AABC Commissioning Group

AIA Provider Number 50111116

Driving to Outcomes: How Evolving Energy Performance Policies Impact the Building Process

Course Number: CXENERGY1824

Ryan M. Colker, J.D.

National Institute of Building Sciences

April 26, 2018

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

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for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

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

Course Description

Communities have established or are establishing energy performance and/or greenhouse gas emission goals. Achieving these goals requires a new approach to building codes and other policies. One approach is increasing focus on project outcomes for new construction and renovations. Outcomes rely on actual results rather than design and construction-based criteria which may not result in achieving goals. This session examines current and proposed outcome-based code provisions (including recent guidance from the NIBS) and how Cx providers and others focused on energy performance can assist building owners in achieving goals.

Learning Objectives

At the end of the this course, participants will be able to:

1. Understand the importance of setting project energy performance goals through outcome-based pathways.

2. Integrate commissioning services into the building life-cycle to support achievement of energy performance goals.

3. Understand how energy codes are evolving to incorporate outcomes and performance requirements.

4. Align the achievement of owner's performance requirements with policy maker goals of reduced energy use.

Establishment of the National Institute of Building Sciences

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


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Chicago Tribune

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TUESDAY JAN. 3, 2017 BREAKING SPORTS TRENDING OPINION SUBURBS ENTERTAINMENT BUSINESS ADVERTISING 39°

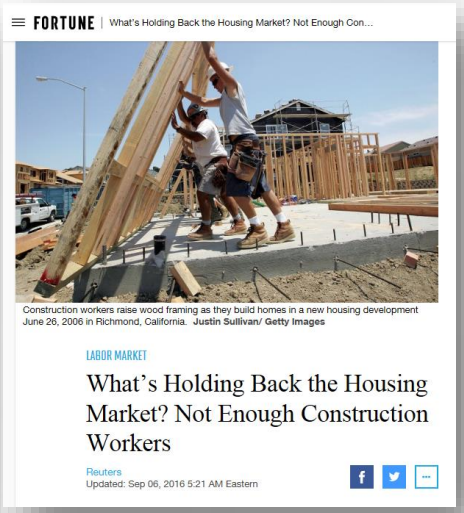
Construction contractors warn of a labor shortage as building booms

Workers from Clune Construction work May 19, 2016, on what will be the customer lounge at Union Station as renovation continues at the Chicago landmark. After a steep fall during the recession, construction activity in the Chicago area is back, but some contractors worry there aren't enough skilled workers. (Phil Velasquez / Chicago Tribune)

By Alexia Elejalde-Ruiz - Contact Reporter
Chicago Tribune

MAY 31, 2016, 6:00 AM

Cranes have sprouted in Chicago as surely as tulips, but a busy construction season is coming with concerns that there aren't enough skilled workers to do all the building.



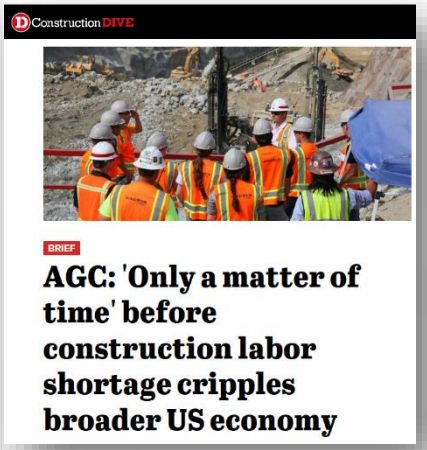
FORTUNE | What's Holding Back the Housing Market? Not Enough Con...

Construction workers raise wood framing as they build homes in a new housing development June 26, 2006 in Richmond, California. Justin Sullivan/ Getty Images

