Building Science for Building High-Performance Homes

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Presenters:

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Fred Malik // Insurance Institute for Business and Home Safety, Tampa, FL

NAHB
2013 NAHB International Builders' Show®
January 22-24 // Las Vegas // BuildersShow.com

Building Science for Building High-Performance Homes

You design and build the homes people rely on for shelter and protection from natural hazards. To protect occupants affordably requires an understanding of building science and the integration of all elements of the design and construction process. Production of a high-performance home requires the knowledge of how buildings operate as a system. A systems-based approach may result in decreased costs and enhanced performance could command a premium if results can be demonstrated to the potential homebuyer.

Learning Outcomes

- Gain insight in the latest on building sciences and how it is likely to impact builders and the homes they design and construct.
- Learn how your perception of building sciences plays a significant role in achieving high-performance buildings.
- Learn the benefits of incorporating technologies and practices that improve building performance and identify how you can apply this knowledge to produce more desirable homes.
- Discover opportunities to achieve energy- and water-efficiency through integration and planning without increased costs.

American Institute of Architects (AIA) Continuing Professional Education

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members upon completion of the AIA/CES Session Participation Forms found in the back of this session room and online at www.BuildersShow.com. Certificates of Completion for both AIA members and non-AIA members are available upon request.

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Public Law 93-383, Sect. 809

Congress directed the Institute to "exercise its functions and responsibilities in four general areas……."

- **Develop and maintain** performance criteria for maintenance of life, safety, health, and public welfare for the built environment
- **Evaluate and prequalify** building technology and products
- **Conduct** related and needed investigations
- **Assemble, store, and disseminate** technical data and related information

The Institute at Work

Industry Advocacy & Outreach

- Consultative Council
- Council on Finance, Insurance and Real Estate (CFIRE)
- National Council of Governments on Building Codes and Standards (NCGBCS)

Facility Performance & Sustainability

- Building Enclosure Technology and Environment Council (BETEC)
- High Performance Building Council (HPBC)
- National Mechanical Insulation Committee
- Facility Maintenance and Operation Committee (FMOC)

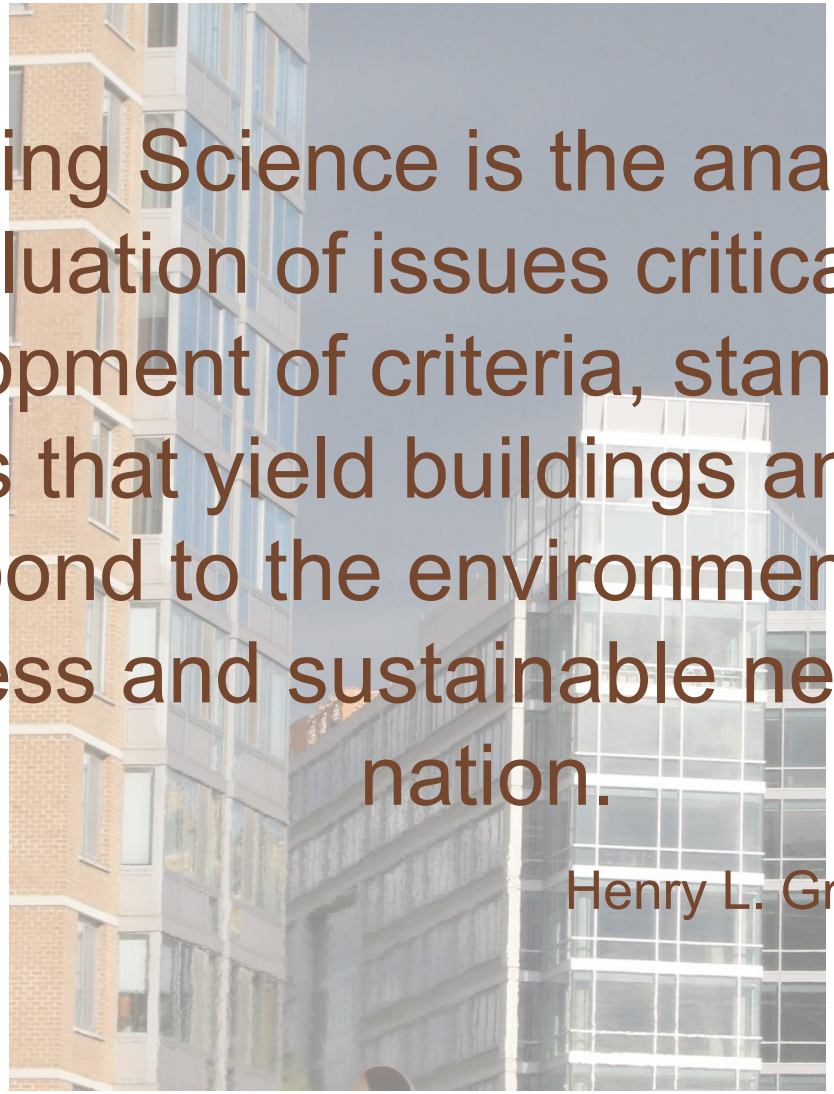
Information Resources & Technology

- Whole Building Design Guide
- National Clearinghouse for Educational Facilities
- buildingSMART alliance
- National BIM Standard-U.S.

Security & Disaster Preparedness

- Building Seismic Safety Council (BSSC)
- Multihazard Mitigation Council (MMC)
- Multihazard Risk Assessment/HAZUS

What is Building Science?



Building Science is the analysis and evaluation of issues critical to the development of criteria, standards and practices that yield buildings and structures that respond to the environmental, societal, business and sustainable needs of our nation.

Henry L. Green, Hon. AIA, 2011

High-Performance Buildings

High-Performance building means a building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy [and water] conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.

-Energy Independence and Security Act of 2007 §401 (PL 110-140)

Consultative Council on HPBs

High-performance buildings, in addition to ensuring a design meets a set of criteria "on paper," must be constructed to plans and specifications and then commissioned and operated as real buildings.

Moving Forward: Findings and Recommendations from the Consultative Council, 2011

Moving Beyond Green™

A truly successful project is one where project goals are identified early on and where the interdependencies of all building systems are coordinated concurrently from the planning and programming phase. Further, it is one that helps the building community better understand the interrelationships, evaluate and appropriately apply the eight high-performance attributes as design objectives.

