2013 Moving Forward: Findings and Recommendations from the Consultative Council
Introduction

Buildings are becoming increasingly complex. At the same time, the businesses, policies and participants that support the built environment in the United States make for an industry dynamic that also is complex. Despite these complexities and numerous priorities, the U.S. building industry has come together under the National Institute of Building Sciences Consultative Council to address challenges, identify findings, make recommendations and seize opportunities to improve the nation’s buildings and related infrastructure, and, thereby, the thousands of communities that depend on them.

Over the past few years, the U.S. building industry, represented by the diversity of the Consultative Council and its Topical Committees, has identified a number of important issues, along with actionable recommendations for resolution. It is their intention that these recommendations would serve as the beginning of a national policy framework for achieving high-performance buildings and communities.

The Consultative Council issued several reports highlighting the industry’s annual priorities. A number of those recommendations remain priorities and are listed here.

• Continue funding for the successful EnergyStar® and WaterSense® programs and surveys for building energy and water data conducted by the U.S. Energy Information Administration (EIA).
• Establish a federal plumbing research facility to advance fundamental plumbing knowledge, including impacts of pipe sizing changes and thermal insulation (pipe insulation) on energy and water use.
• Perform an industry-wide analysis of existing standards applicable to the creation of high-performance buildings to support a standard set of metrics for the industry.
• Study options for incorporating time-dependent valuation (TDV) considerations in the residential and commercial model energy codes.
• Ensure that building and infrastructure issues are incorporated into the ongoing National Climate Assessment by having the building industry and the U.S. Global Change Research Program work cooperatively together.
• Engage the building community with climate and weather scientists to help identify the information required for adaptation to climate change, and develop the practices, standards, codes and guidelines needed by the private and public sectors to adapt the built environment.
• Advance the movement to performance-based (and ultimately outcome-based) codes and standards.
• Invest in energy and water-related infrastructure, which is desperately needed. Such programs, specifically aimed at repairing and replacing aging infrastructure, would vastly improve efficiencies and create jobs.

Detailed explanations of each of these recommendations can be found in past reports, which are available on the Consultative Council’s web page: www.nibs.org/cc.

In 2013, the Council focused specifically on priorities in a few key areas, and provided clear recommendations for action. These areas of focus include:

• The Building Workforce
• Guidance on the Use of Non-Potable Water
• Understanding the Energy/Water Nexus
• Supporting the Existing State and Local Building Regulatory Infrastructure
• Developing the Business Case for Private Sector Investment in Hazard Mitigation
The Building Workforce

There is a growing concern—within individual building-related disciplines and the building industry as a whole—about the dearth of new entrants to the workforce and, in particular, the lack of new candidates for the skilled trades. Despite the fact that the building industry has made significant advancements in the utilization of technology over the years and industry professionals have the ability to earn a quality living, young people (and their parents and other influencers) appear fixed on attaining careers in other sectors of the economy.

While the Obama Administration and others have focused on the implementation of science, technology, engineering and mathematics (STEM) education programs as a means to interest students in scientific and technical careers, few such programs specifically highlight the building sciences. The Institute’s engagement with the National Aeronautical and Space Administration (NASA) and the Total Learning Research Institute (TLRI), which is introducing students to building science and building systems through their participation in a Facility Operations Challenge on Mars City, can serve as an example for linking building sciences with other STEM-related efforts. The building industry should support such efforts to raise visibility for their professions. In addition, all building industry participants should make it a priority to recruit and mentor young entrants into the building professions, skilled trades and related fields.

Over the past few years, changes within the educational system (particularly at the high school level) have seriously influenced the ability of the building industry to attract students to pursue building-related careers. The shuttering of industrials arts or “shop” classes and other hands-on training facilities at the high school level—whether due to concerns about liability, meeting educational objectives or optimizing educational offerings to satisfy evaluation criteria—has limited the opportunities to expose large numbers of students to the buildings trades.

The shifting focus of parents, guidance counselors and federal, state and local departments of education on promoting a two- or four-year college degree in lieu of a trade school has proved detrimental—despite the fact that trade school graduates often have lower student loan debt, are employable and productive immediately, and can earn respectable salaries.