LABOR MARKET

What's Holding Back the Housing Market? Not Enough Construction Workers

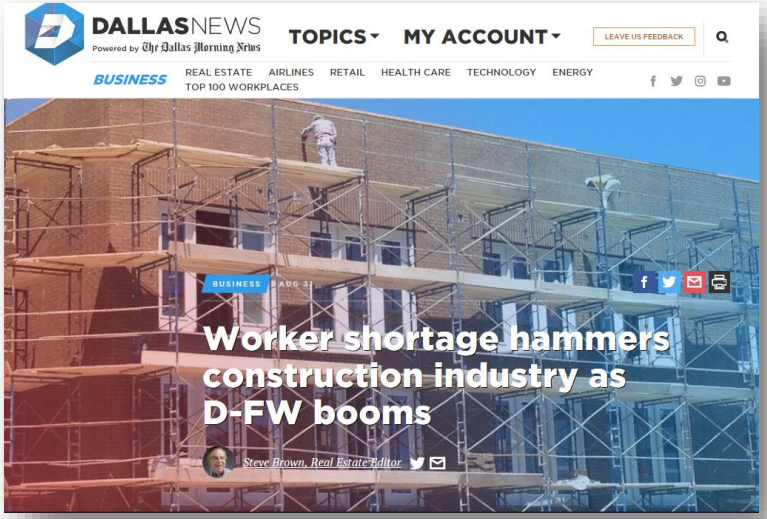
Reuters
Updated: Sep 06, 2016 5:21 AM Eastern



ConstructionDIVE

BRIEF

AGC: 'Only a matter of time' before construction labor shortage cripples broader US economy



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TOPICS MY ACCOUNT LEAVE US FEEDBACK

BUSINESS REAL ESTATE AIRLINES RETAIL HEALTH CARE TECHNOLOGY ENERGY TOP 100 WORKPLACES

BUSINESS AUG 3

Worker shortage hammers construction industry as D-FW booms

Steve Brown, Real Estate Editor

FOX BUSINESS

MARKETS POLITICS FEATURES FBN TV

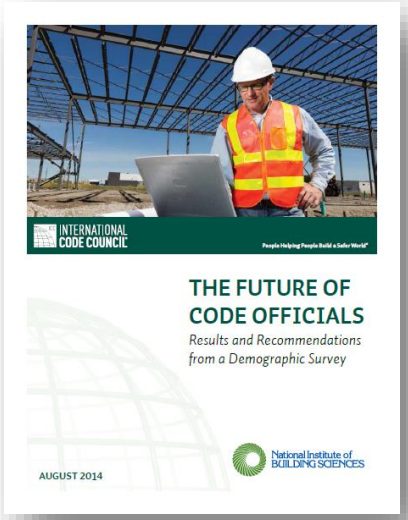
Six-figure construction jobs are going unfilled

By Brittany De Lea | Published January 05, 2018 | Jobs | FOXBusiness

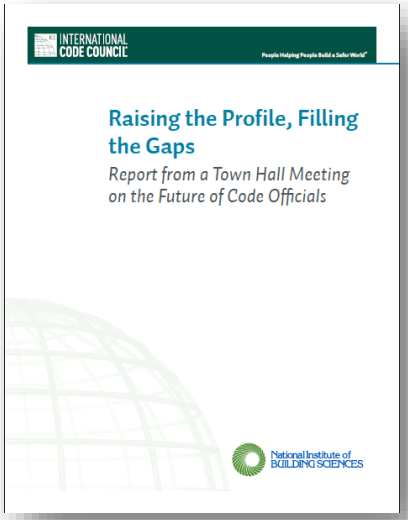
NEWS ALERT

Construction labor shortage causing industry jobs: Kiddar Capital CEO

Kiddar Capital CEO Todd Hitt explains why there is a shortage of labor in the construction industry.

