyze private sector investment through incentives to upgrade offices, stores, schools, and other municipal buildings, universities, hospitals, and other commercial buildings. These incentives include a new tax incentive for building energy efficiency, more financing opportunities for commercial retrofits, a Race to Green competitive grant program for state and municipal governments including incentives for states and municipalities that streamline regulations, codes and performance standards (which is included in the BTP program), and a Better Buildings Challenge with the private sector. This includes expanded research on components and integrated systems that can dramatically increase energy efficiency at a lower cost than building new power plants without sacrificing functionality or safety.

BTP's FY 2012 activities reflect a significant shift by EERE in budget development of incorporating analytically based integrated planning, review, and performance assessment of its programs. BTP's FY 2012 portfolio will achieve rapid gains in the efficient use of buildings energy through a balanced set of strategies. This includes expanded research on components and integrated systems that can dramatically increase energy efficiency at a lower cost than building new power plants without sacrificing functionality or safety. The FY 2012 budget focuses on advanced building components (next generation lighting, heating and refrigeration devices, sensors and controls, windows, shell materials, etc.) and systems integration. Other strategies include appliance standards to bring additional cost savings to consumers appliance standards, accelerated development and adoption of new building codes, development of new information tools on building energy efficiency, building Energy Scores, innovative financing, support for building retrofits, and other methods to accelerate adoption of new efficiency technologies and practices. High-priority FY 2012 investments include providing additional funding to a commercial buildings retrofit initiative (>30 percent of U.S. electricity demand), which is critical to achieving emissions reductions. The initiative will increase integrated commercial buildings technical research to develop and demonstrate new retrofit practices, technologies, and tools for the many types of commercial buildings across the country. This work will support Clean Energy Ministerial initiatives and leverage training programs started under the Recovery Act. The BTP program generates the following benefits:

The U.S. building sector is responsible for 38 percent of total U.S. carbon dioxide emissions.^a BTP contributes to the reduction of GHG emissions by providing technologies that, when commercialized, will make the Nation's buildings more energy efficient. The efficiency gains from these advanced technologies not only reduce the overall energy demand from buildings but also reduce consumption of electricity generated from fossil fuels. The use of energy efficient components and whole-building (systems integrated) design strategies will eventually permit low carbon buildings to become an everyday reality, while keeping the net costs of new components at the same level as existing technologies.

Advanced efficiency technologies can directly reduce oil use in regions of the country that rely on home heating oil, making the Nation less vulnerable to oil supply disruptions or price spikes. R&D activities in components such as advanced envelope and window technologies reduce heating loads in buildings, which reduces building energy use, and therefore reduces the utilization of source energy used in power plants.

^a 2009 Buildings Energy Data Book.

Reduced energy use in buildings can be expected to reduce energy bills for American families and businesses. New technologies developed with the help of BTP and manufactured by the domestic industry will create jobs, spur economic growth, and continue America's role as a global innovator and exporter of high-tech products. Efficient buildings have the added benefit of mitigating the need for the electric power industry to construct expensive new power plants.

BTP projects accelerate deployment of energy efficient retrofits by improving the technology available to retrofit existing buildings, helping Americans save money on their electric bills and lowering GHG emissions. Achieving BTP's goals of reducing the cost of advanced building technologies and homeowner energy bills will permit consumers to use these saved dollars elsewhere.

The proposed FY 2012 investments complement funds provided by the American Recovery and Reinvestment Act (Recovery Act), which support the development of advanced building technologies and deployment mechanisms. Specifically, they support the BTP goals of creating technologies and design approaches that lead to cost effective energy efficient buildings, including making America's existing housing stock more efficient through application of new retrofit technologies and practices. FY 2012 activities will build upon historic clean energy investments in the Recovery Act to further the Nation's energy goals through sustained technology innovation and continued investments in infrastructure. To enable decision makers and the public to follow performance and plans, the program posts its progress in these activities online, at: <http://www.energy.gov/recovery/index.htm>.

Annual Performance Targets and Results

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY 2012 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link <http://www.mbe.doe.gov/budget/12budget/index.htm>.

**Residential Buildings Integration
Funding Schedule by Activity**

(dollars in thousands)

FY 2010 Current Approp ^a	FY 2012 Request
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Residential Buildings Integration	39,194	47,902
SBIR/STTR	0	1,098
Residential Buildings Integration	39,194	49,000

Benefits

Residential Building Integration (RBI) R&D activities will provide energy technologies and solutions to retrofit homes in support of the high priority performance goal for home retrofits. These activities and outputs lead directly to decreased energy use in homes, reduced carbon emissions, and lower homeowner energy bills. BTP activities also invest in National Laboratories and R&D projects contributing to the deployment of science and basic research to create the energy technologies of the future.

Detailed Justification

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request
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Residential Buildings Integration	39,194	47,902
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RBI will continue its R&D into cost-effective, production ready systems. Building America demonstrates strategies to achieve cost-effective energy savings on a production basis by building community subdivisions which will reduce whole-house energy use in new homes by an average of 30 percent by 2013 and 50 percent by 2026 (compared to the IECC 2009 and the Building America Benchmark). Building America is a private/public partnership that conducts research on energy solutions for new and existing homes on a cost-shared basis with major stakeholders in the homebuilding industry. Building America combines the knowledge and resources of industry leaders with DOE's technical capabilities to act as a catalyst for energy efficient change in the home-building industry. Industry partners provide all costs for equipment, construction materials and construction labor used in research projects

DOE conducts residential systems research driven by climate zone specific performance targets and the financial constraint of zero or less net cash flow in three stages for each climate zone. During three stages, Building America acts as a national residential energy systems test bed where homes with

^a SBIR/STTR funding transferred in FY 2010 was \$800,000 for the SBIR program and \$96,000 for the STTR program.

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request
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different system options are retrofitted or designed and built and tested at three levels of system integration, including technology pathways, systems and measures, test houses and pilot communities. These research efforts will result in energy efficient Measures Guidelines and final Energy Efficient Residential Solutions Packages (EERSPs). See tables below for schedules for completion of the packages for new and existing homes. EERSPs provide an integrated, system engineered set of technologies and builder or contractor procedures that achieve a set energy savings level in a particular climate or region.

From the EERSPs developed above, “Best Practices” manuals are designed for contractors, builders, manufacturers, homeowners, real estate agents, educators, insurance companies, and mortgage providers. The manuals present research results in illustrated text targeted to a specific audience to make it easily assimilated. Manuals also synthesize research findings into energy-efficient processes for the building industry. The manuals provide the primary means to communicate research results in the EERSPs to a wider, less technical audience via the web, email and Building America attendance at national conferences. These manuals show consumers, builders, contractors, appraisers, and others how to cost effectively implement energy saving retrofits.