Given the important need for a well-trained workforce to design, construct, maintain and operate high-performance buildings, the Consultative Council makes the following recommendations:

• All members of the building industry should serve as mentors for younger members in their field and/or commit to activities that will expose elementary or secondary students to careers in the 21st century building industry.
• Building industry organizations should build respect for building trades through a multi-faceted approach, including utilization of media outlets (billboards, advertisements, etc.); targeting parents, teachers and guidance counselors; and emphasizing earning potential, employment readiness and technology utilization.
• Industry associations should develop and support STEM education programs—particularly with a buildings focus—to prepare students for careers in the 21st century building industry.
• The U.S. Department of Education (DoEd) and other evaluators of high school performance should include recognition of student enrollment in trade programs as a worthy alternative to two- or four-year college placement rates.
• Building industry members should initiate and participate in local workforce development programs that engage chambers of commerce, businesses, education and training providers and others to develop programs and strategies to address localized needs for an agile and effective workforce capable of designing, constructing, operating and maintaining the communities of the future.
• The U.S. Department of Labor and DoEd, in consultation with building industry representatives and other construction community stakeholders, should develop a comprehensive national workforce plan that includes a focus on appropriate technical education, as well as continuing education of the existing workforce, and engages K-12 students, parents, teachers and guidance counselors in developing a blueprint for an effective 21st century building industry.
**Guidance on the Use of Non-Potable Water**

Though not suitable for drinking, non-potable water can be used for many other purposes. Yet, even though much of the nation has suffered a severe drought in recent years, in many states, due to the lack of clear guidelines for usage, this valuable resource is literally going down the drain.

In recent years, the National Institute of Building Sciences has identified (numerous times) that the lack of nationally recognized, science-based minimum standards to address common uses of non-potable water is a key hindrance to the wider use of non-potable water nationally. Yet, this important water issue has not yet been resolved, and, in many states, the ever-increasing interest in wider use of non-potable water has made the issue even more acute.

There is broad consensus that non-potable water is suitable for a wide range of functions including, but not limited to, toilet and urinal flushing, surface and subsurface landscape irrigation, vehicle washing, cooling tower makeup and automatic fire sprinklers. However, national criteria have not yet been established to address the minimum microbiological and chemical properties required of water for various end uses.

To date, a number of states have created health regulations addressing the use of non-potable water, but they vary in their stringency, approach and applicability to all the available sources of non-potable water. In addition, a number of private sector standards have sought to address the minimum performance of non-potable water treatment systems. However, these standards are not yet broadly adopted and they are only intended to be used in the context of assessing system performance; they do not address all sources or end uses.

On the national level, the U.S. Environmental Protection Agency (EPA) sets minimum water quality requirements for potable water under authority of the Safe Drinking Water Act, but that agency has no complementary authority for non-potable water intended for beneficial reuse. The EPA’s Office of Water does produce a guidance document entitled *Guidelines for Water Reuse*, which is an excellent resource, but it is non-binding. Facilitating the widest use of non-potable water and assurance of human health protection requires a national standard.

Therefore, the Consultative Council recommends the U.S. Congress pass legislation granting the EPA the authority to set uniform national water quality criteria for all appropriate end uses of non-potable water in much the same way it does for potable water under the Safe Drinking Water Act. The procedure the EPA uses to establish such water quality criteria should be an open process utilizing a public-private partnership to benefit from the science-based findings of both the public and private sectors. The agency should also establish appropriate monitoring and assessment criteria and techniques for each end use.

Such action will enable rapid increases in the use of non-potable water throughout the United States, reducing demand for potable water and the energy used to transport and treat it. Removing the current patchwork of regulations will also permit the development of non-potable water technology, facilitating growth of an industry with a potentially worldwide export market.

**Recommendation:**
- The U.S. Congress should pass legislation directing the EPA to set uniform national water quality criteria for all appropriate end uses of non-potable water through an open process utilizing a public-private partnership to benefit from the science-based findings of both the public and private sectors. It should also establish appropriate monitoring and assessment criteria and techniques for each end use.

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**Understanding the Energy/Water Nexus**

The energy/water nexus is a term increasingly used to describe the interdependencies between water and energy resources. Huge volumes of water are consumed in the energy sector for generating electricity and extracting and processing natural gas and other fuels used in buildings. In addition, the processes to pump, treat, heat and deliver the water that is consumed in buildings all require expenditure of a significant amount of energy.

