STATEMENT OF

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Chairwoman Holmes Norton, Ranking Member Diaz-Balart, Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss the U.S. Department of Energy's (DOE) Building Technologies Program activities and the enormous potential for energy savings in the buildings sector.

In 2008, the Nation's 114 million households and more than 74 billion square feet of commercial floor space accounted for nearly 40% of U.S. primary energy consumption, as well as:

- 73% of electricity and 34% of natural gas consumption,
- Energy bills totaling $418 billion, and
- 39% of Carbon Dioxide, 18% of Nitrogen Oxide, and 55% of Sulfur Dioxide emissions.

Additionally, construction and renovation accounted for 9% of GDP, and eight million people were employed in the sector.[1]

The Department is committed to improving energy efficiency in buildings from advances in building technologies and systems, to energy codes for new construction, to weatherization retrofits and promotion of efficient appliances. The Administration continues to renew and build upon these efforts. I would like to give a broad overview of the Building Technologies Program and highlight some of its ongoing activities, particularly regarding commercial building technologies and partnerships.

DOE's Building Technologies Program

The Building Technologies Program develops technologies, techniques, and tools, as well as minimum performance standards, for making residential and commercial buildings more energy efficient, productive, and affordable. The program's current goal is to create technologies and design approaches that enable net-zero energy buildings[2] at low incremental cost by 2020 for residential buildings and 2025 for commercial buildings. The program expects that efficiency technologies and designs will have application to buildings constructed over the next several years, resulting in incremental reductions in energy use throughout the sector.[3]

The research and development (R&D) activities of DOE's Building Technologies Program are fully aligned toward enabling the widespread construction of net-zero energy residential and commercial buildings by 2020 and 2025, respectively. The Commercial Buildings Integration subprogram conducts systems integration R&D, works with national energy alliances on best practices, engages national accounts with research technical assistance to

[1] DOE, *2008 Building Energy Data Book*.
[2] A net-zero energy building is a residential or commercial building with greatly reduced needs for energy through efficiency gains (60 to 70 percent less than conventional practice), with the balance of energy needs supplied by renewable technologies.
[3] DOE, *2008 Building Technologies Multi-Year Program Plan*, http://www.eere.energy.gov/buildings/publications/pdfs/corporate/myp08complete.pdf.

achieve deep energy retrofits and design of high performance new building prototypes, and provides targeted mass procurement and technology solutions to the industry.

The Residential Integration subprogram works through the Building America public-private partnership to develop high performance residential sub-systems and whole house energy improvements, and testing them on a community scale. In addition, the Residential Integration subprogram is implementing the Builders Challenge to deploy the results of the R&D activity, and is implementing efficiency technologies in new homes and catalyzing cost effective retrofits in homes throughout the Nation.

Equipment and component research is designed to fill identified gaps in technical performance and/or cost reduction needed to fully achieve the net zero energy cost and performance goals of the commercial and residential subprograms. Component and equipment research is conducted on Solid State Lighting; Heating, Ventilation, Air Conditioning, Refrigeration and Water Heating; Solar Heating and Cooling; Thermal Envelope and Windows; and Design Tools.

The Appliances and Commercial Equipment Standards Program develops test procedures and energy conservation standards for residential appliances and commercial and industrial equipment. The Program develops regulations that manufacturers must adhere to in making energy efficiency claims as well as in manufacturing products for sale in the United States. These regulations apply to products manufactured in the United States as well as those imported into the United States.

The Department's Building Technologies Program and its partners strive to integrate energy efficient technologies into the marketplace through technology validation and market introduction activities such as Builders Challenge, Building Energy Codes, EnergySmart Hospitals, EnergySmart Schools, ENERGY STAR®, Solar Decathlon, and the Utility Solar Water Heating Initiative (USH_2O).[4]

I would like to underscore the significant potential benefits that would accrue to the Nation if the goals of the Building Technologies Program are achieved, from net-zero energy commercial buildings to efficient appliances for consumers that will contribute to technological advancements and significant energy savings. We typically measure our success in energy savings. These energy savings translate into benefits to consumers through reduced energy bills, cleaner air and water, and the avoidance of greenhouse gas emissions and the potential harmful effects of global climate change. However, we must also be conscious of the potential impact our efforts have on employment. I am happy to report that these goals and the effects on employment, the news is positive.