Table 1: Completion of New Homes Energy Efficient Residential Solution Packages

Research Pilots (IECC 2009 + BA Benchmark)	Hot	Marine & Mixed Humid	Cold
30%	2011	2012	2013
50% ^a	2014	2015	2016

Table 2: Completion of Existing Homes Energy Efficient Residential Solution Packages

Existing Home (Pre/Post)	Hot	Mixed-Humid & Marine	Cold
30%	2012	2013	2014
50%	2015	2016	2017

BTP will also develop retrofit measure guidelines that further increase benefits and reduce costs for implementation of retrofit measures. BTP will complete existing homes research for advanced efficiency measures at the 10-15 percent efficiency level in all climate zones in FY 2012. The annual performance goals in Table 1 reflect the transition to IECC 2009 in the 2011 Building America Benchmark and are technically equivalent to the former Building America goals at the 50 percent level of energy savings compared to the 2010 Building America benchmark. The hot dry and hot humid climate zone have been combined into one report and the marine and mixed humid climates have also been combined. The combined reports will have separate sections describing the climate specific technologies and how to implement these technologies. These reports capture the lessons learned from implementing advanced energy efficient technologies in field tests throughout the Nation and communicate it to builders and contractors.

The RBI goal is to maximize cost effective energy efficiency in homes. Consistent definitions of retrofit measures, standardized analysis tools, and standard work scopes and installation guidelines are required

^a The 70 percent design guide for mixed-humid and cold climates may not be technically achievable because of a shift in focus from new construction to pre-existing homes (retrofit) R&D.

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to enable the development of a large, nationwide, market for energy retrofits. This research will include pilot communities that document and measure costs and energy savings. Based on lessons learned from the pilot communities, the research will provide recommendations for improvements in the Work Scopes, Measures Implementation Guidelines, Design Details, Training and Certification Requirements, and Quality Assurance/Quality Control Procedures that were used to implement measures used in community-scale pilot studies. The data and the resulting case studies from these analyses will be used to support the alignment of DOE's Builders Challenge and the EPA's ENERGY STAR new homes program and to initiate wider-scale retrofit programs.

In FY 2012, DOE will complete analysis of the pilot tests initiated in FY 2010 under the Home Energy Scoring Program. This program was launched in cooperation with local governments, electric utilities, and nonprofit partners in ten pilot communities across the country (in both urban and rural areas that cover a range of climates) to gauge how homeowners received the program and whether the availability of accurate information creates a positive incentive to obtain energy improvements for their homes. Based on pilot test results, DOE expects to launch the Home Energy Score nationally in FY 2012. This will expand the Home Energy Score program to more communities across America, empowering homeowners with better information about the energy efficiency of their homes and specific guidance about how to save money by saving energy.

BTP will also increase research and deployment of energy efficiency within existing homes by supporting the Better Buildings Residential Program, DOE's large scale existing homes retrofit initiative. This support will include resources dedicated to the evaluation, monitoring, and implementation of Better Buildings Residential projects with the eventual goal of applying proven best practices to a National retrofit program. In addition, BTP will work with the National Association of Home Builders (NAHB) and national retailers to promote energy efficient home remodeling and retrofits through innovative financing.

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses.

SBIR/STTR	0	1,098
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In FY 2010, \$800,000 and \$96,000 was transferred to the SBIR and STTR programs respectively. The FY 2012 amount shown is the estimated requirement for the continuation of the SBIR and STTR program.

Total, Residential Buildings Integration	39,194	49,000
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Explanation of Funding Changes

FY 2012 vs. FY 2010 Current Approp (\$000)
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Residential Buildings Integration

The increase in funding will enable an increasing emphasis on retrofit R&D to address the large energy saving potential in the existing housing stock. Funding from this reconfiguration will be used to manage and implement the Better Buildings Residential Program and expand the Home Energy Score Program, developing lessons learned from these pilots into a national program.

+8,708

SBIR/STTR

In FY 2010, \$800,000 and \$96,000 was transferred to the SBIR and STTR programs respectively. The FY 2012 amount is the estimated requirement for the continuation of the SBIR and STTR program.

+1,098

Total Funding Change, Residential Buildings Integration

+9,806

Commercial Buildings Integration
Funding Schedule by Activity

(dollars in thousands)

	FY 2010 Current Approp ^a	FY 2012 Request
Commercial Buildings Integration	38,290	219,923
SBIR/STTR	0	4,077
Total, Commercial Buildings Integration	38,290	224,000

Benefits

In FY 2012 the Better Buildings Initiative seeks to achieve a 20 percent improvement in commercial building energy efficiency by 2020. This initiative will catalyze private sector investment through incentives to upgrade offices, stores, schools, and other municipal buildings, universities, hospitals, and other commercial buildings. These incentives include a new tax incentive for building energy efficiency, more financing opportunities for commercial retrofits, a Race to the Green competitive grant program for state and municipal governments including incentives for States and municipalities that streamline regulations, codes and performance standards (which is included in the BTP program), and a Better Buildings Challenge with the private sector.

By the end of FY 2012, Commercial Buildings Integration (CBI) R&D activities, in collaboration with industry, will develop, document, and disseminate a complete set of 16 technology packages that provide builders energy efficient options to meet their complex performance demands. These packages will enable the achievement of a 30 percent to 50 percent reduction in the purchased energy use in new, small to medium-sized commercial buildings relative to ASHRAE 90.1-2004. In FY 2012, CBI will also complete ten retrofit and ten new commercial buildings case studies (that achieve 30 and 50 percent increase, respectively, in energy efficiency relative to the ASHRAE 90.1-2004 benchmark) with five years or less payback. These activities and outputs lead to decreased energy use in commercial buildings and reduced energy bills for American businesses, with direct benefits to the U.S. economy making a significant contribution to the President's goal of 20 percent by 2020.

^a SBIR/STTR funding transferred in FY 2010 was \$634,000 for the SBIR program and \$76,000 for the STTR program.

Detailed Justification

(dollars in thousands)

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Commercial Buildings Integration

38,290

219,923

Race to the Green competitive grant program to State and municipal governments including incentives to improve and streamline codes, performance standards and regulations relating to commercial energy efficiency, DOE will provide competitive grants to empower States and localities to create the conditions for dramatically accelerating energy-efficiency upgrades to existing buildings that will more than pay for themselves. By implementing suites of policies such as adopting modern building codes, benchmarking and disclosing building energy use, and establishing public energy-savings targets, state and local governments can overcome traditional barriers to building energy efficiency and deliver significant energy and cost savings.

CBI is an integral part of the BTP program, engaging private sector companies, public, non-government and trade organizations through Commercial Building Energy Alliances and a competitively selected CBI supporting consortium. As directed by EISA, BTP consults with the supporting partnership consortium and others to establish CBI priorities and plans. Based on those plans, BTP is executing a program of critical RD&D such as sensors and controls; miscellaneous electrical load (MELs); and technology deployment to meet subprogram goals. CBI is also engaging the commercial buildings industry, manufacturer and supplier base, financial institutions, and stakeholder organizations in overcoming regulatory and market barriers to the adoption and use of the technologies, practices, tools, and techniques being developed. Commercial Building Energy Alliances for Retailers, Commercial Real Estate (owned and leased, hospitality), Hospitals, and Institutions (higher education, state, and local government) are vehicles for peer assistance, technology procurement, and sharing of technology assessments and best practices.