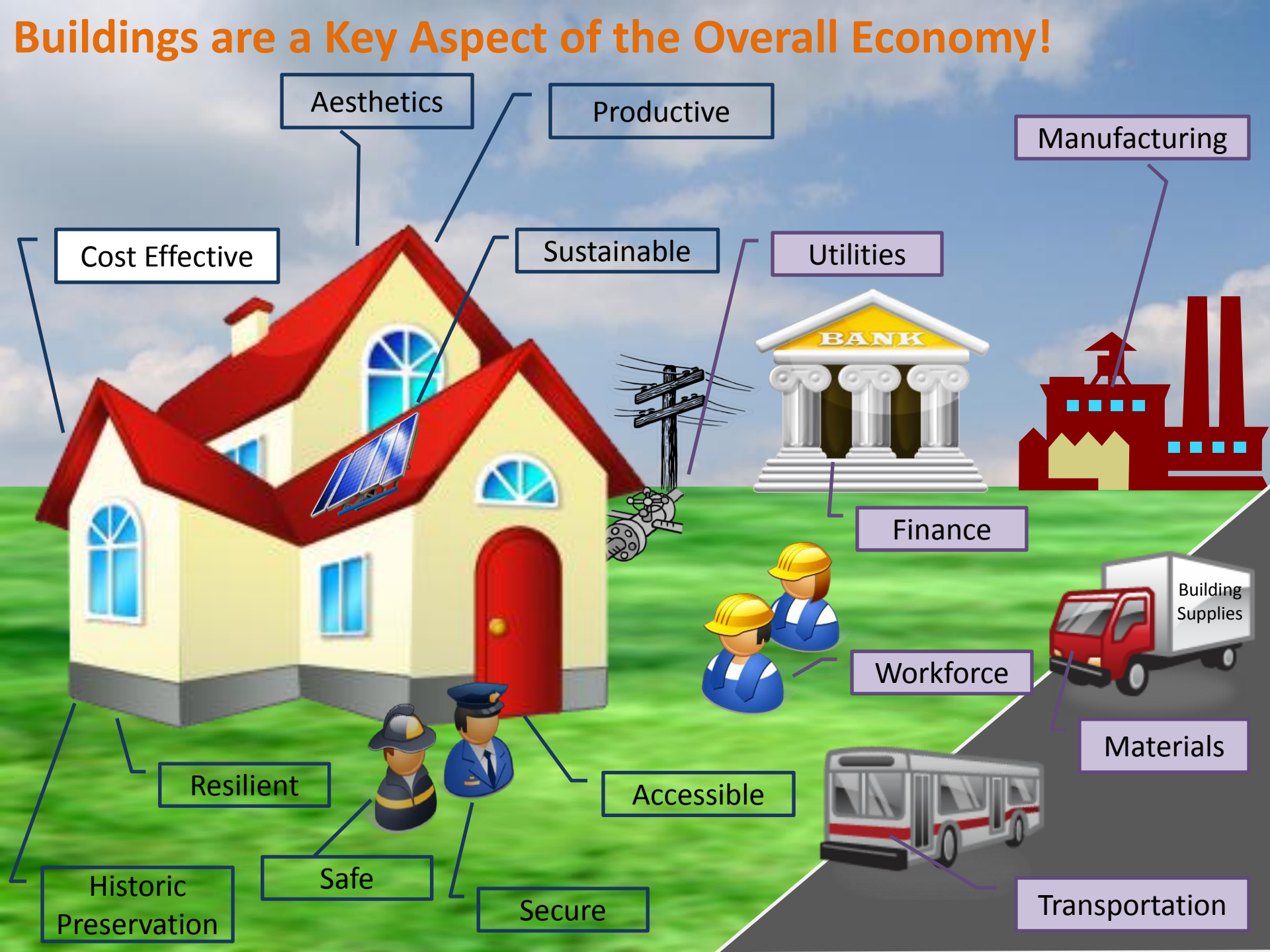
--Sustainable Buildings Industry Council

Beyond Green High-Performance Building Awards

NAHB

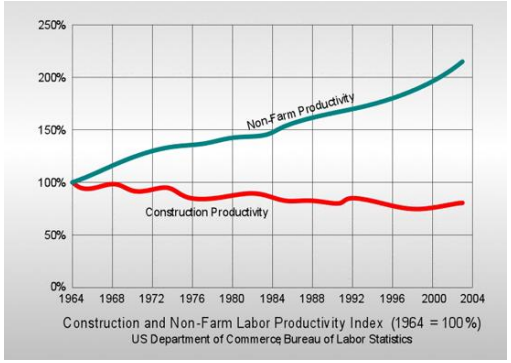
Attributes for High Performance

Buildings are a Key Aspect of the Overall Economy!




Contractors
Finance and Insurance
Owner
Site Development
Engineer
Occupants
Manufacturers & Suppliers
Regulators
Architect