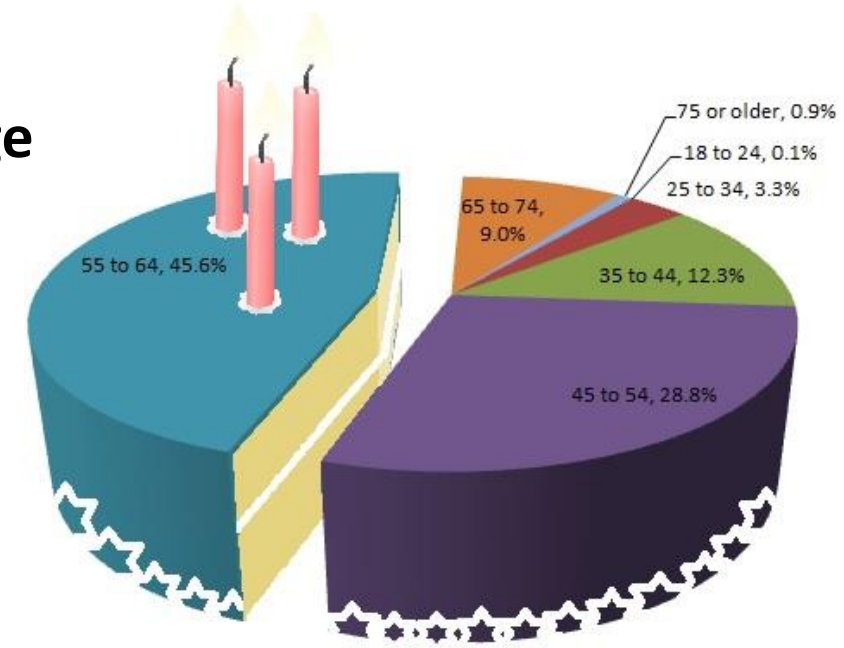


http://www.nibs.org/resource/resmgr/ncgbcs/future-of-code-officials.pdf

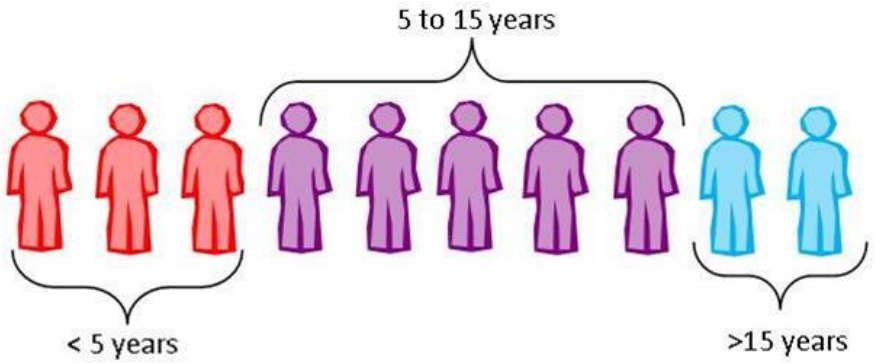


http://www.nibs.org/resource/resmgr/Docs/Final_Rprt_Future_of_Cde_Off.pdf

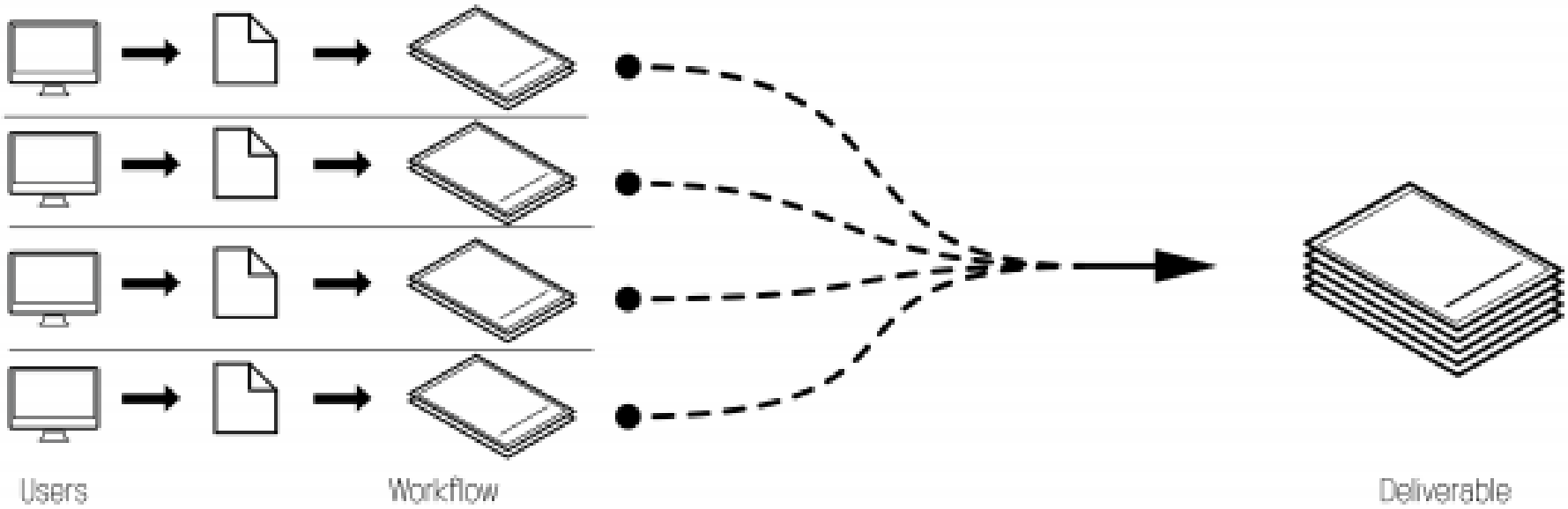
Age



