AMERICAN SOCIETY OF HEATING,
REFRIGERATING AND AIR-CONDITIONING
ENGINEERS

PROTECTING AMERICA'S ECONOMY & CONSERVING OUR ENVIRONMENT: THE BUILDINGS ANSWER

CHALLENGES AND OPPORTUNITIES FACING A NEW CONGRESS

JANUARY 2011

Summary of Recommendations for Protecting America's Economy & Conserving Our Environment: The Buildings Answer
—Challenges and Opportunities Facing a New Congress—

- **Energy Policy & Climate Change**
  - Require posting and annual updates of buildings' energy use
  - Include energy efficiency as a renewable fuel source within renewable standards portfolio
  - Encourage decoupling of utility rates from energy sales
  - Encourage states to implement utility demand-side management programs
  - Provide adequate funding and direction for data collection and analysis of energy use in buildings
  - Support implementation of Smart Grid and micro-grid systems
  - Remove barriers to grid-connection for on-site power generation
  - Require states to adopt commercial building energy codes with ANSI/ASHRAE/IESNA Standard 90.1-2004 as a minimum
- **Incentives for Implementing Energy Efficiency**
  - Set realistic depreciation schedules for HVAC&R equipment to encourage high-efficiency replacements
  - Ensure adequate planning time in extension or implementation of tax credits/deductions
  - Incentivize widespread use of building commissioning, re-commissioning and retro-commissioning
  - Support implementation of technologies utilizing energy previously deemed as waste heat
  - Encourage ongoing education and training for operations and maintenance personnel and building designers and constructors
- **Research and Development to Achieve Energy Goals**
  - Make the Business R&D Tax Credit permanent
  - Continue increased funding under the American Competitiveness Initiative
  - Fund research on
    - on-site and off-site renewable energy technologies
    - building technologies for improved indoor environmental quality and energy efficiency
    - building technologies and designs to achieve net-zero energy buildings
    - human factors of building operation, occupancy, and energy use
    - characteristics and control of indoor contaminants
    - improving teaching and learning of science, technology, engineering and mathematics (STEM) concepts
- **Indoor Air Quality (IAQ)**
  - Establish ASHRAE Standards 62.1, 62.2, and 55 as the major national minimum guidelines on indoor air quality (IAQ) and thermal comfort management
  - Support research to significantly advance understanding of the impact of IEQ on work performance, health symptoms, and perceived environmental quality in offices
  - Fund research to understand the influences of HVAC&R on airborne pathogen transmission in public spaces and develop effective control strategies,
  - Continue government support for IAQ-related education and implementation programs
  - Support research on the intersections between building energy efficiency and IAQ
- **Federal Agencies as National Leaders**
  - Provide agencies with the financial resources necessary to achieve new requirements
  - Provide agencies with technical resources to accomplish and maintain energy use reductions
  - Support training for all employees involved in design, construction, procurement and operation of buildings
  - Fund the Office of Federal High-Performance Green Buildings at the General Services Administration
  - Allow flexibility within the capital and operating budgets to allow consideration of life-cycle costs
  - Encourage use of Building Information Modeling (BIM) for all federal construction projects
  - Continue to support cross-agency working groups
  - Require use of an integrated design process for all federal construction projects
  - Improve transparency and accessibility to agency data on building energy performance and technologies
  - Allow realistic design budgets for Federal building projects
- **Education as a Critical Tool**
  - Support establishment of a grant program to assist states and localities in enforcement of building energy codes
  - Provide funding for "green collar" job training program
  - Support the establishment of university research centers on energy efficient building technologies
  - Develop programs to recruit, train and retain qualified STEM teachers
  - Encourage the adoption of curriculum standards that cultivate high student performance
  - Create opportunities and incentives for women and minorities to pursue STEM careers
- **Government-wide Activities to Further Science and Technology**
  - Work with standards developers to address societal needs through use of voluntary consensus standards
  - Encourage government experts to participate in the development of voluntary consensus standards
  - Support domestic and international policies ensuring copyright and trademark protection for standards developers
  - House of Representatives members should join the High-Performance Buildings Caucus
  - Senator members should establish their own High-Performance Buildings Caucus

The Growing Problem: The Need for Leadership

Fueled in part by population growth and the rise in building floorspace, the nations' demand and consumption of energy is expected to grow by 14 percent through 2035[i]. Residential and commercial building energy expenditures accounted for $445.8 billion in 2008[ii], and lead the way in primary energy use, accounting for approximately 40 percent, ahead of industry (32 percent) and transportation (28 percent)[iii].