However, the energy/water nexus extends beyond the generation of energy and the distribution of water, and its implications need to be better understood in order to provide guidance to standards developers on beneficial strategies for the efficient management of energy and water in our nation’s buildings. Gaining a better understanding of the energy/water nexus’ implications on various building systems and products used in buildings would clearly be instructive for standards developers when considering new provisions that address energy and water-efficient building design.

Detailed evaluation, measurement and verification (EM&V) protocols already exist for analyzing energy-efficiency performance, but these protocols need to be revised to properly address the embedded energy savings emanating from water conservation and management programs. To date, these evaluation protocols only include savings from hot water conservation programs. The protocols need to properly document where interactive water and energy savings occur, and greenhouse gas emission reduction calculation methodologies need to be revised to correctly recognize the contributions coming from the saved embedded energy in water supply, treatment, pumping and consumer end use consumption.

**Recommendation:**
- The National Institute of Standards and Technology (NIST) should develop water and energy industry-accepted EM&V protocols that standards developers can utilize to help make determinations on provisions where water and energy tradeoffs exist.
- Depending on the geographic location, treatment requirements and other factors, the amount of energy to treat and deliver water can vary. The U.S. Department of Energy (DOE) should compile a national database of...
embedded energy in water, as well as embedded water in energy, with a focus on developing regional and local estimates needed for planning purposes.

- DOE should convene regional meetings that assess the need for increased levels of combined energy and water efficiencies based on identified regional resource needs. This will allow for the prioritization of water or energy efficiency provisions where trade-offs exist in utilizing various building component systems and technologies.

- DOE should convene stakeholder meetings and hearings to develop widely accepted energy and water footprint guidelines for use by building owners and facility managers.

- The federal government should work with state and local governments and other stakeholders to develop land use and sustainable community planning guidelines and codes that address antiquated zoning provisions and allow for the most efficient use of energy and water resources.

- DOE should become more engaged in the development of consensus-based building, plumbing, mechanical and electric codes to promote increased levels of energy and water efficiency.

- NIST should reestablish the Plumbing Research Program and begin the research needed to modernize modern water pipe sizing requirements for commercial and high-rise residential buildings contained in the nation’s plumbing codes. This is a very complex issue that necessitates government leadership but it would result in ongoing energy and water efficiencies in every building constructed with right-sized plumbing systems for the entire life of the building.

- The federal government should develop tax incentive plans, such as tax exemptions or tax credits, to promote retrofitting existing buildings by removing old water-guzzling plumbing fixtures and appliances and replacing them with more efficient models. Recent studies estimate that 40 to 60 percent of the toilets installed in existing buildings predate water consumption levels established in the Energy Policy Act of 2005. By replacing these fixtures, the opportunity for meaningful savings of both water and energy is profound.

- The federal government should encourage the installation of smart metering and sub-metering technologies that provide immediate feedback to tenants, building owners and facility managers on both energy and water use. (Sensors to monitor the quality of that water also should be considered.)

- DOE should develop improved EM&V protocols for analyzing energy and water efficiency performance. To date, these evaluation protocols include only savings from hot water conservation programs, not water saved from cold water fixtures, such as high-efficiency toilets and urinals. Intertwined water and energy savings need to be properly documented where they occur, and greenhouse gas emission reduction calculation methodologies need to be revised to correctly recognize the contributions coming from the saved embedded energy in water supply, treatment, pumping and consumer end-use consumption.

- Accreditation organizations should require that architectural curriculums at the nation’s universities include content on efficient plumbing design and address issues related to reducing water use.

- The federal government needs to support desperately needed research on the unintended consequences of water efficiency. There are three specific concerns:

  - Reducing the amount of water flowing through supply lines could increase the risks posed by bacteria in the system. There is a need for better measurement of the amount of time drinking water remains within water utility distribution systems and water supply lines in buildings in order to assess the potential danger that raising water efficiency could reduce disinfection levels.

  - Reducing hot water temperatures in the system could create an environment for pathogens, such as Legionella. Current mandates within plumbing codes reduce hot water temperatures in plumbing systems in order to reduce scalding incidences and to save energy. However, this potentially creates an environment for opportunistic pathogens to grow in hot water pipes. There is a need to determine the best mitigation strategies and technologies to provide for both safety and efficiency. ASHRAE is currently in the process of completing BSR/ASHRAE Standard 188: Prevention of Legionellosis Associated with Building Water Systems, and the accompanying Guideline 12. The highly anticipated publication of these documents will provide facility managers with techniques that can be employed to mitigate Legionellosis outbreaks, as well as a set of best practices for when outbreaks occur.