Shifting Perceptions on Cost of High Performance

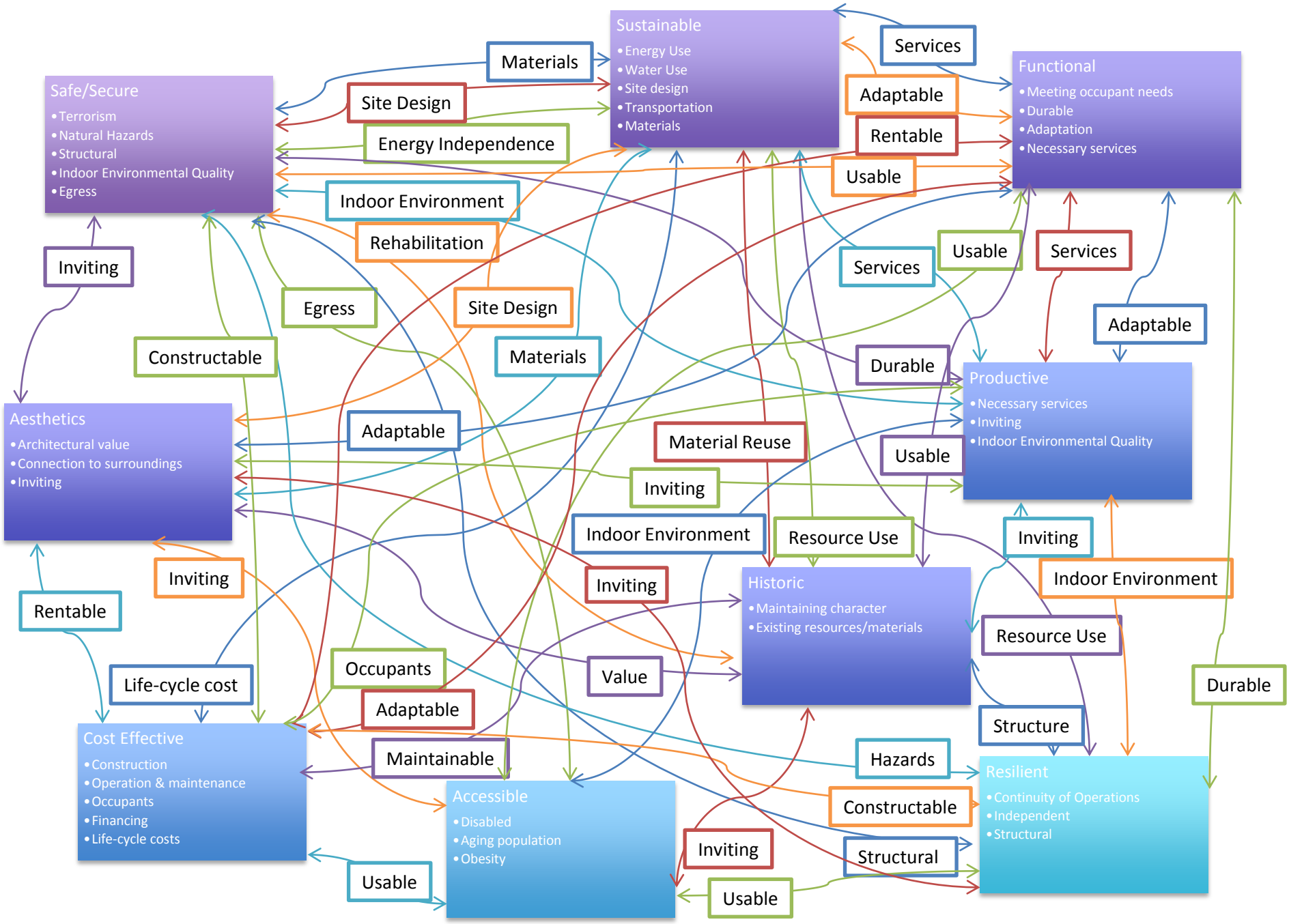


High Performance Buildings
- Operationally Cost effective
- Sustainable / Green / Energy Efficient
- Resilient / DR-COOP
- Supports Productivity / Mission
- Functional / Operational
- Preserve historical value
- Safe to work in
- Secure from threats
- Accessible
- Aesthetically pleasing

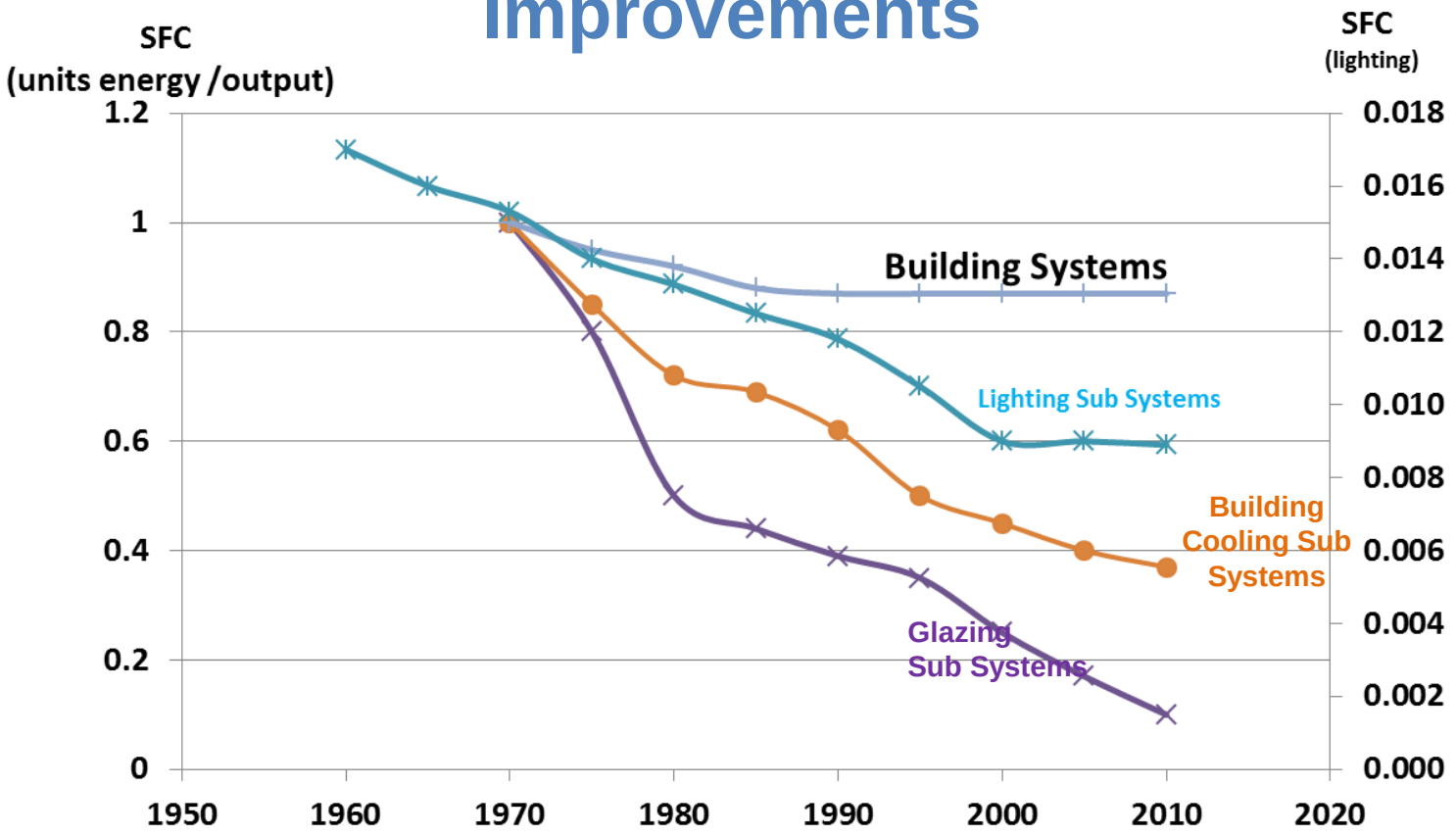
Improved Facility Delivery
- Reduce product waste
- Prefabrication
- Improve supply chain
- Process optimization
- Systems analysis
- Performance analysis
- Commissioning
- Improve product selection
- Common information base
- Coordinate decision making
- Integrate scheduling
- Optimize design
- Design to sustain

Results
Achieve net zero energy
Reduce water consumption
Protect environment
Reduced carbon footprint
Meet LEED goals
Meet Energy Star Goals
Asset optimization