Fiscal and envionrmental conservation call on all individuals and stakeholders to uncover means for saving limited financial resources and protecting the environment. Buildings are responsible for vast energy use, and are also one of the most cost-effective means of solving the nation's fiscal and energy challenges.

Building Codes & Standards: Immediate & Long-Term Economic Impact

Energy code compliance in commercial, residential, and Federal buildings is generally below 50 percent in many states and jurisdictions[iv], costing taxpayers millions each year in unnecessary expenses, and piling up environmental damage that will have to be paid for later.

Building standards – which become codes when adopted – are essentially best practices and collective technical expertise that have withstood the rigors of public review and scrutiny. If building energy code compliance was increased to 90 percent, it would produce savings of approximately $2.7 billion by 2020, and over $10.2 billion in 2040 and each year thereafter[v]. Where the federal government is the building owner, these savings can be used for deficit and debt reduction and reinvested in other priorities to achieve further savings and advance other priorities. In the private sector, these savings can be used to advance building owners' other business interests.

Getting to 90 percent compliance requires serious commitment from the federal level, but can be achieved through a series of straightforward steps, which include:

- Provide better education and training for building design personnel;
- Establish a grant program to train code officials in the enforcement of existing building energy codes; and
- Require building owners to disclose building code compliance and energy efficiency when selling, leasing, or sub-leasing.

Building efficiency puts people to work. The entire U.S. construction industry employs approximately 10 million people, including manufacturing. By focusing on improving energy efficiency in buildings, this number can be expected to rise[vi].

In short, energy efficient buildings help strengthen the foundations of the U.S. economy by increasing savings, potentially decreasing debt, and growing jobs that cannot be outsourced overseas.

ASHRAE: Who We Are & How We Can Help

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is in a unique position to assist decisionmakers in developing unbiased, technically sound policies to address many of the concerns facing our society—including energy and environmental conservation, education, and the economy and jobs.

Founded in 1894, ASHRAE is an international non-profit technical organization of over 52,000 individual members. Our members represent the diversity of the building community, including consulting engineers, contractors, manufacturers, architects, and many others. ASHRAE fulfills its mission of advancing heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world through research, standards writing, publishing and continuing education.

ASHRAE has long provided leadership on critical issues facing the nation. During the energy crisis of the 1970s, ASHRAE developed the first consensus-based energy efficiency standard for commercial buildings[vii] which is the basis for the current national model energy code for commercial buildings[viii]. As the world struggled with depletion of the ozone layer, ASHRAE served as a resource for policymakers.

ASHRAE Mission:

To advance the arts and sciences of heating, ventilating, air conditioning and refrigerating to serve humanity and promote a sustainable world.

This leadership continues as ASHRAE provides standards and guidance to reduce the energy use of buildings, provide proper indoor environmental quality (IEQ), and produce high-performance buildings. For the model building energy code, in the 2010 version, ASHRAE has achieved energy savings greater than 20 percent over the 2004 version. ASHRAE also recently published the first code-intended commercial green building standard in the United States, ANSI/ASHRAE/USGBC/IES Standard 189.1, which serves as a compliance path of the International Green Construction Code (IGCC), published by the International Code Council. Commercially viable net zero energy buildings (NZEBs)[ix] are the necessary future direction of the building industry and ASHRAE has committed to provide design guidance for NZEBs in the near future.

Addressing energy use in existing buildings also is critical—between 70 and 85 percent of the buildings that will be present in 2030 already exist today. ASHRAE also has developed standards and guidance, educational programs, and other initiatives to address building operations and maintenance and retrofit and renovation opportunities.

As the new members of Congress examine critical issues facing the economy, ASHRAE is pleased to serve as a technical resource and offers the following policy recommendations for achieving national energy and sustainability goals through buildings.