  - Reducing the flow of water in the pipes could increase problems with drain blockages and corrosion. Reduced flows from toilets, other plumbing fixtures and appliances within sanitary plumbing systems are increasing the likelihood of building drain blockages and failures resulting from corrosion due to decreased quantities of water in the drain pipes. Several research projects currently underway in the United States, notably by the Plumbing Efficiency Research Coalition (PERC), will help to determine “how low we can go” without negatively impacting public health and safety. Phase 1 of the PERC research, which was funded entirely by the private sector, is now complete. As a result, the U.S. EPA WaterSense® program has decided to move forward with a new specification for high-efficiency commercial toilets. However, Phase 2 of this research has stalled, due to lack of funding.
Supporting the Existing State and Local Building Regulatory Infrastructure

State and local governments serve an important function in keeping their communities safe. Unfortunately, many jurisdictions have undergone significant reductions in budgets in the past several years and do not have the resources to fully support their building safety departments. Having the federal government help support that important function, through the provision of technical and financial resources, such as education and training, technical assistance, grants and incentives would help local communities while advancing the national priority of having resilient, efficient, high-performing buildings.

In the United States, most state and local governments adopt model codes that are published by non-profit, private-sector codes and standards development organizations. A key value of this system is consistency and certainty—which ultimately benefits the U.S. economy, U.S. businesses and U.S. citizens. This system delivers buildings and structures that serve the needs of our nation's citizens. The U.S. Congress\(^1\) and the Office of Management and Budget\(^2\) both have recognized the value of this private-sector-led system. This private-sector-led process also supports the incorporation of new technologies and innovations through a consistent development process.

In addition to the development and adoption of building codes that reflect a community's priorities, an effective compliance verification mechanism with strong “boots on the ground” is important for understanding and enforcement of construction codes. However, current funding mechanisms for code departments do not reflect their importance to the community. In many jurisdictions, building departments are expected to cover all expenses through funds collected through permit fees. When construction activity is robust, departments are generally able to maintain adequate funding and save contingency funds for future slowdowns in construction. However, when the economy (and thus state and local revenue) declines, any surplus maintained by the department is seen as a source of revenue for the general fund, thus leaving departments unable to maintain personnel and training. Establishing code departments as independent enterprise functions that can support themselves and assist local residents and businesses—no matter the jurisdiction's budget challenges—may be an opportunity to circumvent these cyclical impacts.

Code departments need to market their value to change how they are perceived in their communities. Many departments are seen as an adversary to development, when instead, they have the opportunity to serve as advisors to designers, contractors and owners. For example, up-to-date building codes and strong code compliance can impact a community's resilience to hazard events. This, in turn, affects the affordability of insurance for citizens and businesses. Jurisdictions and their building departments need to develop and communicate these merits in an understandable way so that their citizens and leaders gain a greater understanding of the department’s importance to the community. Because stakeholders do not necessarily see an instantaneous payback when their communities adopt updated codes, building departments must educate their citizens and elected officials on the value of construction codes.

Code departments are just one piece of a state or local government’s strategy for achievement of community goals. Infrastructure maintenance and updates are often overlooked as valuable contributors to community resilience planning and disaster response. Unfunded infrastructure liabilities place a strain on the economic resilience of communities. State and local governments should recognize the parallel opportunities to address sustainability and resilience and should incorporate them into a multi-faceted approach to achieve community goals.

Recommendations:
- DOE; the U.S. Department of Homeland Security (DHS), including the Federal Emergency Management Agency (FEMA); the U.S. Department of Commerce, including the Economic Development Administration; the EPA; and the U.S. Department of Housing and Urban Development (HUD) should work together, and with the private sector, to identify the economic, social and environmental benefits to communities that adopt and verify compliance with construction codes.
- All federal agencies should ensure that any grants they give to states and localities in support of community development, resilience, housing, planning, transportation and other related functions include prerequisites or other requirements focused on the adoption and compliance with up-to-date building codes. The adoption and compliance rate assessments for energy codes contained within the American Recovery and Reinvestment Act could serve as a model.
- Relevant federal agencies should support development of a joint, web-based portal to provide state and local code departments with access to relevant federal documents, best practices, case studies, training resources, technical resources, grant applications and other tools. The Institute's WBDG Whole Building Design Guide®, which already houses a wealth of federal agency criteria and other construction-related information, might serve as either a template or home for such a resource.
- The National Institute of Building Sciences, with technical and financial support from both the public and private sectors, should conduct a study on the impact of construction codes and code departments on local economies.