BTP is also providing cost-shared research and technical assistance on a competitive basis to Commercial Building Partners. Commercial Building Partners are comprised of business entities with building portfolios of significant square-footage that regularly engage in new construction, and also implement retrofits of existing buildings on a regular basis. Commercial Building Partners are firms that have committed to a building retrofit that reduces energy use by 30 percent, and the design of a prototype new building at 50 percent reduced energy use, relative to ASHRAE 90.1-2004. Building Partners activities enable the development of an in-depth understanding of the technical challenges and gaps, market factors and barriers, and business cases and obstacles associated with achieving CBI goals. As CBI progresses, retrofit and prototype savings targets will be increased to reflect research successes and availability of new and advanced technologies, tools, and practices. In addition to Commercial Building Partner activities, BTP is engaging the full spectrum of research performers (i.e., National Laboratories, universities, and private sector companies) in cost-shared research needed to develop technologies, tools, and practices required to meet the long-term CBI goals.

(dollars in thousands)

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Commercial Building Partnerships are opportunities for DOE to experiment with commercial buildings, the Energy Alliance partners, as well as to enable emerging technology RD&D. In late FY 2010, DOE initiated approximately 20 new retrofit projects with partners. These projects will be measured and validated with regard to the focused technology or strategy deployed. The resulting data will be disseminated into the marketplace, focusing on owners, engineers, architects, and operations and maintenance staff.

In addition, DOE works with the High-Performance Green Building Partnership Consortia, a DOE-recognized building industry group, which provides high-performance green building information and disseminates research results. DOE will support the consortia in development of green building retrofit guides in FY 2012.

To support the robust challenge to continuously maintain energy improvements achieved in corporate properties in the commercial and industrial sectors, DOE will accelerate the introduction of the Global Superior Energy Performance partnership (GSEP) nationally. GSEP was announced internationally as part of the Clean Energy Ministerial and will coordinate national level certification programs. These programs will require commercial facilities to implement energy management systems such as the forthcoming ISO 50001 energy management standard and related measurement and verification protocols. To deploy the program, region-focused and specialty-focused extension centers will develop tools, resources, and materials to use nationally and internationally in support of the GSEP. Once companies take up the challenge to make and maintain energy efficiency improvements, corporations' acceptance and action on the challenge will then create demand within the commercial retrofit marketplace.

DOE is committed to accelerating community scale deployment and engagement in retrofit research and implementation. The U.S. construction industry is highly fragmented with more than a million companies participating in the market. Over 80 percent are small firms with less than 10 employees, two-thirds have fewer than five employees, and less than 1,000 firms employ 500 or more persons. The composition of the construction workforce differs from the U.S. workforce due to the large number of self-employed workers (sole proprietorships and partnerships). Within the construction industry, there are 1.8 million self-employed workers. This fragmentation makes it challenging to achieve the commercial building energy efficiency transformation needed to ensure success in a 21st century economy. BTP will develop a community scale commercial buildings extension partnership, modeled after successful programs in agriculture and manufacturing, as a deployment vehicle for best available technologies, practices, materials, and equipment. This partnership program will:

- Provide ongoing support to the retrofit industry through workforce development efforts focused on standardizing training and certification of the related workforce. Education efforts are directed at unskilled and skilled craft workers, operations and maintenance workers, foremen, and field engineers;
- Deliver technical and business assistance to small and medium enterprises through the delivery of a comprehensive program of analysis, benchmarking, demonstration, road-mapping, advisory, and clearinghouse services, leveraging the existing commercial buildings alliances and partnerships; and

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request
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- Provide analysis of financial, tax, and regulatory incentives to promote the accelerated adoption of emerging new technologies, practices, materials, and equipment and support energy efficiency as a good business decision.

In FY 2012, BTP will also invest in research and deployment activities in the areas of building operations, maintenance, commissioning, and auditing. The Commercial Buildings Program will pilot a small scale commercial building extension program with the National Institute of Standards and Technology (NIST) and universities. This partnership will allow university students and professors to work within their communities to grow the auditing, operations, and commissioning activities with local businesses. It also provides a national network for easily disseminating information and data regarding commercial building retro-commissioning and retrofits.

Commercial Building Design Technology Packages Performance Targets

Characteristics	Units	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Small and Medium Sized Commercial Building Design Technology Packages	30% Energy Savings	0	1	1	2	4	4	0	0	0	0	0	0	0
Commercial Building Design Technology Packages	50% Energy Savings	0	0	0	0	0	0	4	0	0	0	0	0	0
Case Studies (Retrofit)	30% Energy Savings	0	0	0	0	0	0	0	5	10	10	10	10	10
Case Studies (New Buildings)	50% Energy Savings	0	0	0	0	0	0	0	5	10	10	10	10	10

In FY 2012, BTP will continue work on the development of retrofit and new buildings case studies that will help drive a net cost-effective increase (50 percent) in commercial building energy efficiency over ASHRAE 90.1-2004. The Commercial Building Design Team will develop a case study final report documenting all findings to include energy savings, redesign costs, and payback period for each building constructed or retrofitted. These reports will be of laboratory technical quality and peer-reviewed for public distribution. FY 2012 will focus more efforts on documenting energy savings in existing buildings, with ten case studies.

Advanced Energy Design Guides are “code plus” documents, which push 2009 ASHRAE 90.1 or 2009 IECC to be 30-50 percent more efficient. Energy Alliance members will nominate retrofit specific guides in order to concentrate activities, define clear working group meetings with outside partners/stakeholders, and draft a deployment structure that is clear and accessible. These activities will be coordinated with the Code’s program, launched with industry backing, and will be available for communities to adopt. Work on these guides will wind down in FY 2010.

(dollars in thousands)

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Analytical studies on cool roofs report very large carbon mitigation potential through the direct rejection of heat from urban surfaces. However, these claims have not yet been validated. In FY 2010, BTP hosted an international scientific peer review panel and developed a comprehensive research roadmap plan for cool roofs.

Beginning in FY 2012, research will be conducted to develop an accelerated performance rating for cool roofs from the current requirement of three years to six months, allowing for faster introduction of new innovative products in the marketplace. The “aged” performance rating is critical because all roofs get soiled, which reduces their energy performance over time and ratings provide realistic energy savings potential. Significant effort will be required to promulgate the new test procedure in U.S. standard organizations, as well as within International Standard Organizations. Cool roof materials reflect more heat than standard materials and thus lower thermal conduction into buildings, decrease air conditioning requirements and provide additional benefits of urban heat island mitigation in hot climates.

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses.

SBIR/STTR **0** **4,077**

In FY 2010, \$634,000 and \$76,000 was transferred to the SBIR and STTR programs respectively. The FY 2012 amount shown is the estimated requirement for the continuation of the SBIR and STTR program.

Total, Commercial Buildings Integration **38,290** **224,000**

Explanation of Funding Changes

FY 2012 vs. FY 2010 Current Approp (\$000)
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Commercial Buildings Integration

Additional funding is allocated to a major initiative in retrofitting commercial buildings (>30 percent of U.S. electricity demand) critical to achieving Administration goals for emissions reductions. The initiative will increase integrated commercial buildings technical research to develop and demonstrate new retrofit practices, technologies, and tools for the many types of commercial buildings across the country. This work will support Clean Energy Ministerial initiatives and leverage the training programs started under the Recovery Act. DOE will challenge industry to design cost-effective integrated building systems, including sensors, software, and inexpensive meters, to identify and diagnose energy waste and improve efficiency for building owners and

+181,633

**Energy Efficiency and Renewable Energy/
Building Technologies/
Commercial Buildings Integration**

FY 2012 Congressional Budget

FY 2012 vs. FY 2010 Current Approp (\$000)
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managers.