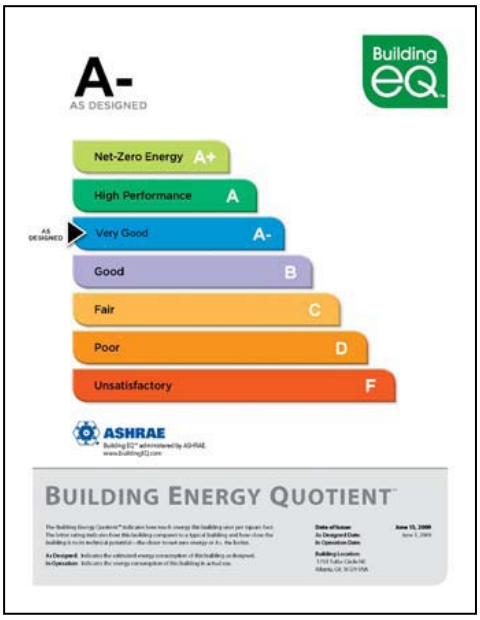
Energy Policy & Environmental Conservation

Concerns about energy and environmental conservation should become top priorities of the new Congress. Energy efficiency—particularly in buildings—offers a significant opportunity to address these concerns, since it is an accepted Industry fact that buildings consume approximately 40 percent of the total energy in the United States[iii].

Empowering stakeholders with information on the impact of their actions is a core component to increasing building efficiency. ASHRAE has begun to fill this information gap by developing a Building Energy Labeling Program – the Building Energy Quotient (Building EQ), which is currently being piloted around the country.

The most visible component of the Building EQ program is the label itself, which allows the general public, tenants, building owners, prospective owners, and operations and maintenance personnel to quickly and easily view how energy efficient a building is in operation compared to its design (Asset Rating) through an easily understood alphabetical and color scale. (See Figure 1.)

Figure 1 – ASHRAE's Building Energy Quotient Building Label Program



The As Designed (Asset) Rating provides an assessment of the building based on the components specified in the design—including mechanical systems, building envelope, orientation and daylighting. The Asset Rating will be based on the results of a field inspection and a building energy model, and can be updated when improvements are made to the building.

The Operational Rating is determined through an on-site assessment, during which the building owner is provided with building-specific information that can be used to improve his/her building. Documentation on previous energy efficiency upgrades and commissioned systems is also included. With information on both the Asset and Operational Ratings, building owners can make side-by-side comparisons which could further reconcile differences between designed and measured energy use.

Incentives for Implementing Energy Efficiency

While Federal policies can help shape the nation's energy policy, engagement by the private sector is necessary. A comprehensive program of incentives will encourage businesses and individuals to invest in energy saving technologies and practices resulting in greater penetration in the marketplace.

However, any tax credits or deductions intended to transform the design or construction process or invigorate an industry must account for the necessary planning time desired by these sectors. The Commercial Building Tax Deduction, for example, has the potential to significantly reduce the energy use associated with commercial buildings, but its initial utilization was limited due to its short time frame relative to the design and construction process. The current five year extension through 2013 will allow for greater certainty. Credits for the renewable energy sector also should reflect our long-term goals. Short-term or uncertain-term incentives diminish the potential investment in the sector. Long-term investment is necessary to push technological advances and market penetration.

Technologies and practices that utilize energy previously thought of as waste heat—such as heat recovery and combined heat and power—are essential to reducing the energy use associated with buildings. Their widespread implementation should be supported through realistic depreciation schedules, tax credits and job training programs.

In order to encourage replacement of older, less efficient (and sometimes CFC-based) equipment, depreciation schedules for heating, ventilation, air-conditioning, and refrigeration (HVAC&R) equipment should be set at a level that reflects the actual life-span of the equipment rather than the current 39 years. Additional benefits also could be included to encourage selection of equipment that goes beyond the minimum requirements.

Commissioning, re-commissioning, and retro-commissioning[x] of buildings can help assure that a building is operating at its maximum efficiency. Since many buildings currently are not operating according to their original design, re-commissioning and retro-commissioning frequently results in significant energy savings. Widespread utilization of commissioning, re-commissioning, and retro-commissioning should be encouraged through the tax code.