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[4] More information is available on each of these programs at the following links:
Builders Challenge: http://www1.eere.energy.gov/buildings/builderschallenge.html
Building Energy Codes: http://www1.eere.energy.gov/buildings/energycodes.html
EnergySmart Hospitals: http://www1.eere.energy.gov/buildings/energysmarthospitals/
EnergySmart Schools: http://www1.eere.energy.gov/buildings/energysmartschools.html
ENERGY STAR®: http://www1.eere.energy.gov/buildings/energystar.html
Solar Decathlon: http://www1.eere.energy.gov/buildings/solar_decathlon.html
Utility Solar Water Heating Initiative (USH_2O): http://www1.eere.energy.gov/buildings/ush2o/

Achieving the Program's goals of reducing the cost of advanced building technologies and homeowner energy bills will permit consumers to spend these saved dollars elsewhere, stimulating other parts of the economy and potentially resulting in cumulative net consumer savings of nearly $450 billion by 2030 and nearly $3.4 trillion by 2050. In addition, cumulative savings to the electric power industry are expected to be over $300 billion by 2030 and over $1 trillion by 2050.[5] These estimates do not include potential benefits associated with projects funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act).

We have begun to think even more broadly about the impact of our program. The buildings sector is a huge part of our economy. It has suffered in the recent economic downturn, but remains a critical engine of future growth. In 2006, the building construction trades employed over 7.5 million workers. Related trades such as architecture and equipment manufacturing employed another half million.[6] These numbers have decreased, but the Buildings program may have a positive impact on the future employment picture. One recent analysis found that, by the year 2030, DOE's efforts "have the potential to increase employment by up to 446,000 jobs, increase wage income by $7.8 billion, reduce needs for capital stock in the energy sector and closely related supporting industries by about $207 billion and create net capital savings that are available to grow the nation's future economy."[7] These estimates were made prior to the new increased investment on building and home efficiency programs established under the Recovery Act.

Finally, we know that buildings impact the economy beyond the building footprint. In electricity use, for example, flipping on a light switch means fossil, nuclear, or renewable energy power plants must meet that demand. Buildings also impact land use through supporting infrastructure such as roads, bridges, street lighting, wires, and pipes. Consider water usage as just another example. Most building energy use does not directly impact water, yet the water impact of energy production is very large, via generation plant cooling requirements. Thermoelectric-power withdrawals accounted for 48 percent of total water use, 39 percent of total freshwater withdrawals for all categories, and 52 percent of fresh surface-water withdrawals in 2000.[8] As a result of energy savings through our program efforts, we estimate that we can avoid freshwater withdrawals of almost 2.5 trillion gallons a year by 2030.

A 2008 study by Pacific Northwest National Laboratory suggests that a more aggressive, sustained effort in R&D, regulation, and deployment could result in energy savings of 8.5 Quadrillion Btu per year by 2025 – equivalent to the total primary energy consumption of California each year.[9] These energy savings might further result in a cumulative avoidance of an estimated 4.4 Gigatons of CO_2 emissions between now and 2025, which equates to over

[5] Budget of the United States Government for Fiscal Year 2010
[6] Buildings Energy Data Book, Tables 1.3.7 and 1.3.8 (http://buildingsdatabook.eren.doe.gov)
[7] MJ Scott et al, Energy Economics 30 (2008) 2283–2301
[8] Source: U.S. Geological Survey Circular 1268, "Estimated Use Of Water in The United States in 2000 (http://ga.water.usgs.gov/edu/wupt.html)
[9] JA Dirks, et al, "Lost Opportunities in the Buildings Sector: Energy-Efficiency Analysis and Results," Pacific Northwest National Laboratory, September 2008, PNNL-17623

10% of the projected cumulative CO_2 emissions from the buildings sector over that same period. These energy savings, if realized, would cause total primary energy consumption in the buildings sector to level off over the 2009-2025 study period, to just below 2009 consumption levels.

Commercial Buildings Initiative

Launched in August 2008, the Net-Zero Energy Commercial Building Initiative (CBI) is the umbrella initiative that will guide and coordinate public and private partnerships to advance the development and market adoption of net-zero energy commercial buildings (NZEBs). CBI works with researchers at DOE National Laboratories, as well as with public and private partners, to achieve the goal of marketable NZEBs by 2025.

In support of the CBI, DOE's key commercial buildings research includes whole building system integration, indoor environmental quality, control strategies and diagnostics, space conditioning, and process and miscellaneous equipment. Another major area is the development of technology solutions for achieving 30-50% savings at the building system level (lighting, heating, and cooling). The first technology solution, Commercial Lighting Solutions web tool design aid, launched in May 2009.