DOE will implement the Race to Green competitive solicitation to state and local governments for innovative programs, including incentives to encourage improvements to codes regulations, and performance standards relating to commercial buildings.

SBIR/STTR

In FY 2010, \$634,000 and \$76,000 was transferred to the SBIR and STTR programs respectively. The FY 2012 amount is the estimated requirement for the continuation of the SBIR and STTR program.

+4,077

Total Funding Change, Commercial Buildings Integration

+185,710

**Emerging Technologies
Funding Schedule by Activity**

(dollars in thousands)

	FY 2010 Current Approp ^a	FY 2012 Request
Emerging Technologies		
Lighting R&D	25,562	25,832
Space Conditioning and Refrigeration R&D	9,000	19,690
Building Envelope R&D	16,000	25,345
Analysis Tools	5,500	4,837
Solar Heating and Cooling	6,500	0
Energy Innovation Hub: Energy Efficient Building Systems Design ^b	22,000	24,369
SBIR/STTR	0	2,627
Total, Emerging Technologies	84,562	102,700

Benefits

Emerging Technologies activities will accelerate the introduction of highly efficient technologies and practices for both new and existing residential and commercial buildings. Emerging Technologies activities support BTP goals through R&D of advanced lighting, building envelope, windows, space conditioning, water heating, and appliance technologies and analysis tools. Without advanced components and subsystems, such as the SSL technologies developed by these activities, the goal of maximizing cost effective energy efficiency in buildings will not be met.

^a SBIR/STTR funding transferred in FY 2010 was \$1,204,000 for the SBIR program and \$144,000 for the STTR program.

^b Per P.L. 111-85, DOE exercised the option to fund the NREL Ingress/Egress project with Recovery Act funds. The use of this option provided \$22.0 million in funding for the Energy Efficient Building Systems Design Energy Innovation Hub.

Detailed Justification

(dollars in thousands)

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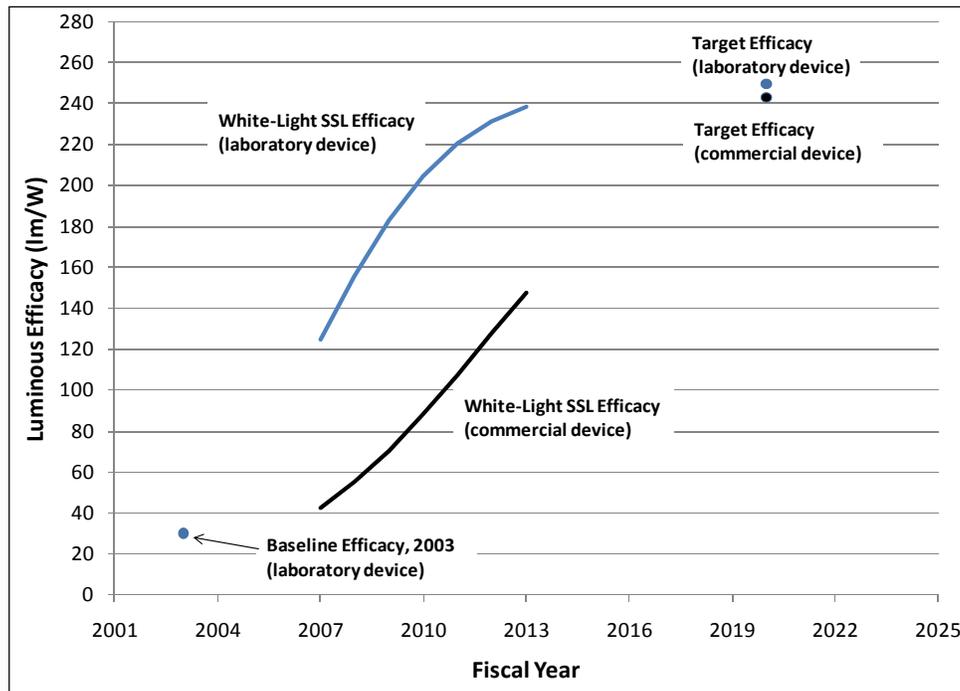
Lighting R&D

25,562

25,832

The R&D agenda of the SSL activities is established through an annual consultative process with general lighting industry, compound semi-conductor industry, universities, research institutions, National Laboratories, trade organizations, other industry consortia, and the Next Generation Lighting Industry Alliance (DOE’s competitively selected SSL Partnership). A majority of the tasks are competitively bid and awarded to entities with proposals that meet these priorities and the SSL portfolio’s stated objectives. The SSL activity classifies projects into three R&D classes: LED Core Technology, Product Development, and Manufacturing Improvements.

Efficacy Projection for White-Light SSL Laboratory Devices (Projections 2005 to 2012)



This projection is translated into point values in the following table, with the five-year target milestones.

Point Values of Efficacy Projections for White-Light SSL Laboratory Devices (fiscal year)

Characteristics	Units	2003 (baseline)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SSL Performance Targets	Lm/W	30	65	79	95	101	110	120	123	126	129	130
Actual		48	65	79	95	107	117	-	-	-	-	-

**Energy Efficiency and Renewable Energy/
Building Technologies/
Emerging Technologies**

FY 2012 Congressional Budget

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SSL R&D Topics

Topic	LEDs		OLEDs	
	Current R&D	Future R&D	Current R&D	Future R&D
Core:	<ul style="list-style-type: none"> • Phosphors • Semiconductor materials • Defect Physics • Light extraction 	<ul style="list-style-type: none"> • Substrates, buffers and wafers • Alternative Structures • Encapsulating and packaging • Fabrication of component prototypes 	<ul style="list-style-type: none"> • Novel Materials • New architectures • Light extraction • Improved charge injection • Transparent electrodes 	<ul style="list-style-type: none"> • Encapsulating materials • Material/structures evaluation • Substrate materials • Down conversion materials • Modeling of material principles • Electrodes and interconnects • Fabrication and patterning techniques
Product Development:	<ul style="list-style-type: none"> • Luminaire life and performance • Optical coupling and modeling • Packaging • Manufactured materials • Thermal design • Materials in devices • Light extraction from devices 	<ul style="list-style-type: none"> • Electronic development • Fabrication and manufacturing challenges • Device architectures • Mechanical design 	<ul style="list-style-type: none"> • Application of materials in fabrication • Applied light extraction • Manufacturing process optimization • Device encapsulation and packaging 	<ul style="list-style-type: none"> • Surface modification techniques • Demonstration architectures • Simulation tools for devices • Power spreading and driver electronics • Luminaire design • Synthesis manufacturing scale-up • Tools for manufacturing
Manufacturing:		<ul style="list-style-type: none"> • Epitaxial growth tools and processes • LED chip manufacturing • Automated LED packaging • LED luminaire manufacturing 		<ul style="list-style-type: none"> • Production of OLED lighting prototypes • Paths to high volume manufacturing of OLED devices

The SSL portfolio currently funds nine core priority R&D topics and eleven Product Development priority R&D topics.^a The second round solicitation awards^b of the SSL Manufacturing R&D Initiative

^a For further information on the SSL R&D Pathways, as discussed at the SSL Workshop by the research community and documented in the Multi-Year Program Plan FY 2009 – FY 2014, see the SSL website: (www.ssl.energy.gov)

^b The date of the first reward will be March 1, 2011.