To assure that buildings continue to operate as designed, a well trained operations and maintenance staff is necessary. Building owners should be encouraged to provide ongoing education and training through tax credits or deductions. Similar incentives should be extended to architecture and engineering firms to promote the utilization of the best available tools, technologies and practices.

Future incentives for reducing energy use should examine the use of an integrated approach rather than a component-by-component approach. Buildings operate as a system and the greatest levels of energy savings at the least cost can be achieved through an interdisciplinary approach that looks at the building envelope, lighting, power, and HVAC&R systems as interrelated and interdependent.

Upgrading to a Smarter Grid: Avoiding Blackouts and Powering Our Future

The nation's current electrical grid is 99.97 percent reliable, but the grid is showing signs of age. Outages cost American consumers $150 billion annually, and outages affecting 50,000 or more people increased by 41 percent in the late 1990s[xi]. With demand for electricity expected to grow by 30 percent by 2030[xii], and continued aging of the grid infrastructure, the impact of these outages may also increase.

The need for federal action is clear and undeniable, with several economic and security advantages.

The evolution from the current grid where electricity is simply generated and consumed, to a more dynamic and interactive "Smart Grid"[xiii] presents a multitude of potential benefits to consumers, utilities, businesses, and society at large. By communicating with end-users in real-time, the future grid will decrease total energy consumption, reduce peak demand, and improve the integration of central station and distributed renewable sources of energy into the grid.

The Smart Grid also will improve energy security by protecting the privacy of consumers and automatically rerouting power, essentially "self-healing" by resisting and responding to emergency scenarios, such as attacks and natural disasters. The Smart Grid also will benefit the economy through real-time pricing, potentially lowering costs to end-users.

A critical component of the Smart Grid is effective communication between energy generation sources and end users. ASHRAE strongly believes that ASHRAE/NEMA Standard 201P *Facility Smart Grid Information Model* can provide a basis for common information exchange between control systems and end-use devices found in single- and multi-family homes, commercial and institutional buildings, and industrial facilities that is independent of the communication protocol in use. This standard is currently in development as a joint standard of ASHRAE and the National Electrical Manufacturers Association (NEMA).

ASHRAE also believes that BACnet *A Date Communication Protocol for Building and Automation and Control Networks* (ANSI/ASHRAE Standard 135-2008), and BACnet technologies should play a leading role in the evolution and implementation of the Smart Grid.

BACnet is a well-established data communication protocol for building automation and control networks, and has been communicating on standard IP networks for more than ten years. BACnet currently possesses energy management and load control capabilities, and is a natural fit for integration into the Smart Grid. Recently BACnet's Utility Integration Working Group was re-chartered as the Smart Grid Working Group. The Working Group focuses on enabling buildings to act as full participants in the Smart Grid – receiving price and event signals from grid operations, as well as requests for resource status, and responding to grid signals with control actions to appropriately manage energy.

The transition to a Smart Grid is a necessary next step in securing and improving our nation's electrical infrastructure, however many unknowns remain. Extensive research and development is needed on the

Smart Grid and Smart Grid technologies to better understand the challenges and opportunities of building and implementing the advanced grid.

Similarly, because the evolution to a Smart Grid will be complex and far-reaching, affecting each and every person in the United States, ASHRAE encourages the new Congress to coordinate with consumer, industry, utility, governmental, and other stakeholder groups on an ongoing, multi-year educational campaign at the local, state, and national levels to help prepare society for the changes that will accompany the gradual shift to a Smart Grid. A comprehensive building efficiency program can reduce demand and the need for new capacity. In many states, utility profits are directly tied to the amount of energy sold—resulting in a disincentive to promote efficient use of energy. Decoupling utility rates from energy sales is a successful means for promoting efficiency programs. States also should be encouraged to initiate demand side management programs[xiv] through utilities—such programs can result in a more stable electrical grid and reduced need for development of new power plants. Implementing a Smart Grid system can assist in the development of demand side management programs and more efficient energy use. Necessary incentives should be provided to utilities and building owners to support its implementation. Smart metering will assist utilities and building owners in taking advantage of real-time pricing which will reduce peak demand. Further utility investment in energy efficiency can be encouraged by including energy efficiency as an acceptable energy resource within renewable portfolio standards.