Initial Investment Costs + Lifetime Cost Reductions = Zero or Net Positive


Sustainable
• Energy Use
• Water Use
• Site design
• Transportation
• Materials
Functional
• Meeting occupant needs
• Durable
• Adaptation
• Necessary services
Safe/Secure
• Terrorism
• Natural Hazards
• Structural
• Indoor Environmental Quality
• Egress
Aesthetics
• Architectural value
• Connection to surroundings
• Inviting
Productive
• Necessary services
• Inviting
• Indoor Environmental Quality
Historic
• Maintaining character
• Existing resources/materials
Cost Effective
• Construction
• Operation & maintenance
• Occupants
• Financing
• Life-cycle costs
Accessible
• Disabled
• Aging population
• Obesity
Resilient
• Continuity of Operations
• Independent
• Structural
Materials
Site Design
Energy Independence
Indoor Environment
Rehabilitation
Egress
Site Design
Materials
Constructable
Adaptable
Material Reuse
Inviting
Indoor Environment
Resource Use
Inviting
Occupants
Adaptable
Maintainable
Value
Life-cycle cost
Rentable
Inviting
Usable
Hazards
Constructable
Structural
Inviting
Usable
Services
Adaptable
Rentable
Usable
Services
Usable
Services
Adaptable
Durable
Inviting
Indoor Environment
Resource Use
Structure
Durable

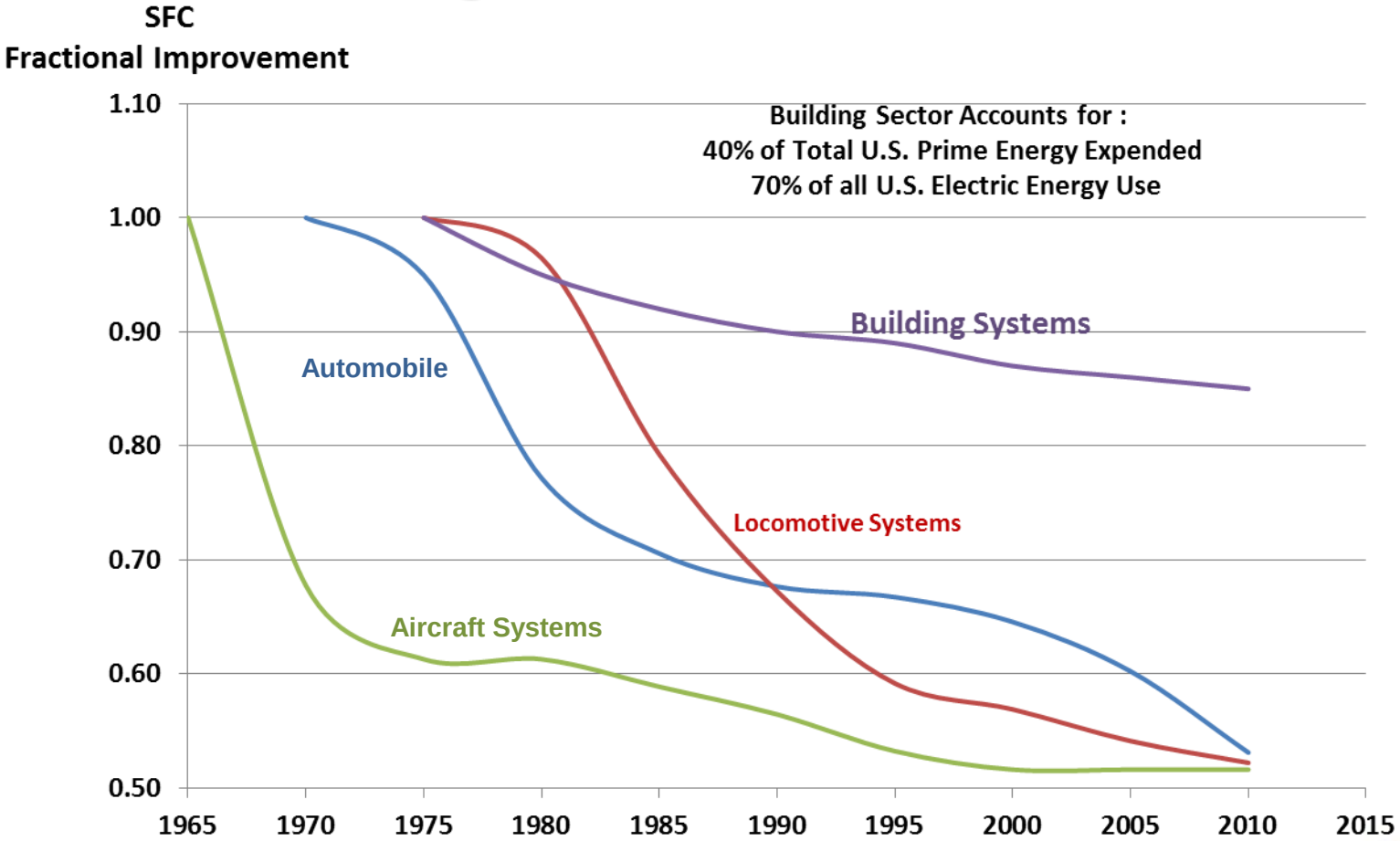
Building System & Sub-system Energy Efficiency Improvements



Building Sector Accounts for :

40% of Total U.S. Prime Energy Expended
70% of all U.S. Electric Energy Use

Efficiency Improvements: Building Sector vs. Other Sectors



Is the Whole Just the Sum of Its Parts?

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Integration and Systems Thinking