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1National Technology Transfer and Advancement Act (NTTAA)
2Office of Management & Budget (OMB) Circular A-119
Developing the Business Case for Private Sector Investment in Hazard Mitigation

Responding to climate change and other hazards is a cross-sector endeavor with implications for health, safety and economics. Therefore, resilience is not a federal government issue, but a national issue requiring national engagement. To achieve national resilience will require those professionals responsible for national infrastructure, from across all levels of government and the private sector, to work cooperatively to map out a course of action. A multihazard, multi-stakeholder approach is required in order to achieve the nation’s resilience goals.

With the growing incidence of hazard events occurring across the United States and globally—and the increasing costs associated with recovery and reconstruction following such events—there is growing interest and support from all levels of government and the insurance industry for investing in mitigation, whether through building codes or other methods. The Institute’s Multihazard Mitigation Council conducted a study in 2005, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities,* for FEMA that identified the value of federal investment in mitigation. However, the value of the private sector investing in mitigation activities has only been identified anecdotally.

Both the public and private sectors need an understandable, yet comprehensive, definition of resilience to support current decision making and set future directions for investment and policy development. Providing reliable data—particularly at the point where such data can inform and influence decision making—is important. One particularly important input point is when making financial decisions. The White House’s Climate Data Initiative is one step in providing an open, computer-readable data source, but the data still must be presented in a meaningful way at the appropriate time. Identifying metrics for resilience is equally challenging—they must evolve from abstract notions to measurable standards that can be used to demonstrate value.

The Institute’s 2005 *Natural Hazard Mitigation Saves* study, which found that every federal dollar spent on mitigation saves society an average of four dollars, highlighted the need to assess and understand savings beyond just those that accrue to the federal government, but to state and local governments and the local economy. The Institute should revisit the *Mitigation Saves* report. To be worthwhile, a new assessment of the value of mitigation should examine and explain the decision-making process for investments, but it also must look beyond the individual investments and resultant savings made at the building level and look at how individual investments can benefit communities as a whole. This would support multi-stage, multi-sector approaches that will likely prove effective and financially justified, in contrast to a project-by-project approach to identifying and funding mitigation.

**Recommendations:**

- **DHS, HUD, EPA, DOE and the U.S. Department of Transportation (DOT) should incorporate resilience planning and mitigation requirements into all relevant grants.**
- **Community ratings conducted for various purposes, including the National Flood Insurance Program and private sector insurance programs, should be integrated and expanded to include development of community-wide resilience ratings that can be used to identify best practices; assist in awarding federal and state grants; and support private-sector decision making, including insurance underwriting and financial investments.**
- **Federal agency programs, including grant programs, should support state and local implementation of resilience strategies.**
- **Federal agencies, working with state and local governments and private sector organizations, should identify critical information needs and methods to address complexities in resilience planning and implementation and to demonstrate the value of investments in resilience—particularly those that provide impacts beyond the level of individual investments, but to the community as a whole.**
- **The National Institute of Building Sciences Multihazard Mitigation Council, with support from the public and private sectors, should update the report *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities* to address current savings and the benefits that accrue to state and local governments and the private sector.**
- **DHS should develop a decision support tool to help state and local governments and the private sector invest in resilience.**
- **Communities should convene regular meetings bringing together elected leaders from federal, state and local government, city and county departments, utilities and other leaders to address community-wide issues, including resilience. An initial national meeting of leaders from representative groups may be desirable to start the dialogue.**
- **NIST, DHS and other relevant federal agencies should develop a National Resilience Strategy with engagement from state and local leaders. The strategy should make use of directives associated with the President’s Climate Action Plan and the November 1, 2013, Executive Order: Preparing the United States for the Impacts of Climate Change.**

**Conclusion**

As federal, state and local governments, building industry organizations and industry practitioners work to improve the built environment and address their many priorities, the Consultative Council is pleased to provide the above recommendations to advance the industry and the nation. In the coming year, the Council will continue to refine these recommendations and identify other important issues before the industry.

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2. The MMC has developed a concept paper and begun fundraising for conduct of such a study with a focus on the value of private sector investment in mitigation.