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may support topics such as: LED Driver Manufacturing, Tools for Epitaxial Growth, OLED Deposition and Patterning Equipment, and OLED Materials Manufacturing. Each year, R&D topics are reviewed for progress, completion of topical areas, new topics to start, and advice from the Alliance and the research community. The R&D topics are reprioritized for each annual solicitation.

FY 2012 focuses will include:

- Core Technology Research: Applied research for technology development, with particular emphasis on meeting efficiency, performance, and cost targets (LED Novel Substrates, buffers and wafers; and OLED Novel Transparent Electrodes);
- Product Development: Using the knowledge gained from basic or applied research to develop or improve commercially viable materials, devices, or systems (LED Electronic Component Research; and OLED Panel Outcoupling); and
- Manufacturing Improvement: Accelerating SSL technology adoption through manufacturing improvements that reduce costs and enhance quality.

Emerging Technologies activities will continue to analyze and address barriers to enable market introduction and commercialization of technologies resulting from these research projects. Included in this activity is the Bright Tomorrow Lighting Prize (L Prize), the first government-sponsored technology competition designed to spur lighting manufacturers to develop high-quality, high-efficiency SSL products to replace the common light bulb.

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses.

Space Conditioning and Refrigeration R&D

9,000

19,690

Space conditioning systems, which transformed the 20th Century by enabling building users to become more productive and comfortable, will continue to play a critical role in achieving BTP's low energy building goal. Space conditioning equipment for residential and commercial buildings consumes approximately 32.5 percent of the total energy used in buildings and is the most important contributor to summer peak electricity demand.^a

Although the energy efficiency of HVAC equipment has increased substantially in recent years, new approaches and technologies are needed to continue this trend. The dramatic reductions in HVAC energy consumption necessary to support low energy building goals require a systems-oriented approach. This approach characterizes each element of energy consumption, identifies alternatives, and determines the most cost-effective combination of options. Therefore, the first task in this effort will involve system characterizations, identification of necessary upgrades to analysis tools, and an assessment of cost and performance of alternative solutions.

To achieve low energy buildings, the Space Conditioning R&D activity will reduce the energy consumption of commercial HVAC and residential water heating equipment by 80 percent over baseline levels by 2020. The residential baseline for HVAC (or HVAC & water heating) is the IECC

^a 2009 Buildings Energy Data Book, U.S. Department of Energy, November 2009.

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(International Energy Conservation Code) 2006.

Space Conditioning System Performance Goals

Characteristics	Status	2007 Target	2010 Target	2020 Target
Annual Residential HVAC, Water Heating and Dehumidification Energy Consumption Reduction vs. Building America benchmark IECC 2006 (demonstrated product)	Baseline	25%	50%	–
Annual Residential Water Heating Energy Consumption Reduction vs. IECC 2006 as the benchmark	Baseline	–	–	80%
Annual Commercial HVAC Energy Consumption Reduction vs. 2004 Baseline	Baseline	–	–	80%

In FY 2012, BTP will continue the development of an air-to-air integrated heat pump system that can meet the air heating, cooling, dehumidifying, ventilating, and water heating requirements of a tight-envelope mechanically ventilated low energy home, and the development of a ground-source integrated heat pump (GS-IHP). New strategies for achieving cost effective energy efficiency will also be assessed, looking at the contribution to low energy buildings, as well as overall market potential. These strategies will include novel ways of integrating highly efficient space conditioning and water heating, while also insuring comfort through proper ventilation and humidity control. Strategies which are essential to achieving low energy homes, but which also have widespread application potential to existing buildings, will be a particular focus of the research.

BTP will continue looking into affordable advanced materials, components, refrigeration cycles, and systems in FY 2012, which improve system energy consumption (including CO₂ systems). BTP will also continue research on non-vapor compression technologies with humidity control to reduce the energy consumption of HVAC, dehumidification, and water heating equipment by 50 to 80 percent over baseline levels. In addition, BTP will work on retrofit technologies, application of nanotechnology to AC component design, development of zero-global warming potential refrigerants, development of next-generation residential water heaters at a cost effective price premium with multi-functional capabilities, development of integrated end-use appliances, and identification of the most promising target technologies and components in miscellaneous electric loads to reduce energy consumption by 30 percent.

Another priority in FY 2012 is the continued development of a new generation of working fluids, refrigerants and blowing agents, with greater energy efficiency and lower global warming impacts. Refrigerants and blowing agents are used in wide variety of appliances, air conditioning, and refrigeration equipment. Refrigerants are the “lifeblood” of vapor compression cycle equipment, which dominates the global residential and commercial HVAC market. New findings and policy developments regarding climate change are putting new pressures on HFC alternatives, because of their high-Global Warming Potential (GWP) values. DOE has a critical stake in the development, evaluation and eventual choice of any new working fluids. A roadmap will be developed that include goals, estimated impacts of

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achieving these goals, and timetables.

Beginning in FY 2012 work will continue on the next generation water heating research: CO₂ heat pump water heaters and absorption natural gas water heaters. BTP will identify Not-in-Kind (NIK) technologies that can replace or be integrated with conventional vapor compression technologies to provide energy savings or other relevant environmental benefits. These different NIK technologies should be comparable or have better performance than state-of-art (SOA) vapor compression systems. NIK technologies could include but are not limited to thermoelectric cooling, thermotunneling (thermionic), thermoacoustic cooling, magnetic refrigeration, absorption cycle heat pumps and compressor-driven metal hydride heat pumps.

The Solar Heating and Cooling (SH&C) key activity is being combined with the Space Conditioning and Refrigeration R&D key activity in FY 2012. SH&C strives to provide the thermal energy needs of a low energy building. Building end uses that can be met by solar thermal technologies include domestic water heating, space heating, and space cooling. The overall goal is a 40 to 50 percent cost reduction of installed SH&C systems with a levelized cost of energy of \$0.06 to 0.08/kWh over the life of the system by FY 2015.^a The overall goal and research agenda for SH&C will be reviewed and by FY 2012 the appropriate role for SH&C within the Space Heating and Cooling Portfolio will be determined.

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses.

Building Envelope R&D

16,000

25,345

Window Technologies

Window performance continues to be vital to reaching residential and commercial buildings goals. Development of cost effective, highly efficient, and dynamic glazing and fenestration systems for all building types throughout the U.S. will require a portfolio of technologies matched to those types and climatic conditions. The table below lists the performance measurement targets for the windows program. All performance measurements are relative to historical baselines that were set as the baseline for new construction in 2003.

^a Warm climates had a baseline of \$0.12 to 0.14/kWh in 1999 and cold climates, on which research has just begun, have a baseline of \$0.18 to 0.20/kWh with a base year of 2009.

