Homeland Security

Science and Technology

December 2-3, 2009
Washington, D.C.

# 2009 Security, Energy and Environmental (SEE) Summit



*Exploring Innovative and Advanced Applications of Physical Security, Energy Efficiency and Environmental Sustainability for our Nation's Buildings*

National Institute of BUILDING SCIENCES

*An Authoritative Source of Innovative Solutions for the Built Environment*

## Introduction

On December 2-3, 2009, the National Institute of Building Sciences hosted the Security, Energy and Environmental (SEE) Summit in Washington D.C. The Summit was sponsored by the U.S. Department of Homeland Security Science and Technology Directorate, Infrastructure and Geophysical Division. The purpose of the SEE Summit was to develop recommendations for the successful integration of building security design measures, applications, materials and systems with innovative and advanced applications of energy efficiency and environmental sustainability. This event brought together nearly 60 leaders from government agencies, laboratories and universities, industry associations and organizations, and the private sector.

The government agencies included National Science Foundation (NSF), Department of Defense (DoD), Department of State (DOS), Smithsonian Institution, Environmental Protection Agency (EPA), General Services Administration (GSA), Department of Energy (DOE), Department of Veterans Affairs (VA), Federal Emergency Management Agency (FEMA), and the Department of Homeland Security (DHS).

The laboratories and universities included Lawrence Berkeley National Laboratories, U.S Army ERDC/CERL, University of Minnesota, and Virginia Tech.

Industry associations and organizations included the American Institute of Architects (AIA), American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE), American Society of Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME), National Electrical Manufacturers Association (NEMA), American Architectural Manufacturers Association (AAMA), American Council of Engineering Companies (ACEC), High Performance Building Council (HPBC), and Federal Facilities Council (FFC).

Private sector representatives came from Wiss-Janney-Elstner, HOK, Barbara Nadel Architects, PMC Group, Catalyst Partners, Weidlinger Associates, William H. Gordon Associates, and URS Corp.

The overall premise of the Summit was to develop a comprehensive set of recommendations to foster and promote a new paradigm resulting in buildings that meet the definition of high-performance buildings as defined in the U.S. Energy Independence and Security Act (EISA) of 2007.

- **Title IV – Sec 401. Definitions.**
  - **High Performance Building –** The term “high-performance building” means a building that integrates and optimizes on a life cycle basis all major high performance attributes, including energy conservation, environment, safety, security, durability, cost-benefit- productivity, sustainability, functionality, and operational considerations.


**Addressing the Challenge**

The U.S. Energy Independence and Security Act (EISA) of 2007, created “to move the United States toward greater energy independence and security,” has caused Federal agencies to reassess their mindsets and work processes—not only about energy and sustainability, but also about the environment at large, as well as the built environment and its attending performance attributes, including security.

To form a framework for debate and then action to address these issues, the Department of Homeland Security’s Science and Technology Directorate, Infrastructure and Geophysical Division convened a broad spectrum of federal agencies and the building community for the Security, Energy, and Environment (SEE) Summit.

The SEE Summit provided a forum for exchanging public and private perspectives on energy, sustainability, and security. The Summit enabled all who took part to understand how performance-based whole building design is key to creating a sustainable and defensible built environment and goes hand-in-hand with the need to embrace an integrated design process. It addressed how Federal agencies are approaching EISA requirements for energy independence by 2030 and at the same time promoting other high performance attributes, such as building security.

Above all, the summit pointed out that all players in the building industry need to look at security, energy, and environment as interdependent issues that provide

complementary support in high-performance buildings. This kind of interdependent thinking also is necessary for creation of a research agenda for a materials science data base—and for the development new design strategies and new materials.

A second recurring theme throughout the Summit was the need for resilience in buildings, or the ability of a building to adapt to changing conditions; including catastrophic events and circumstances.

A third recurring theme was that it's going to take a partnership of government, academia, private and public sector research, and industry across the building community to assemble the pieces necessary to make buildings more resilient in high-performance ways.

Ultimately, this new initiative must be designed to support:

- Coordinated research programs
- Integrated building design guidance
- Performance-based standards
- Uniform building validation/certification.