Hazards and Energy Efficiency

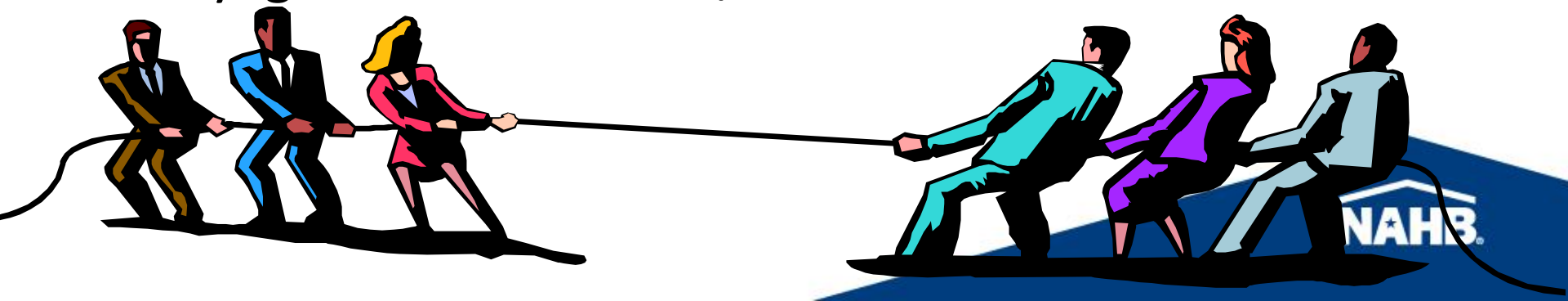
– Missiles v. Foam Board

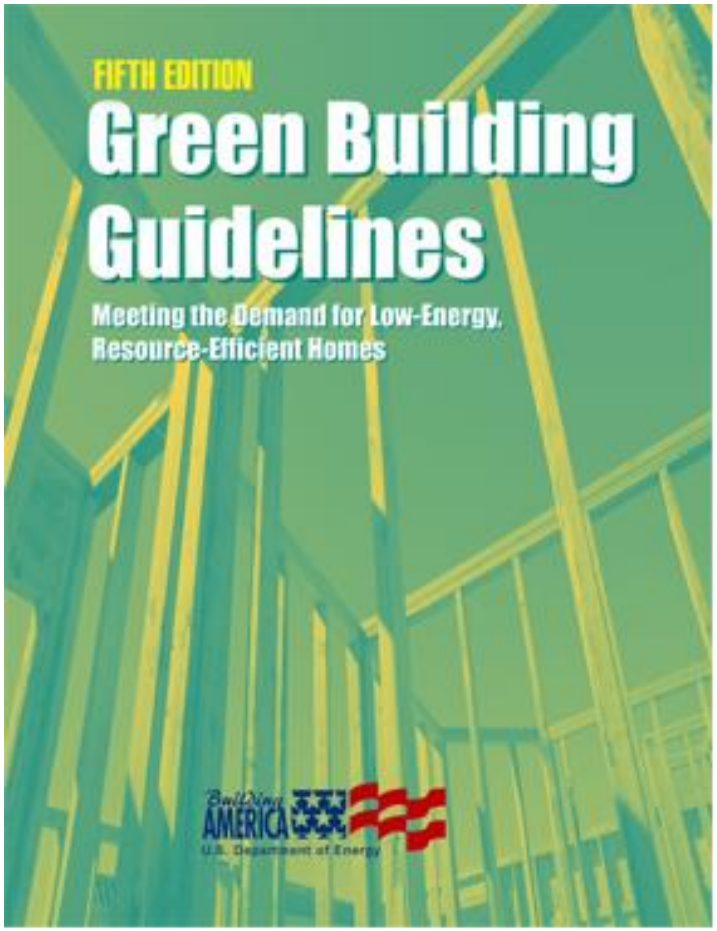
IEQ and Energy Efficiency

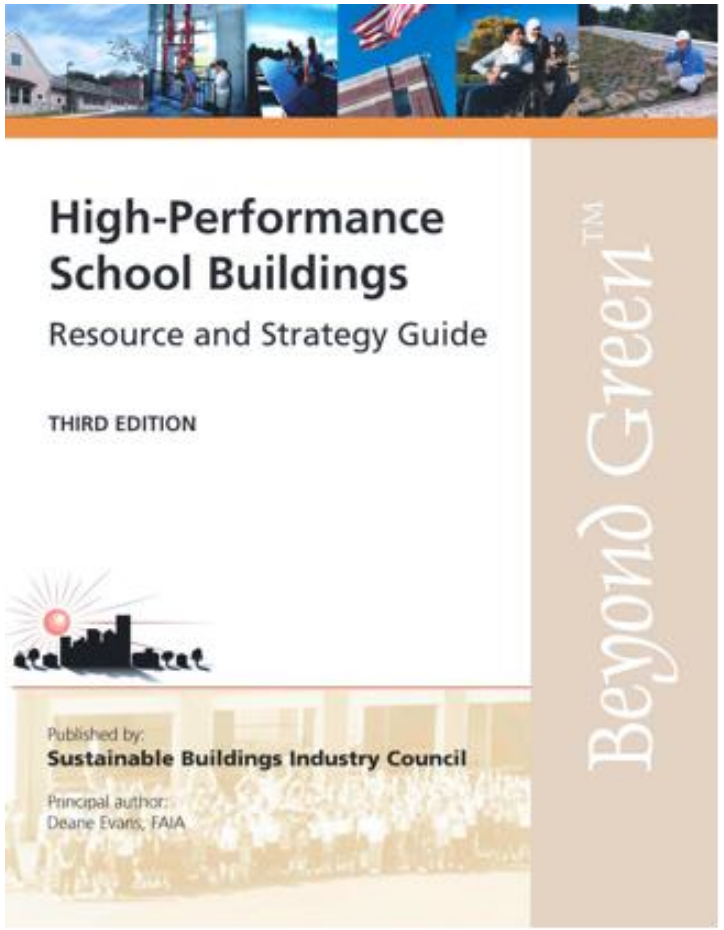
– Ventilation v. Air Tightness

Orientation, Site Planning, Energy and Hazards

– Daylight v. SHG v. Flood/Fire




FIFTH EDITION
Green Building Guidelines
Meeting the Demand for Low-Energy, Resource-Efficient Homes
Building America
U.S. Department of Energy


High-Performance School Buildings
Resource and Strategy Guide
THIRD EDITION
Published by:
Sustainable Buildings Industry Council
Principal author:
Deane Evans, FAIA
Beyond Green™

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WBDG
WHOLE BUILDING DESIGN GUIDE
a program of the
National Institute of Building Sciences

The Gateway to Up-To-Date Information on Integrated 'Whole Building' Design Techniques and Technologies

With over 500,000 users downloading 4 million documents per month

The goal of 'Whole Building' Design is to create a successful high-performance building by applying an integrated design and delivery approach to the project during the planning and programming phases.

EXPLORE
The WBDG User's Guide ▶

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POPULAR LINKS

- Unified Facilities Criteria
- Unified Facilities Guide Specifications (UFGS)

NEWS

VIEW ALL

SBIC Accepting Entries for 2011 Beyond Green Awards
Nov 10, 2011
View Details

New Legislation Would Save Money, Improve Energy Usage in Federal Buildings
Nov 7, 2011
View Details

A Pakol, Shemagh and the WBDG
Oct 31, 2011
View Details

EVENTS

VIEW ALL

2011 Annual Meeting & Ecobuild America Conference
December 05 - 09, 2011
Washington Convention Center, Washington, D.C.
View Details

2011 buildingSMART alliance Conference
December 05 - 09, 2011
Washington, D.C.