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**Windows Performance Goals
Percent Reduction in Energy Use^a**

Characteristics	2003 Status	2010 Result	2015 Target	2020 Target
Energy Consumption Improvement	Base ENERGY STAR (Low E)	37%	40-50%	40-60%

In FY 2012, BTP will continue competitive fundamental science research to develop the second generation of materials, chemical engineering applications, and advanced manufacturing processes that can offer “leap frog” reductions in the cost of dynamic windows while maintaining a high level of reliability and durability with a broad range of optical properties. The second generation of dynamic windows is targeted to enter the market between 2012 and 2015 with substantially lower consumer prices. BTP will also work on cost effective R10 (U value of 0.10) highly insulating windows with conventional low cost multi-pane designs, as well as higher risk, high performance vacuum glazings. These products are needed for colder climates to offer significant savings in existing and new construction applications for all buildings. New innovative integrated daylighting systems will offer greater savings for the commercial building markets.

Thermal Insulation and Building Materials

The Building Envelope element will contribute to low energy building goals and deep retrofit solutions by advancing a portfolio of new insulation, moisture and design guidelines, advanced air sealing techniques, and dramatic performance improvement in exterior insulation finishes systems (EIFS), with both residential and commercial wall applications.

Reducing energy losses through the building enclosure will contribute significantly to DOE’s attainment of a practical low energy building. In pursuit of the next generation of attic/roof systems that will save 50 percent energy over the Building America baseline. The next generation of attic/roof systems integrating thermal mass, ventilation, radiant barriers and advanced insulated roof structures will be completed in cold and mixed climates for the residential, steep slope commercial retrofit and new construction markets in FY 2012. In FY 2012, dynamic roof surface systems will begin to enter the marketplace; however price premiums will still exist. DOE will be working with American Society for Testing and Materials (ASTM) to help develop testing protocols and further evaluations.

The table below lists the performance goals for Thermal Insulation activities. All performance measurements are relative to historical baselines that were set as the Building America regional baseline for new construction. Achieving cost-effectiveness and durability are critical aspects of these targets.

^a These percentage reductions will only be considered complete after meeting technical performance requirements such as incremental price/sq. ft., size (sq. ft.), visual transmittance, solar heat gain coefficient, durability (American Society for Testing and Materials Tests), U-value, and incremental cost \$/sq. ft. FY10 result is for cold and mixed climates for affordable highly insulating windows that have been commercialized for the first time in the U.S.

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Thermal Insulation and Materials Performance Goals

Characteristics	2004 Status (units: R-Value*)	2010 Result (units: R-Value*)	2015 Target (units: R-Value*)
Advanced attic/roof system	30	Dynamic annual performance equal to conventional R-45	Improved dynamic annual performance at no extra cost
Wall insulation	10	Dynamic annual performance equal to conventional R-25 ^a	Improved dynamic annual performance at no extra cost

* R-value measures the resistance to heat flow for a material. The higher the R-value, the better walls and roof will resist the transfer of heat

BTP is developing advanced envelope materials in response to needs identified by the Residential Buildings and Commercial Integration subprograms. Large scale whole house, full scale applications for insulation with phase change materials that offer thermal mass effects to dramatically reduce peak loading. In FY 2012, studies will be continued along with work on new ASTM test standards to provide a metric to market dynamic insulation systems. In addition, new lower cost phase change material will enter the market to allow for a viable industry segment compared to the current niche market that was initiated by a DOE 100 R&D Award in FY 2009.

Under the DOE-wide Dollar-A-Watt Initiative, BTP will work with the Solar Energy Technologies Program (SETP) to understand the potential of Building-Integrated Photovoltaics (BIPV) for renewable energy generation. BIPV is the integration of PV modules directly into building materials (e.g. roofing systems) such that workers in the construction trades can install these integrated PV components during the normal process of building construction or renovation with a minimum of additional training, equipment, or work-flow changes. Because of this integrated installation process, BIPV offers one potential technology pathway to reduce “balance of systems” (BOS) costs for PV installations, which are an increasingly large fraction of the total installed cost of PV systems as the cost of PV modules continues to fall.

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses.

Analysis Tools

5,500

4,837

Similar technologies and design approaches will be applied to improve the performance of existing buildings to accompany BTP’s goals related to new construction. The goals cannot be met through research alone to significantly improve the performance of components (e.g., windows, appliances,

^a Subject to no additional operating cost, within the traditional 3.5-in. wall dimension, with acceptable durability characteristics.

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heating and cooling equipment, and lighting). Meeting the goals also requires a revolutionary approach to building design and operation that can achieve up to 70 percent reductions in load, coupled with careful integration with onsite renewable energy supplies, as well as thermal and electrical storage. Building energy performance is the result of interactions among many elements including climate (outdoor temperature, humidity, solar radiation and illumination); envelope heat and moisture transfer; internal heat gains; lighting power; HVAC equipment; controls; thermal and visual comfort; and energy cost. These complex interactions cannot be understood and quantified without simulation tools. For example, the effect of dimming controls on the electric lights with daylighting includes reductions in lighting electricity use and heat gain from lights. Lower heat from lights reduces cooling use (amount depends on cooling equipment efficiency) and in the winter can significantly increase the heating energy. Thus, the annual impact of daylighting on energy use requires detailed calculations that consider these interactions.^a This in turn requires powerful simulation tools that support evaluation of new demand-reduction and energy-supply technologies throughout building design, operation, and retrofit.

EnergyPlus is leveraged as the basis for a number of commercial products and is a cornerstone of analysis resulting in Advanced Energy Design Guides, codes, and standards. The EnergyPlus Development Team is an ongoing and effective collaboration between National Laboratories, universities, and industry. The team works to accomplish tasks from a prioritized enhancement list developed in consultation with industry. In addition, work will continue to increase the execution speed of EnergyPlus. Two major releases were completed in FY 2010 (October 2009 and April 2010). The releases included updates to increase robustness along with adding several features such as better input data, enhanced control systems, and the addition of several building component models. The EnergyPlus team provides training and user support increasing the adoptability of the program. In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses; and international activities.

Solar Heating and Cooling

6,500

0

In FY 2012, this technology area will be combined with Space Conditioning and Refrigeration R&D in the Space Conditioning and Refrigeration R&D key activity.

^a In a series of field evaluation case study reports, NREL found that simulation tools were one of the essential elements for tuning the building design as well as the operating building performance [Paul A. Torcellini, Ron Judkoff, and Drury B. Crawley, "Lessons Learned: High-Performance Buildings," ASHRAE Journal, September. 2004].

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Energy Innovation Hub: Energy Efficient Building Systems Design

22,000

24,369

As part of the DOE-wide Energy Innovation Hub initiative, EERE awarded the Energy-Efficient Building Systems Design Hub in August 2010 to a consortium of academic, industry and National Laboratory partners led by Pennsylvania State University. The consortium, known as the Greater Philadelphia Innovation Cluster (GPIC), will conduct a program of RD&D to accelerate the innovation and deployment of energy-efficiency technology for buildings.

The GPIC RD&D program focuses on several technology areas including: integrated computer design tools; dynamic subsystems such as building envelopes, HVAC equipment, on-site energy generation, waste-heat utilization, and energy storage; and building control systems to integrate overall building energy operations. The program also focuses on efforts in education and workforce development, by working with regional Workforce Investment Boards to train the construction and retrofit-related workforce in energy technologies and energy-efficient building practices. Finally, the program will focus on understanding the impacts of policy, market, and behavioral factors in the spread and adoption of energy-efficient technologies in buildings.