**Fundamental Principles of Integrated Whole Building Design**

Participants agreed that the major principles underlying the development of this initiative should include:

- **Early design collaboration** among all participants in the building process, including an informed building owner.

- Clear and unambiguous **documentation of the actual building design and design process**. Participants were encouraged that current and future advancements in building information modeling (BIM) will provide substantial improvement and benefits of clearer and more appropriate documentation ultimately to the building owner over the building life cycle.

- **An open and transparent process**. Participants pointed out that open information generated in BIM versus vulnerability raises operational issues when dealing with government agencies. Procurement and delivery methods need to be addressed to allow for changes in the delivery process.

- **Performance-based codes and standards.** Performance based codes and standards state goals and objectives to be achieved and describes method that can be used to demonstrate whether designs, systems, or products meet the specified goals and objectives. A performance based standard focuses on desired characteristics of the final product, service, or activity rather than requirements for the processes to produce it thus providing more flexibility and

opportunities for innovation and advancements in design, materials, and products.

- **Building performance evaluation** that emphasizes measurable owner requirements, documentation of the basis of design including system and material selection, and uniform whole building performance verification standards and validation methods.

- **Life-cycle cost analysis** is the backbone of determining the most appropriate design strategies and systems for the overall highest performance of a whole building. The current separation between the acquisition of the building and its operating and maintenance budgets creates a significant disincentive for the consideration of anything but first costs until a more holistic approach is implemented.

- **Education of both students and professionals in building science**. The lack of building science curricula in professional schools of architecture, engineering and architectural engineering is a major barrier to the dramatic improvement of this country's building stock and offers substantial opportunities to provide for a new cadre of design professionals qualified to increase building performance.

## Goals and Actions

A number of recommendations were developed by the Summit participants during the plenary sessions. These recommendations have been compiled into a set of goals and actions that could be taken to promote the fundamental principles of integrated whole building design.

The goals are interdependent and mutually supportive. Summit participants agreed that an industry/government council should be established to address the goals and action items put forward at the summit.

### Goal: 1. Bring federal agencies, academia, industry and research communities together to promote integrated building design

As building-related organizations and agencies stay focused on their constituent concerns, the challenge will be to integrate their knowledge and activities into the overall initiative. For example, the threat of CBRN attack and many architects' lack of expertise in this SEE component is example of the type of professional awareness that needs to be increased. As we develop accurate and accepted procedures for performance-based and life-cycle analyses, we need to have the necessary expertise—across the building industry--to achieve SEE mandates.

DHS also needs to focus on the economic aspects of adding these considerations to buildings. This demands consideration of building economics--including trends such as patterns of ownership and critical occupancies—as we consider buildings as functional entities. It is likely that the private sector will follow the federal lead in this area, so it is important to keep industry building owners and facility managers involved in the process.

**Actions**

- Convene an industry/government council to bring all sectors to the table focused on promoting integrated design practice, reducing stovepipes, encouraging development of advanced materials, and developing strategies, guidance and education to implement integrated design, and practice.
- Conduct an annual SEE Summit to bring to together government, academia and industry to support and promote integrated design.
- Help develop necessary expertise—across the building industry--to achieve SEE mandates.
- Emphasize and highlight case studies of buildings where SEE concepts have been integrated especially in federal buildings.
- Foster the inclusion of building economics in the overall initiative.
- Implement program to bring private building owners and facility managers into the SEE program.

**Goal: 2. Change design practice to promote integrated design process.**

Design practice is slowly changing to adopt principles of integrated design. Industry analysts generally agree that the availability of new electronic tools and processes are resulting in increasing design collaboration, better documentation, and more open and transparent processes. The increasingly widespread availability of building integration modeling (BIM) tools is providing significant opportunities for the adoption of more integrated design processes.

Integrated design process is particularly important to DHS for achieving goals such as fostering multihazard design where integrated design is necessary for success. DHS can promote integrated design processes through practices that include explicit support for interoperability among systems employed. Further, adoption of life-cycle analyses will foster the integration of SEE considerations not only for whole buildings but also for new concepts such as resiliency.