PARTICIPATING AGENCIES

FEATURED PROGRAM

DHS, Science & Technology Directorate, High Performance Resilience Program

This program was created by the U.S. Department of Homeland Security (DHS) in 2009 to improve the security and resilience of our nation's buildings and infrastructure. For more information on security, visit the WBDG's Secure/Safe Design Objective pages.

NEW & UPDATED PAGES

Productive – including Integrate Technological Tools, Assure Reliable Systems and Spaces, Design for the Changing Workplace, Promote Health and Well-Being and Provide Comfortable Environments

DSIRE™

Database of State Incentives for Renewables & Efficiency

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

IREC Interstate Renewable Energy Council

North Carolina Solar Center

DSIRE SOLAR
solar policy information

DSIRE is a comprehensive source of information on state, federal, local, and utility incentives and policies that support renewable energy and energy efficiency. Established in 1995 and funded by the U.S. Department of Energy, DSIRE is an ongoing project of the North Carolina Solar Center and the Interstate Renewable Energy Council, Inc.

Search DSIRE

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DSIRE
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www.dsireusa.org

Resources

- RPS Data
- Summary Maps
- Summary Tables
- Library
- What's New?
- Search

myDSIRE

PRODUCTS

- Explore Products >
- Find ENERGY STAR Products
- How a Product Earns the Label
- Save Energy at Home
- Join Our Movement
- Store Locator
- Rebate Finder

HOME IMPROVEMENT

- Explore Home Improvement >
- Common Home Problems
- Assess Your Home
- Air Seal & Insulate
- Heat & Cool Efficiently
- Home Performance with ENERGY STAR
- For Contractors

BUILDINGS & PLANTS

- Explore Buildings & Plants >
- Find Certified Buildings & Plants
- Models of Success
- Guidelines for Energy Management
- Tools & Resources Library
- Expert Help
- Commercial Building Design

NEW HOMES

- Explore Certified New Homes >
- Find an ENERGY STAR Builder
- Find Home Energy Rater Partners
- Find Incentives for ENERGY STAR New Homes
- ENERGY STAR New Home Features
- Benefits for Homeowners
- For Residential Professionals

HEADLINES

- 2013 ENERGY STAR Award Applications Now Available
- ENERGY STAR Buildings Partner Meeting to be Held 10/10-10/11 in Washington, DC

More Headlines

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CELEBRATING 20 Years of ENERGY STAR

Tax Credits for Energy Efficiency

Most Efficient 2012

Cool Your World with ENERGY STAR @home

ENERGY STAR in Affordable Housing

Recycling with ENERGY STAR

Building Enclosure Councils

Atlanta
Austin
Boston
Charleston
Charlotte
Chicago
Colorado
Dallas
DC
Greater Detroit
Honolulu
Houston
Kansas City (MO)
Los Angeles
Miami
Minneapolis
New York
Philadelphia
Portland
Research Triangle (NC)
San Antonio
San Francisco
St. Louis
Seattle
Western PA
Wisconsin

Above the Flood: Elevating Your Floodprone House

FEMA 347 / May 2000

FEMA

Home Builder's Guide to Coastal Construction

Technical Fact Sheet Series

FEMA P-499 / December 2010

FEMA

Home Builder's Guide to Construction in Wildfire Zones

Technical Fact Sheet Series

FEMA P-737 / September 2008

FEMA

Federal Emergency Management Agency
U.S. Department of Homeland Security
500 C Street, Southwest
Washington, DC 20472