Existing barriers to grid connection for on-site power generation (mostly by renewable sources) are hindering the implementation of such technologies and are necessary for the implementation of net-zero energy buildings. Such barriers must be removed and provisions must be established to allow widespread implementation of net-metering.[xv]

Programs such as the EPA/DOE EnergyStar and Federal Trade Commission's EnergyGuide provide consumers and building owners with important information for making informed decisions regarding their energy use. Other federal agencies are critical to the advancement of the development and enforcement of energy standards and guidelines and must be adequately funded, including the Department of Energy (DOE), Department of Commerce's National Institute of Standards and Technology (NIST), Environmental Protection Agency (EPA), and the General Services Administration (GSA).

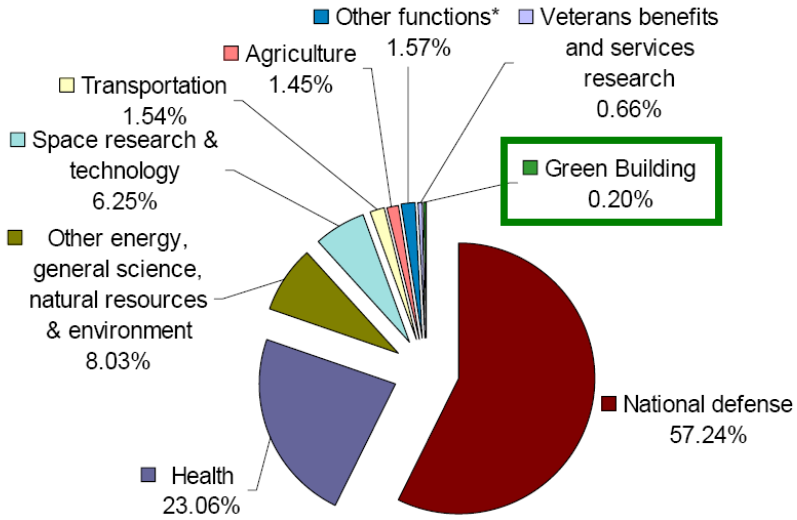
Adequate funding and direction should be provided for data collection and analysis of energy use in commercial buildings—this is critical to understanding and reducing current energy use. Additionally, building owners should be required or encouraged to post and annually update a building's energy use through a labeling program such as ASHRAE's Building EQ program. Through such a program building owners, perspective tenants and owners, and the public would be able to track the energy use of buildings—should the energy use increase, the owner likely would investigate to determine the cause of the increase. Proper operation and maintenance can also help identify the cause or prevent any such occurrence.

Research and Development to Achieve Energy Goals

As the nation looks to buildings to reduce our energy use and increase environmental conservation, research and development (R&D) into all aspects of the built environment is necessary—from both the public and private sector. Despite the significant value that buildings contribute to the nation's GDP (all construction accounts for a 13.4 percent share of GDP in 2006[xvi]) and their large proportion of the nation's energy consumption, the resources dedicated to building R&D are woefully inadequate.

The U.S. Green Building Council has estimated that only 0.2 percent of federal R&D spending went toward green building related R&D (see Figure 2). Within DOE, a small fraction of their R&D program is focused on buildings-related research despite 40 percent of the nation's energy use attributable to the sector.

Figure 1: Federal R&D Budget Authority, by Budget Function FY2003-2005[xvii]



** Other functions include education, training, employment, and social services; income security; and commerce. Green building data was compiled from agencies and the Office of Management and Budget (OMB); baseline federal R&D budget data comes from the National Science Foundation (NSF). The 0.2% funding toward green building does not include money from the Department of Defense.*

Private sector investment in R&D is also small compared to other sectors—in 2003 only 1.2 percent of sales across all construction is invested in R&D compared to 3.2 percent of sales across all sectors.[xviii] The Business R&D Tax Credit is a critical incentive for private sector investment in R&D and should be made permanent.

Expanded Federal support for R&D across disciplines related to the built environment is required. The precedent established by the American Competitiveness Initiative to significantly increase funding for research at the DOE Office of Science, National Institute of Standards and Technology, and the National Science Foundation (NSF) must be continued and expanded. Funding should be designated specifically

for basic and applied research on building technologies that result in improved IEQ and energy efficiency and on building technologies and designs to achieve net-zero energy buildings. Research and development in both on-site and off-site renewable energy technologies will be necessary to encourage rapid deployment in the marketplace and help realize the development of NZEBs. DOE's National Labs are an excellent resource for necessary buildings related R&D—they should be funded at levels commensurate with the importance of their research.