The program will be divided into five tasks: 1) Integrated Design Processes and Computational Tools for the Delivery and Operation of Energy Efficient Building Systems; 2) Whole-Building Systems, Enabling Components, Robust Controls, and Diagnostics; 3) Economic, Policy, and Behavioral Factors Influencing Building Energy Consumption; and 4) Demonstration, Knowledge Management and Deployment.

Similar to the other Energy Innovation Hubs, the GPIC consortium is basing its operations on a new model of conducting multidisciplinary, integrated research programs. DOE will encourage risk-taking by the consortium by making the initial grant period five years, renewed thereafter for up to 10 years. For the period of the grant, Principal Investigators from the 22 Hub partners will be co-located at a single research facility in the Philadelphia Navy Yard, a former Department of Defense facility closed in the mid-1990s under the Base Closure and Realignment (BRAC) process. The consortium will use the Navy Yard, which has over 200 buildings and an independent electric microgrid, as a "virtual municipality" test bed for energy technology systems and "policy simulation experiments".

The work of the Hub will be integrated with three other related DOE investments in the Philadelphia Navy Yard, including the Mid-Atlantic Clean Energy Applications Center (focusing on combined heat and power technology), the GridSTAR Smart Grid Training Application Resource Center (focusing on training smart grid installers), and the Northern Mid-Atlantic Solar Regional Training Center (focusing on train-the-trainer programs for solar installers).

The Hub also serves as the anchor of the multi-agency Energy Regional Innovation Cluster (E-RIC) initiative. Under this initiative, several other Federal agencies will award funding to organizations partnering with the GPIC to bring expertise in manufacturing and supply chain issues; economic development; education; and workforce development. The participating E-RIC agencies include the NIST, the Department of Commerce's Economic Development Administration (EDA), the Department of Education, the Department of Labor, the Small Business Administration (SBA), and the National

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Science Foundation (NSF).

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses.

SBIR/STTR **0** **2,627**

In FY 2010, \$1,204,000 and \$144,000 was transferred to the SBIR and STTR programs respectively. The FY 2012 amounts shown are estimated requirements for the continuation of the SBIR and STTR program.

Total, Emerging Technologies **84,562** **102,700**

Explanation of Funding Changes

FY 2012 vs. FY 2010 Current Approp (\$000)
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Lighting R&D

Existing Manufacturer R&D Initiatives projects will be maintained. +270

Space Conditioning and Refrigeration R&D

Increase in funding is due to combining Solar Heating and Cooling with Space Conditioning and Refrigeration R&D and expanded investment in the next generation of working fluids, refrigerants, and blowing agents with greater energy efficiency and reduced global warming impacts. These next generation fluids will replace those technologies that are slated to be discontinued due to pending regulatory legislation in the next few years and research is critical to replacing the fluids for the next generation of air conditioners, refrigerators, and other such appliances. +10,690

Building Envelope R&D

To accelerate the development of BIPV systems, BTP will work with SETP in incorporating input from an August 2010 "\$1/W" workshop and a Request for Information (RFI) issued in December 2010. Research may focus on: (a) packaging and encapsulation materials and methods that allow integration into a variety of residential and commercial building envelope components, while avoiding reductions in PV cell performance from rooftop heating; (b) systems that reduce the installation +9,345

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FY 2012 vs. FY 2010 Current Approp (\$000)
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time and cost relative to standard rack-mounted or Building-Applied Photovoltaics (BAPV); and (c) approaches to avoiding or reducing system costs in other building material needs through BIPV installation. BTP will also conduct a series of workshops with the roofing and construction industry to better understand the workforce and training barriers to integrating BIPV systems into the standard building construction and renovation workflow.

Analysis Tools

Software modules are needed to give EnergyPlus design software the capability to run models incorporating the latest in energy efficient building technologies. The funding decrease will reduce the number of new features – originally planned for five functionality improvements - designed for EnergyPlus. Due to a reduced emphasis on new construction, one less module will be released and the funds will be refocused on higher priority R&D.

-663

Solar Heating and Cooling Systems (SH&C)

Reduction reflects the combination of SH&C activities with Space Conditioning and refrigeration R&D.

-6,500

Energy Innovation Hub: Energy Efficient Building Systems Design

The funding increase reflects accelerated activity after the initial period awarding and establishing the Hub.

+2,369

SBIR/STTR

In FY 2010, \$1,204,000 and \$144,000 was transferred to the SBIR and STTR programs respectively. The FY 2012 amounts shown are estimated requirements for the continuation of the SBIR and STTR program.

+2,627

Total Funding Change, Emerging Technologies

+18,138

Technology Validation and Market Introduction
Funding Schedule by Activity

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Technology Validation and Market Introduction		
Rebuild America	1,000	0
ENERGY STAR	7,000	10,000
Building Energy Codes	9,000	10,000
Solar Decathlon	5,000	5,000
Total, Technology Validation and Market Introduction	22,000	25,000

Benefits

Technology Validation and Market Introduction (TVMI) activities increase efficiency levels of buildings and equipment. ENERGY STAR encourages the adoption of very efficient products through a large network of stakeholders using marketing and procurement tools and by training builders to retrofit existing homes.

Building Energy Codes submits code proposals, supports the upgrading of model building energy codes, and provides technical and financial assistance to States to update, implement, and enforce their energy codes to meet or exceed model codes in support of Section 304 of ECPA. It also promulgates standards for manufactured housing as required by Section 413 of EISA. These activities and outputs increase the energy performance of newly constructed homes and commercial buildings, target consumers, assist them in reducing energy bills, and contribute to job creation in the construction industry.

Solar Decathlon is a high-profile university competition that promotes public awareness of highly efficient building technologies and energy efficient homes using solar energy. The competition fosters innovation and encourages incorporation of new building technologies and design practices into engineering and architecture university curricula.

Detailed Justification

(dollars in thousands)

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Rebuild America

1,000 0

The Rebuild America activities, e.g. EnergySmart Schools and EnergySmart Hospitals have been realigned with the Commercial Buildings Integration activities in FY 2011.

ENERGY STAR

7,000 10,000

Through its partnership with more than 7,000 private and public sector organizations, ENERGY STAR delivers the technical information and tools that organizations and consumers need to choose energy efficient solutions and best management practices.

DOE will continue to raise the efficiency targets of ENERGY STAR products and support program enhancements as stated in the MOU between DOE and EPA signed September 30, 2009. The DOE ENERGY STAR team will work with EPA to help promote currently labeled products. A three-pronged strategy will be deployed in FY 2012 to support the portfolio of existing technologies: 1) develop and maintain procedures for testing ENERGY STAR products; 2) verify compliance with program requirements, while identifying and addressing product performance issues; and 3) work with EPA and participating manufacturers, retailers, and energy efficiency program sponsors on certification and product testing.

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses.

Building Energy Codes

9,000 10,000

In FY 2012, BTP will initiate analyses, support upgrading the next generation of ASHRAE 90.1 codes, and set substantial new efficiency targets. Upgrades will include performance criteria based on size, internal functions, and envelope characteristics (beyond the current prescriptive criteria) permitting the next substantial increase in code stringency.