Homebuilders' Guide to Earthquake Resistant Design and Construction

FEMA 232 - June 2006

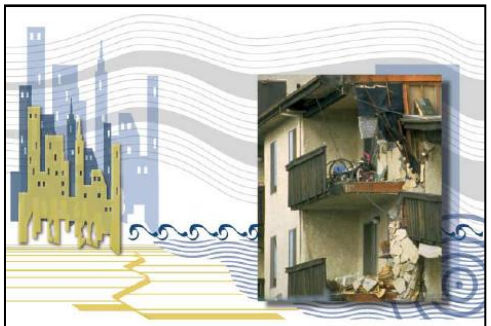
FEMA

nehrp

Natural Hazards and Sustainability for Residential Buildings

FEMA P-798 / September 2010

FEMA



Risk Management Series

Incremental Seismic Rehabilitation of Multifamily Apartment Buildings

Providing Protection to People and Buildings

February 2004

FEMA

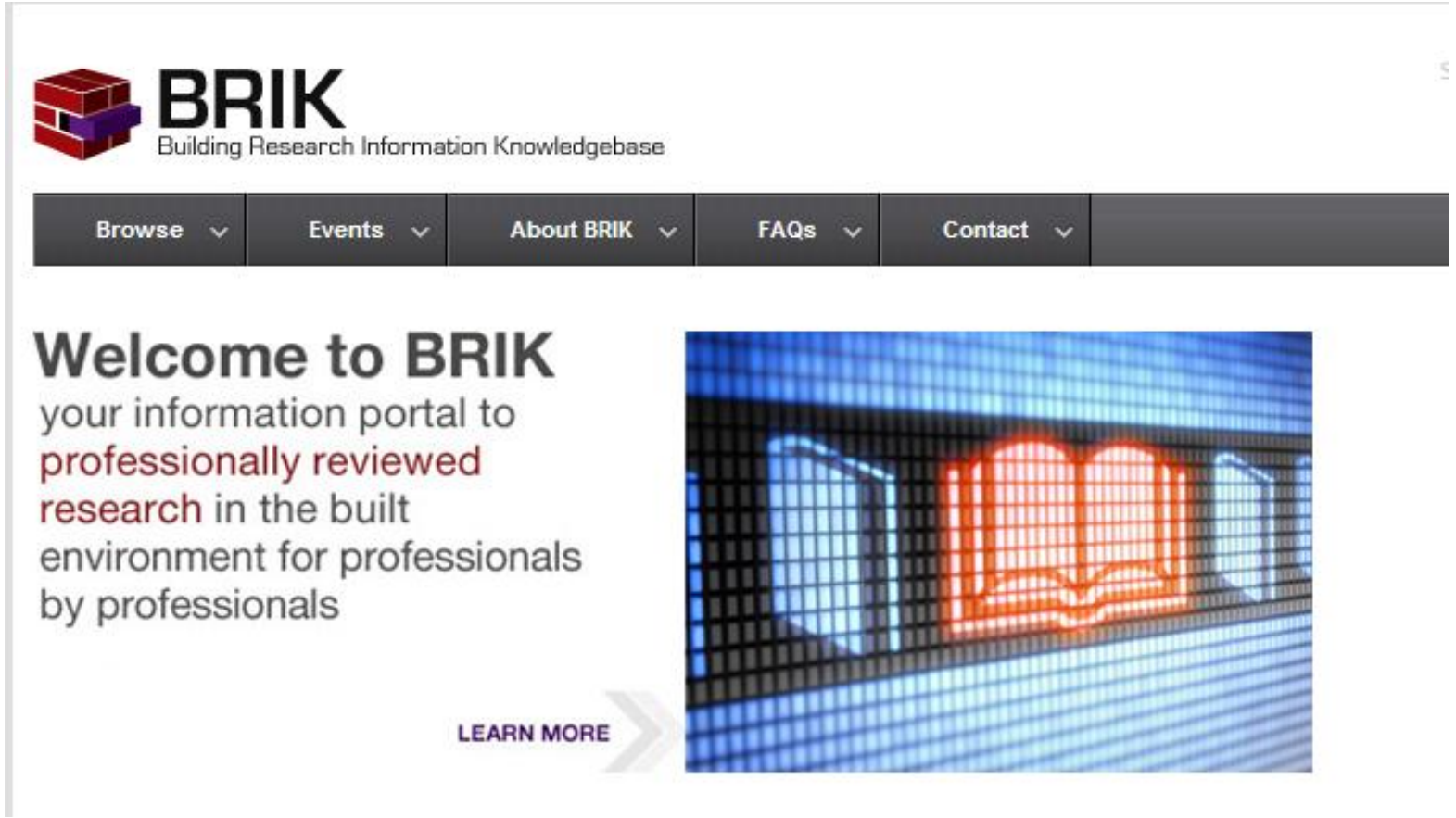
FEMA 398

NAHB

Codes, Standards, Guidance and Rating Systems

- American Society of Civil Engineers (ASCE)
- ASHRAE
- ASTM International
- Department of Energy
- Environmental Protection Agency/EnergyStar
- Green Building Initiative
- Insurance Institute for Business and Home Safety
- International Association of Plumbing and Mechanical Officials (IAPMO)
- International Code Council
- NAHB Research Center
- National Fire Protection Association (NFPA)
- Passive House Institute US
- RESNET
- U.S. Green Building Council

Research Needs to Advance High Performance



- Currently seeking knowledge partners
- www.BRIKbase.org

Building Resilient Communities

- Supporting the local tax base
  - Employees for businesses
  - Consumers for businesses
- Attracting Residents and Businesses

Demonstrating the Benefits

Total Cost of Ownership Focus

- Reduced energy and water costs/risk

SAVE Act

- Affordability based on Mortgage + Insurance + Taxes + Utilities

Comparison to Peers

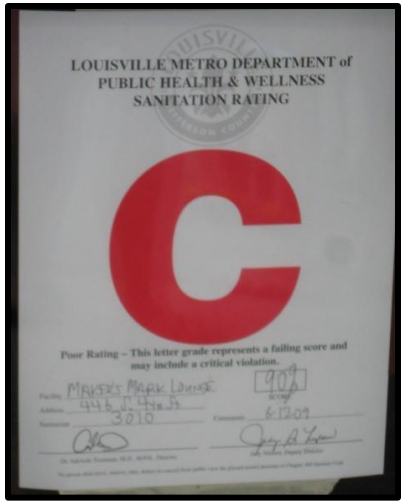
Differentiation: Codes are a Minimum!

Resilience in Face of Hazards

Getting Value in Appraisals

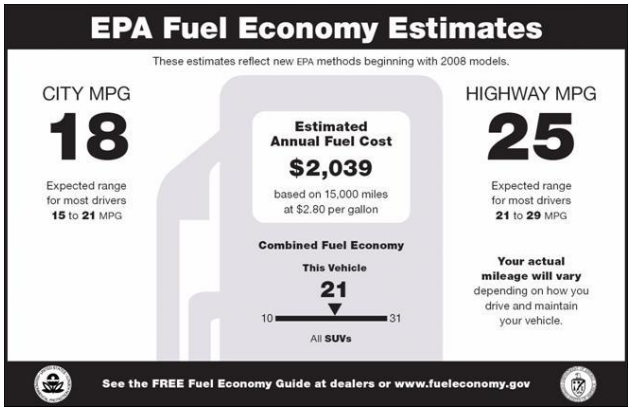
All approaches can result in additional $$$ in Homebuilder pockets