Social science research also will be critical to understanding and responding to the human factors of building operations, occupancy characteristics, energy use and IEQ. A greater understanding of contaminants and the indoor environment is also necessary. Research is needed to identify indoor pollutants including biological and chemical contaminants relevant to disease transmission, sources of the pollutants, limits on acceptable concentration levels, and whole-building control measures for volatile organic comnpounds (VOCs), mold and other asthma triggers.

Additionally, research focused on improving the teaching and learning of science, technology, engineering and mathematics (STEM) concepts and critical thinking skills is essential to ensuring a competent technological workforce.

Indoor Air Quality (IAQ)

The nation's productivity is inextricably linked to the environments in which Americans live and work. As a result, indoor air quality (IAQ), and more broadly, Indoor environmental quality (IEQ, encompassing IAQ, thermal environment, lighting, and acoustics) are important factors in protecting and strengthening the nation's health, safety, and economic future. It has been estimated that annual health care cost and productivity benefits of as much as $200 billion (in 1996 dollars) could result from attainable improvements in IEQ, many times the associated cost[xix].

As stated in ASHRAE's Position Statement on Indoor Air Quality[xx], people in buildings frequently report discomfort, including eye, nose and throat irritation, headaches, fatigue, lethargy, and upper respiratory problems. Scientific studies have determined that these health effects and discomfort are associated with the characteristics of buildings, including buildings' HVAC&R systems and IAQ.

To address these issues, and as a global leader in HVAC&R research, technical standards, and guidance, ASHRAE has developed several standards, including:

- ANSI/ASHRAE Standard 62.1-2010 *Ventilation for Acceptable Indoor Air Quality*;
- ANSI/ASHRAE Standard 62.2-2010 *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*; and
- ASHRAE Standard 55-2010 *Thermal Environmental Conditions for Human Occupancy*.

Taken together with ASHRAE's professional certifications[xxi], these standards form the basis for improving IEQ in commercial and residential buildings.

Recognizing the need to improve IAQ, several federal agencies and states have already adopted or referenced these standards in their minimum building requirements. However, ASHRAE believes that IAQ improvements should not be limited to knowledgeable and proactive states and agencies. As a result, we encourage Congress to establish ASHRAE Standards 62.1, 62.2, and 55 as the major national minimum guidelines on indoor thermal and IAQ management.

Because research and knowledge are never complete, ASHRAE also encourages Congress to:

- Support research to significantly advance understanding of the impact of IEQ on work performance, health symptoms, and perceived environmental quality in offices and residences;
- Fund research to understand the influences of HVAC&R on airborne pathogen transmission in public spaces and develop effective control strategies[xxii],
- Continue government support for IAQ-related education and implementation programs; and
- Support research on the intersections between building energy efficiency and IAQ.

For additional information on ASHRAE's research priorities, also see ASHRAE's Research Strategic Plan 2010-2015, *Navigation for a Sustainable Future*, available at www.ashrae.org/research.

Federal Agencies as National Leaders

Federal agencies have long been looked to as an example of what can be done within the built environment. As the nation's largest holder of real estate, the federal government has the opportunity and resources to influence the development and implementation of building design, construction, operations and maintenance tools, technologies and practices. Federal buildings should serve as public showcases and leading examples of energy efficiency and IEQ through their design, construction, equipment, and operations and maintenance.

The Energy Independence and Security Act (EISA) (Pub.L. 110-140) included new stringent requirements regarding federal agency energy use for the entire building portfolio and fossil fuel-based energy use in new buildings.[xxiii] While these requirements could result in significant energy savings and environmental benefits, and encourage development of new technologies, agencies must have the financial and technical resources necessary to implement them. Existing mechanisms such as energy savings performance contracts (ESPCs) can be effective in some circumstances, but access to additional resources will be necessary.