Working with industry representatives and partners is critical to achieving the goal of marketable net-zero energy commercial buildings by 2025. We are engaged with building industry leaders through energy alliances and research partnerships to move us toward that goal. Key CBI alliances and partnerships include:

- Commercial Building Energy Alliances – Informal associations of commercial building owners and operators who work to significantly reduce energy consumption and carbon emissions. Currently, alliances exist for retail, commercial real estate, and hospitals.

- Commercial Building National Accounts (NAs) – Commercial building owners and operators with large portfolios of buildings that regularly build new buildings and retrofit and renovate existing buildings. The National Renewable Energy Laboratory collaborates with National Account partners in pre-design, design, performance verification, and reporting phases of a process aiming to construct buildings that achieve savings of 50% or retrofit buildings that achieve 30% savings above American Society of Refrigeration and Air-Conditioning Engineers (ASHRAE)/IESNA Standard 90.1-2004. National Account partners can then deploy this knowledge through their building portfolios. In FY 2008, 23 National Account partners agreed to work with DOE. Another 50 National Accounts are planned in FY 2009.

- High-Performance Green Building Consortium – DOE-selected building industry groups that work with DOE to accelerate the commercialization of high-performance building technologies by disseminating information on new technologies within the commercial building community. A high-performance commercial building offers

improved energy, economic, and environmental performance compared to standard practice.

Building Energy Codes and Standards

The Department works closely with ASHRAE on its Standard 90.1 and with the International Code Council (ICC) on its International Energy Conservation Code (IECC) in response to Title III of the Energy Conservation and Production Act, as amended (42 U.S.C. 6831 et seq.).

In 2007, DOE challenged ASHRAE to upgrade Standard 90.1 to be 30% more stringent than its 2004 edition by 2010 and has been actively engaged in the ASHRAE standards process by providing technical assistance to support the upgrade of Standard 90.1. ASHRAE reports that it is on track to achieve the 30% goal.

The Department also joined many stakeholders in the IECC process to upgrade the 2006 edition of the IECC by 30% by 2012. Significant progress has been made in the 2009 edition, upgrading it by about 15%. The Department is an active participant in the codes development process by providing engineering, economic and energy analyses of improvements to the code as well as specific code proposals.

Appliance Standards

In the 1970s, there was a debate over whether to set energy conservation standards for consumer products, including refrigerators. Many were concerned that standards would be too expensive to meet and would lead to higher prices for consumers. The Appliance Standards Program was established with the passage of the Energy Policy and Conservation Act of 1975 (EPCA), which designated test procedures, conservation targets, and labeling requirements for certain major household appliances. The Act has been amended several times, changing the conservation targets to mandatory standards and adding many additional products to eventually include a broad range of residential and commercial products. As amended, the appliance standards requirements are among the broadest and most stringent of any country in the world. Once the standards passed, manufacturers put their engineers to work developing new products to meet and exceed the standards. Manufacturers were successful and developed new, energy efficient products that often exceeded the requirements.

For example, refrigerators cost less today than they did before DOE's ENERGY STAR®, research, and energy conservation standards programs. Yet, today's refrigerators are larger, have more features and use less than one-third as much energy as those earlier designs. DOE estimates that its programs have contributed to a decrease in refrigerator energy consumption on the order of 0.25 quads compared 1975, even though the number of refrigerators grew by 35%. This energy savings is equivalent to the amount produced by 58 coal power plants.[10]

[10] Source: 1975 to 2005 energy use – DOE refrigerator standards rulemaking data developed by Lawrence Berkeley National Laboratory; 2015 projection – EIA's *Annual Energy Outlook 2005;* number of households – Buildings Energy Data Book Table 2.1.1.

President Obama showed his interest and expectations for the Appliance Standards Program just 17 days after his inauguration. The President visited DOE and set out his expectations for the program in a memorandum to Secretary Chu requesting DOE take all necessary steps to finalize legally required energy conservation standards rulemakings as expeditiously as possible and consistent with all applicable judicial and statutory deadlines.

Builders Challenge and DOE Residential Energy Efficiency Initiatives

The goal of Builders Challenge is to build 220,000 new high-performance homes by 2012. These homes improve energy efficiency by at least 30% over a typical new home. To date, more than 1,000 homes have been qualified as meeting the Builders Challenge and 200 builders have agreed to build to meet the Builders Challenge in the future.