Buildings are finally entering the information age

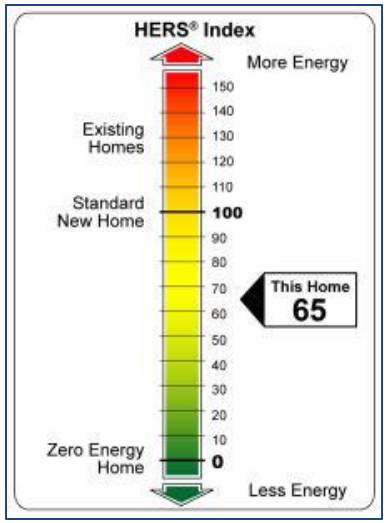


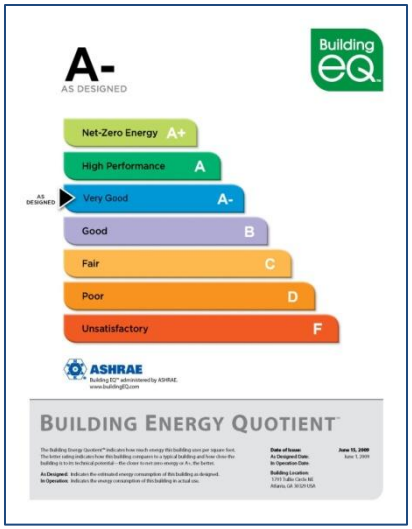
Restaurant Sanitation Ratings

Car Fuel Economy Estimates



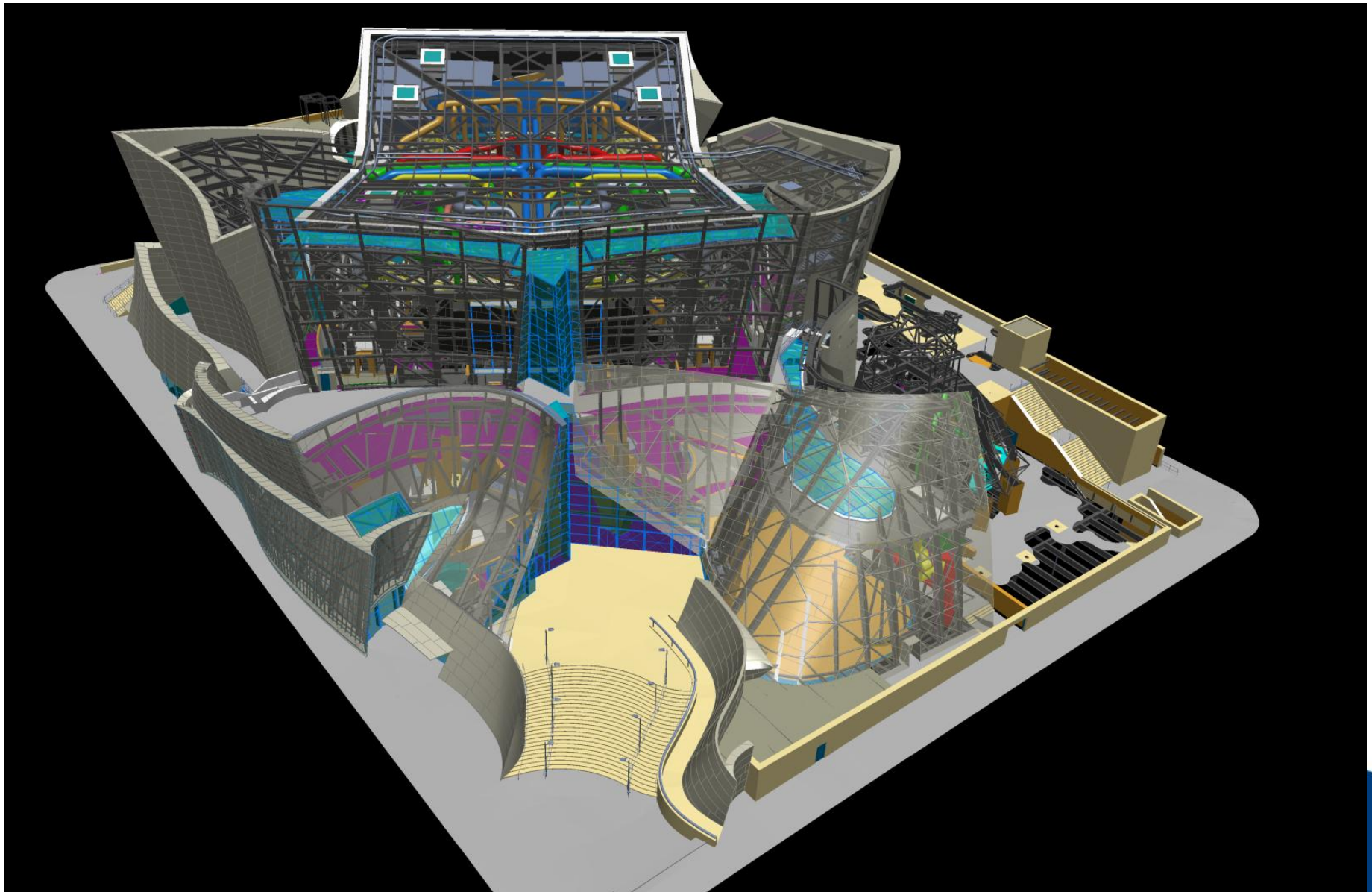
Nutrition Facts Label





The Age of Measurement and Verification

BIM: The Great Integrator



Ifc - Building Information Model

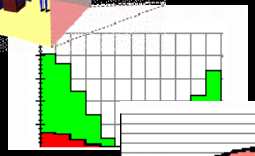
Laws and regulations
-Building regulations
-Building specifications

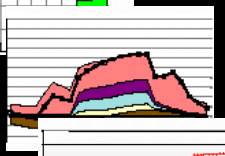
Design and Analysis
-Drawings, calculations
-Architect, engineer,…

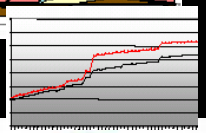
Knowledge databases
-Best practise knowledge
-Own practice

Modeling
-Visualisation, 3D models

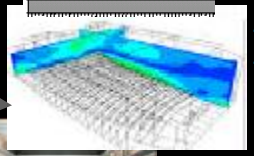
Briefing
-Functional req.
-Estimates
-Conditions
-Requirements



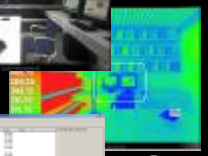




Simulations
-Comfort
-Ventilation, heating
-Energy
-Light, sound
-Insulation
-Fire, usage
-Environment
-Life time predictions
-Crowd behavior
- Safety



Demolition, refurbishment
-Rebuild
-Demolition
-Restoration

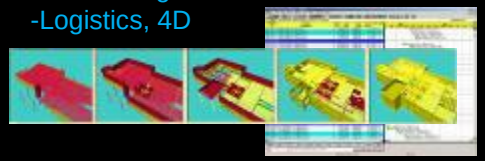


Costing
- Initial cost
- Life-cycle
- Value Engineering

Facility management
-Letting, sale, operations
-Maintenance
-Guaranties

Specifications
-Specification sheets
-Classification standards
-Estimates, accounting

Construction management
-Scheduling
-Logistics, 4D



Procurement
-Product databases
-Price databases

By Lars Bjørkhaug
Illustrations by: Byggforsk, Olof Granlund, NBLN University of California, Stanford University

Building the Building Community

- A Job for One Leads to Jobs for Others
- Improving Building Performance and Owner and Occupant Satisfaction
- Fostering Positive Perception of the Industry
- Improved Public Policy through Collaboration

Transition in the Design & Construction Industry

- New/better modeling tools needed to address design & operation connections
- Demonstrates importance of BIM and integrated design
- Component-by-component and discipline-by-discipline approaches will no longer produce the desired results. Contracting must reflect collaborative needs.

Identifying Universal Challenges

- **Performance Data**: Where are we now and where are we going?
- **Speaking the Same Language**: Can we communicate effectively?
- **Reaching Consensus**: Arriving at the same point but by different means
- **Shifting Perceptions**: Start with the desired outcome and then chart the path
- **Making Connections**: Demonstrating why it matters
- **It's About People**: Human behavior and education are key
- **A Cast of Thousands**: Building by building and actor by actor
- **Changing Habits**: Can existing practices get us where we want to go?

QUESTIONS?

IBS Education handouts are available at www.BuildersShow.com/handouts

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