A government-wide revolving fund for energy improvements and energy efficient equipment purchases should be established. The fund can be financed by the energy savings an agency receives due to the

improvements made by the agency. Both the Energy Policy Act of 2005 (EPAct) (Pub.L. 109-58) and EISA already have mechanisms for federal agencies to retain the savings achieved through energy use reductions.

Previous funding patterns may need to change—more funds may be needed initially to implement energy savings, but over the long-term, associated energy costs will fall. Also, with consistent annual energy reduction requirements, agencies will be requesting funding for energy related projects on a regular basis. Design fees for new and existing federal projects must allow for the up-front costs necessary to achieve high-performing buildings through integrated design.

As recognized in EISA, existing barriers between capital budgets and operating budgets can serve as a disincentive to invest in assets with increased first cost but a decreased life-cycle cost—greater flexibility within agency budgets could encourage greater focus on life-cycle costs.

Agencies will require technical resources to accomplish and maintain energy use reductions. The General Services Administration's Office of Federal High-Performance Green Buildings can be the office responsible for coordinating the availability of these resources, but it must be adequately funded. Training for asset managers, facilities managers, procurement managers and others on energy saving technologies, finance mechanisms, and operations and maintenance also should be supported.

Existing cross-agency working groups such as the Interagency Sustainability Working Group (ISWG) and the Council on Indoor Air Quality (CIAQ) provide excellent forums to develop mutually applicable guidance and share best practices. Other government-wide requirements will help establish best practices that can be applied in both the public and private sectors. Agency data on building energy performance and technologies should be more transparent and accessible to other agencies and the building community.

Building Information Modeling (BIM) is currently being utilized for GSA projects but should be required across agencies to assist in asset management, employing integrated design practices, streamlining operations and maintenance, and advance uptake in the marketplace. An integrated procurement, design, and construction process should be required for all federal construction projects to assure all high-performance building requirements are achieved despite limited financial resources.

Education as a Critical Tool

As we are challenged to improve the performance of buildings, a skilled engineering and technical workforce is necessary to assure that buildings are properly designed, constructed and maintained. Assuring the existence of such a workforce will require a focus on education from elementary school through continuing education programs. Investment in a technical workforce to achieve increasingly more efficient buildings can provide significant economic benefit (see Table 1).

Table 1: Potential New Green Jobs - U.S. Total[xxiv]

	2018	2028	2038
Renewable Power Generation	407,200	802,000	1,236,800
Residential & Commercial Retrofitting	81,000	81,000	81,000
Renewable Transportation Fuels	1,205,700	1,437,700	1,492,000
Engineering, Legal, Research & Consulting	846,900	1,160,300	1,404,900
Total	**2,540,800**	**3,481,000**	**4,214,700**

Recruiting, training, and retaining teachers qualified in science, technology, engineering and mathematics (STEM) is essential. Programs should be implemented to recognize educators who excel in STEM education and encourage the best and brightest scientists and engineers to teach. Curriculum standards should cultivate high student performance and foster creativity, experiential problem solving and critical thinking. Grant programs can support a focus on hands-on learning and the necessary curriculum development. Minorities and women should have opportunities and incentives to pursue STEM coursework and careers.

To support the development of the next generation of building designers, constructors, and operators, research centers focused on energy efficient building technologies and practices should be established on university campuses. Funding for "green collar" job training programs such as the program established under EISA also will help assure a continuing workforce focused on reducing the fossil fuel based energy use of buildings.

In an effort to assist states and localities in the enforcement of existing building energy codes, a grant program should be established to help provide the necessary training for code officials. Within the finance and insurance industry, the importance of following building codes and proper operations and maintenance to protecting the continued value of assets should become more prominent and be incorporated into contracts and policies.

Government-wide Activities to Further Science and Technology

Recognizing the overall importance of science and technology to society, the new Congress should focus on actions across the government that respect the critical role of science and technology.

Members of the House of Representatives should join the High-Performance Building Congressional Caucus, a bipartisan effort to bring policy-relevant expertise from across the buildings community to policymakers.[xxv] Senators should likewise form their own High-Performance Building Caucus to bring the benefits and shared expertise of the House Caucus to the Senate.