DOE efforts focus on significantly increasing energy efficiency in existing homes including promotion of improvements through home performance contracting, which entails comprehensive whole-house assessments. These efforts are implemented by utilities, state energy offices, and not-for-profits that recruit and train home improvement contractors. Qualified contractors conduct a comprehensive assessment using diagnostic equipment. Based on this assessment, contractors offer a prioritized list of solutions; they then complete the needed renovations or work closely with other participating contractors. Common improvements suggested are sealing air leaks and ductwork, adding insulation, improving the heating-cooling system, and upgrading lighting. More than 50,000 assessments and 15,000 installations have been completed since 2002.

Buildings Efficiency and Economic Recovery

The Department's Building Technologies Program is utilizing up to $344.3 million in Recovery Act funds to expand and accelerate the development, deployment, and use of energy efficient technologies in all major types of commercial buildings as well as new and existing homes. The activities funded are:

- Advanced Building Systems Research (up to $99.5 million) – These projects will address research focused on the systems design, integration, and control of both new and existing buildings. Buildings need to be designed, built, operated, and maintained as an integrated system in order to achieve the potential of energy efficient and eventually net zero-energy buildings. These projects will move beyond component-only driven research and address the interactions in buildings as a whole, in order to progress development of integrated, high performance buildings and achieve net zero-energy buildings.

- Residential Buildings Development and Deployment (up to $69.7 million) – Expanded work in Residential Buildings will increase homeowner energy savings by supporting energy efficient retrofits and new homes while raising consumer awareness of the

benefits of increased health, safety, and durability of energy efficiency. The projects will provide technical support to train workers and create jobs, developing a new workforce equipped to improve the Nation's homes and will permit a major initiative to provide builders with technical assistance and training through states, utilities, and existing programs to increase the market share of new homes achieving substantial whole house energy savings. To address existing homes, DOE will work with municipalities with a variety of housing types and vintages as well as subdivisions with similar housing stock to encourage a large number of energy efficiency retrofits.

- Commercial Buildings Initiative (up to $53.2 million) – These Recovery Act funds will be used to accelerate and expand partnerships with major companies that design, build, own, manage, or operate large fleets of buildings and that commit to achieving exemplary energy performance. This funding will be used to expand the number of these partnerships from 23 to about 75 through a competitive process beginning in September 2009.

- Buildings and Appliance Market Transformation (up to $72.1 million) – Key activities include preparing the design, construction, and enforcement community to implement commercial building energy codes that require a 30% improvement in energy efficiency over the 2004 code in 2010; and accelerating and expanding DOE's Appliance Standards program to evaluate innovative technologies and develop new test procedures that are more representative of today's energy use and equipment.

- Solid State Lighting Research and Development (up to $49.8 million) – The objective of the solid state lighting activities is to advance state-of-the-art solid-state lighting (SSL) technology and to move those advancements more rapidly to market through a coordinated development of advanced manufacturing techniques. This project will both aid in the development and reduce the first cost of high performance lighting products. Continuing advances can accelerate progress towards creating a U.S.-led market for high efficiency light sources that save more energy, reduce costs, and have less environmental impact than other conventional light sources.

Other Departmental activities funded by the Recovery Act also place significant focus on buildings and building energy codes, such as the Energy Efficiency and Conservation Block Grants (EECBG), Weatherization Assistance, and State Energy programs.[11] EECBG supports activities such as the enforcement of building energy codes; conducting building audits; establishing financial incentives for efficiency; and installing LEDs.

In addition, in response to Recovery Act requirements, governors advised the Secretary that they have taken actions to ensure the implementation of the 2009 IECC or equivalent for residential buildings, and Standard 90.1-2007 for commercial buildings. They must provide similar assurances that the State will implement a plan to achieve 90% compliance with their new codes by 2017. DOE is gearing up to provide technical assistance to States to implement these new codes and to implement, enforce, and evaluate compliance.

[11] See Section 410 of the American Recovery and Reinvestment Act of 2009.

Conclusion

The Department is committed to improving energy efficiency through innovative R&D, public outreach, and collaborative partnerships. Improved energy efficiency in buildings generally is a fast, low-risk, and economical way to reduce energy consumption and associated environmental emissions, including greenhouse gases. We look forward to working with Congress to continue to realize short-term energy and cost savings, and to contribute to the goal of achieving net-zero energy residential and commercial buildings in the future.

Thank you for the opportunity to appear before you today, and I am happy to answer any questions.