Efforts to improve the ASHRAE and IECC Codes must align with the existing cycles used by the two bodies to update their respective codes. The cycles include periods for new technical proposals, review, comment, and revision, and generally take three years. In previous revision cycles, both the ASHRAE and IECC codes have been improved incrementally at the rate of one to two percent per cycle. With increased emphasis on building energy codes, the current goal is to increase both ASHRAE and IECC codes by 50 percent over baseline in the ongoing revision cycle and increase adoption by all States. Significant progress has been made towards these goals, with estimated increases of 10 to 11 percent for ASHRAE and 15 percent for IECC since 2006. These ongoing improvements contribute to reaching DOE's goal of maximizing cost-effective energy efficiency.

DOE will also conduct analyses and publish determinations in the Federal Register as to whether each new edition of the baseline model codes will improve the energy efficiency of buildings.

Determinations are to be issued within one year of the publication of the model codes. DOE will

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improve energy code compliance tools, integrating them with the design process and non-energy code enforcement. Technical assistance will be provided to States to adopt, update, implement, and enforce their energy codes to meet the 2009 IECC and Standard 90.1-2010.

DOE will also propose standards for energy efficiency in manufactured housing that will meet or exceed the 2009 IECC. Manufactured housing codes will be updated within one year of each IECC code revision.

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses.

Solar Decathlon	5,000	5,000
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The U.S. Department of Energy Solar Decathlon is an award-winning program that challenges 20 collegiate teams to design, build, and operate solar-powered houses that are cost-effective, energy-efficient, and attractive. The winner of the competition is the team that best blends affordability, consumer appeal, and design excellence with optimal energy production and maximum efficiency. As a result, the Solar Decathlon continues to be a successful technology, innovation, and workforce development program for thousands of college graduates. The highly energy efficient buildings will be constructed and judged in 2012.

Total, Technology Validation and Market Introduction	22,000	25,000
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Explanation of Funding Changes

FY 2012 vs. FY 2010 Current Approp (\$000)
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Rebuild America

Rebuild American activities have been realigned within the Commercial Building Integration subprogram.	-1,000
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ENERGY STAR

Accelerated review and development of test procedures for ENERGY STAR products.	+3,000
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Building Energy Codes

Increase efforts to raise energy efficiency level of building codes with more analysis and submission of code proposals.	+1,000
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Energy Efficiency and Renewable Energy/
Building Technologies/
Technology Validation and Market Introduction

FY 2012 Congressional Budget

FY 2012 vs. FY 2010 Current Approp (\$000)
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Solar Decathlon

No change.

0

Total Funding Change, Technology Validation and Market Introduction

+3,000

**Equipment Standards and Analysis
Funding Schedule by Activity**

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request
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Equipment Standards and Analysis	35,000	70,000
Total, Equipment Standards and Analysis	<hr/> 35,000	<hr/> 70,000

Benefits

Equipment Standards and Analysis activities lead to improved efficiency of appliances and equipment by conducting analyses and developing standards that are technologically feasible and economically justified. In 2012, BTP will work on 42 active rulemakings and 8 final rules. Test procedures and energy conservation standards developed by this subprogram correlate directly to energy policy objectives such as increasing energy savings, reducing peak electricity demand, and reducing carbon emissions. According to a study by American Council for an Energy Efficient Economy (ACEEE), “peak capacity reduction from existing standards is expected to reach 72 GW in 2010, or about 7 percent of the projected U.S. generating capacity.”^a

Detailed Justification

(dollars in thousands)

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Equipment Standards and Analysis	35,000	70,000
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In FY 2012, DOE will accelerate development of 4 minimum energy efficiency standards that are technologically feasible and economically justified. DOE continues to be committed to clearing the backlog of delayed actions that accumulated during prior years, while simultaneously applying all new requirements instituted by EPC Act 2005 and EISA. In FY 2012, DOE will continue to take all necessary steps, consistent with the consent decree, EPC Act 2005, and EISA, to finalize legally required efficiency standards consistent with all applicable judicial and statutory deadlines.

As part of its base schedule to clear the backlog and meet all statutory obligations, the subprogram continues with its ongoing rulemakings and will begin rulemakings for 9 product categories in FY 2012. The base schedule that drives the initiation of these rulemakings is a result of DOE’s multi-year planning effort to comply with all statutory rulemaking obligations. Initiating these rules in FY 2012 will enable DOE to meet the deadlines for these products in future years.

^a Neubauer, Max, et al., “Ka-BOOM! The Power of Appliance Standards.” Report Number ASAP-7/ACEEE-A091. July 2009, p. 9. <http://www.standardsasap.org/documents/Ka-BOOM!%20Executive%20Summary.pdf>

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Funds may also be used to prepare for challenges such as new technologies utilized in appliances including compound use appliances, networked or interconnected appliances, and test procedure sensing devices that can give false readings of efficiency levels. In accordance with EISA, in FY 2012 DOE will continue work on incorporating standby and off mode power consumption into test procedures for residential products. Activities in FY 2012 will also include responses to waiver requests from manufacturers and requests for input and recommendations to the DOE Office of Hearings and Appeals. Resource planning is critical to minimize delays and availability conflicts of DOE staff and associated contractor support.

The FY 2012 funding increase will serve several simultaneous purposes including: accelerating the rate at which mandated standards and test procedures are promulgated; increasing the coverage of the program by promulgating standards and test procedures for products for which standards currently do not exist; and reducing the time period between updates to these standards. The program has analyzed the impact of various funding levels with respect to the speed and scale of the rulemakings and potential energy savings. From a list of more than 100 products that are candidates for new and accelerated rulemakings, DOE has tentatively selected several high priority product categories to add to the program or accelerate compared to the base schedule. DOE will conduct a related test procedure rulemaking for each product that is accelerated. 6 product types have been identified as the most likely candidates for new rulemakings beyond the prior-year's multiyear schedule.

In addition, these funds may be used to support efforts such as peer review, data collection and dissemination; technical, market, economic and other analyses. Increased funding will also reinforce the effectiveness of the standards by ramping up enforcement activities. As standards increase in stringency over time, enforcement activities will become more important as the risk of non-compliance increases.

Total, Equipment Standards and Analysis

35,000

70,000

Explanation of Funding Changes

FY 2012 vs. FY 2010 Current Approp (\$000)
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Equipment Standards and Analysis

The funding increase in 2012 will allow DOE to increase the scope and effectiveness of its energy conservation standards by accelerating the test procedure and standards rulemakings that are currently scheduled, allowing for the use of DOE's existing authorities to establish standards for additional products that have large energy savings potentials. DOE will continue to work on its rulemakings and will begin rulemakings for 9 product categories in FY 2012. These products, which have potentially high energy savings, are tentatively scheduled to commence in FY 2012. These rulemakings are in addition to those already planned to begin in FY 2012 as part of DOE's base schedule to meet DOE's statutory obligations. DOE will also expand its activities in certification and enforcement in order to increase the effectiveness of existing energy conservation standards. Certification and enforcement improvements will include updates to existing certification and reporting requirements for manufacturers along with increases in the frequency and scope of product testing to verify compliance with DOE standards.

+35,000

Total Funding Change, Equipment Standards and Analysis

+35,000