The increasing prevalence of BIM tools and processes presents particular opportunities for DHS. Having a facility designed electronically before physically allows for the consideration of multiple design imperatives such as security, energy and environmental requirements. It also is critical for providing first responders with an updated electronic “map” of a facility that could be made available in a real-time request.

DHS could also develop a matrix for decision-makers that allows them to consider the entire building as well as the individual building systems. DHS could also encourage systems design for architects and engineers, as well as testing protocols for whole building systems. DHS also could foster design professionals' knowledge of other professions that work on buildings through an integrated design process beginning at the onset of a project.

**Actions:**

- Working through the industry/government council and with allied building-related organizations, such as the buildingSMART alliance, promote integrate design processes to industry, government and universities.
- Encourage the adoption of life-cycle analyses and whole systems design that foster integration of SEE considerations.
- Support R&D and other initiatives that explore the interrelationships between the building enclosure elements and SEE considerations.
- Develop a whole-building matrix for decision-makers.
- Encourage and support testing protocols for whole building systems as well as whole buildings.
- Foster design professionals' knowledge of other professions that work on buildings through an integrated design process.

**Goal: 3. Reduce stovepipes in federal agencies and programs.**

It seems likely that stovepipes of information will continue within individual Federal agencies unless they agree to adopt a performance-based approach to integrating SEE concepts. Mission-driven agencies may inadvertently add to stovepipe problems by focusing solely on their own requirements. If presented with a venue through which to share information with other agencies, they might find it easier to adopt a broader, more comprehensive approach. These issues and other ways to reduce stovepipes should be addressed by an industry council to bring all sectors to the table with the purpose of fostering the integration of building design.

**Actions:**

- Identify, analyze and characterize major stovepipe issues within selected agencies that design, build and operate facilities.
- Develop case studies and best practices where agencies have reduced or eliminated stovepipes and introduced integrated design.
- Develop strategies and incentives for agencies to address the stovepipe problem.

**Goal: 4. Define and coordinate the development of advanced materials and other new products research for buildings.**

Materials can offer a great focus for a multidisciplinary perspective. New, emergent materials for buildings to deal with energy, optimization, performance, remediation and response are being developed for applications that have multiple benefits. For example, carbon fiber concrete does not use steel rebar resulting in a lighter, thinner product (reducing transportation costs) that outperforms traditional concrete for physical security.

Too often, however, government procurement regulations inhibit new products' flow into the marketplace by their stringent requirements of standards and testing. There also is a trend for agencies to ask trade associations to write standards for new product certification—and it takes years to develop a standard.

As a countermeasure, DHS, and the Federal government in general, can take on more risk than the private sector and develop test beds for building technologies to meet SEE requirements. Another federal role could be to develop a process for testing materials and products on higher - rather than minimum - performing levels.

DHS could focus advanced materials research on more global issues instead of solving individual problems. Current standards for materials and products are not tested for all aspects of SEE. DHS could conduct and support research on how different classes of building elements react with other SEE elements. Research also could entail how to foster interaction among product manufacturers. As an example, DHS could study how to quantify and support use of resiliency in materials and products.

**Actions:**

- Developing test beds and demonstration projects for new advanced products and components.
- Encourage and support more rapid standards, testing and code adoption procedures for new products and materials.
- Conduct and support a program of basic and applied research on advanced materials for SEE application. Explore how different classes of building elements react with other SEE elements.
- Foster interaction and coordination among divergent research communities
- Consider integrated research for materials that are multifunctional and resilient.
- Support the establishment of innovation centers to stimulate the development of advanced products and materials.

**Goal: 5. Develop integrated design process strategies, guidance, and education.**

Without a clear understanding of SEE requirements, a design team cannot develop a true whole building design analyses. These types of demands point to the necessity of cross-agency coordination, including the integration of criteria development and training

programs.  Education is an equally important component of creating an integrated design process.

**Actions**

- Foster and support the development of integrated design criteria and guidance among government agencies.
- Promote educational institutions in providing curricula for integrated design.
- Sponsor educational design competitions in schools of architecture that require a integrated SEE approach and involve other departments within the college/university.
- Partner with schools and deans to integrate these types of multidisciplinary programs in the professional schools.