ASHRAE: Technical Expertise to Policy-Makers

As the nation looks to reduce its dependence on foreign energy sources, decrease its environmental impact, and grow its economy, buildings offer an excellent opportunity to achieve these goals. As the new Congress considers legislation that impacts the built environment, ASHRAE is pleased to provide a clear strategy for addressing these issues. We are poised to offer the leadership and unbiased, technical knowledge necessary to transform the built environment in pursuit of a more sustainable world.

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[i] U.S. Energy Information Administration. *Annual Energy Outlook 2010*. http://www.eia.doe.gov/oiaf/aeo/. (November 2010)

[ii] U.S. Energy Information Administration. *Annual Energy Outlook 2010*. http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_3.xls

[iii] National Science and Technology Council 2008. *Federal Research and Development Agenda for Net-Zero Energy, High-Performance Green Buildings*.

[iv] "Building Energy Code Compliance: A Low-Cost Tool to Boost Jobs, Cut Pollution, and Advance Energy Independence; Every Dollar Spent Yields $6 in Energy Savings." http://imt.org/files/FileUpload/files/PolicymakerFactsheet-EnergyCodeCompliance.pdf. October 2010.

[v] "$810 Million Funding Needed to Achieve 90% Compliance with Building Energy Codes." http://imt.org/files/FactSheet-EnergyCodeComplianceFunding.pdf. September, 2010.

[vi] Department of Energy 2008. Buildings Energy Data Book. http://buildingsdatabook.eere.energy.gov.

[vii] Now ANSI/ASHRAE/IESNA Standard 90.1-2010.

[viii] Energy Conservation and Production Act, Title III, Section 304(b).

[ix] A net zero energy building (NZEB) is a building that produces at least as much energy as it consumes on an annual basis.

[x] Commissioning is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria. Re-commissioning is an application of the commissioning process requirements to a project that has been delivered using the commissioning process. Retro-commissioning is the commissioning process applied to an existing facility that was not previously commissioned. See ASHRAE Guideline 0-2005: The Commissioning Process.

[xi] Litos Strategic Communication. "What a Smart Grid Means to Our Nation's Future." United States Department of Energy. 2009. http://www.oe.energy.gov/DocumentsandMedia/Policymakers.pdf. November 19, 2010.

[xii] U.S. Energy Information Administration. "Annual Energy Outlook 2010." http://www.eia.doe.gov/oiaf/aeo/electricity.html. November 19, 2010.

[xiii] Smart Grid is an electricity transmission and distribution network or "grid" that uses two-way communications, advanced sensors, and distributed computers to improve the efficiency, reliability and safety of power delivery and use.

[xiv] Demand Side Management entails actions that influence the quantity or patterns of use of energy consumed by end users, such as actions targeting reduction of peak demand during periods when energy-supply systems are constrained.

[xv] Net metering is a service to an electric consumer where electricity generated by that consumer from an on-site generating facility and delivered to the local distribution facilities may be used to offset electricity provided by the electric utility to the consumer.

[xvi] Department of Energy 2009. Buildings Energy Data Book. http://buildingsdatabook.eere.energy.gov.

[xvii] USGBC 2007. *Green Building Research Funding: An Assessment of Current Activity in the United States*.

[xviii] Department of Energy 2009. Buildings Energy Data Book. http://buildingsdatabook.eere.energy.gov.

[xix] Fisk, W. 2002. *How IEQ Affects Health, Productivity*. ASHRAE Journal 44(5): 56-58.

[xx] American Society of Heating, Refrigerating and Air-Conditioning Engineers. "Indoor Air Quality Position Statement," 2005, http://www.ashrae.org/docLib/20060823_20066572959_347.pdf.

[xxi] Additional information on ASHRAE's professional certification programs available at http://www.ashrae.org/certification/.
[xxii] See also ASHRAE's Position Document on Airborne Infectious Diseases, available at http://www.ashrae.org/docLib/20090901_AirborneInfexDiseasesPDFrev.pdf.
[xxiii] See the report *High-Performance Federal Buildings: Meeting EISA Requirements through 2030* for results of a public/private sector workshop on implementing the requirements in EISA. http://www.ashrae.org/docLib/20081103_FedBldgReport.pdf.
[xxiv] The U.S. Conference of Mayors 2008. *Current and Potential Green Jobs in the U.S. Economy*.
[xxv] For more information on the caucus see http://www.hpbccc.org.