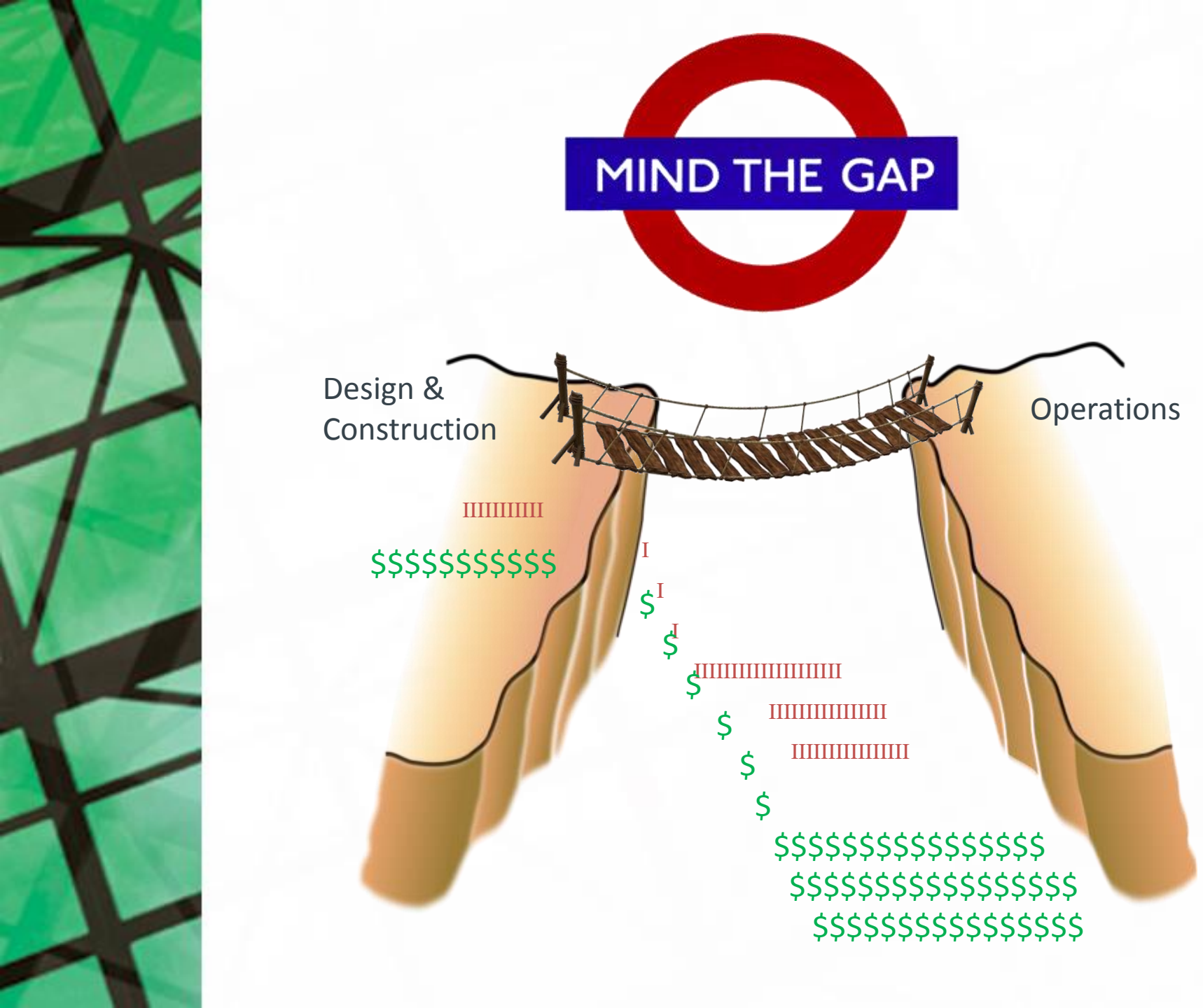
Retirement Plans



Past/Current Workflow



http://www.popsci.com/building-information-modeling-how-construction-industry-getting-smart


MIND THE GAP
Design &
Construction
Operations
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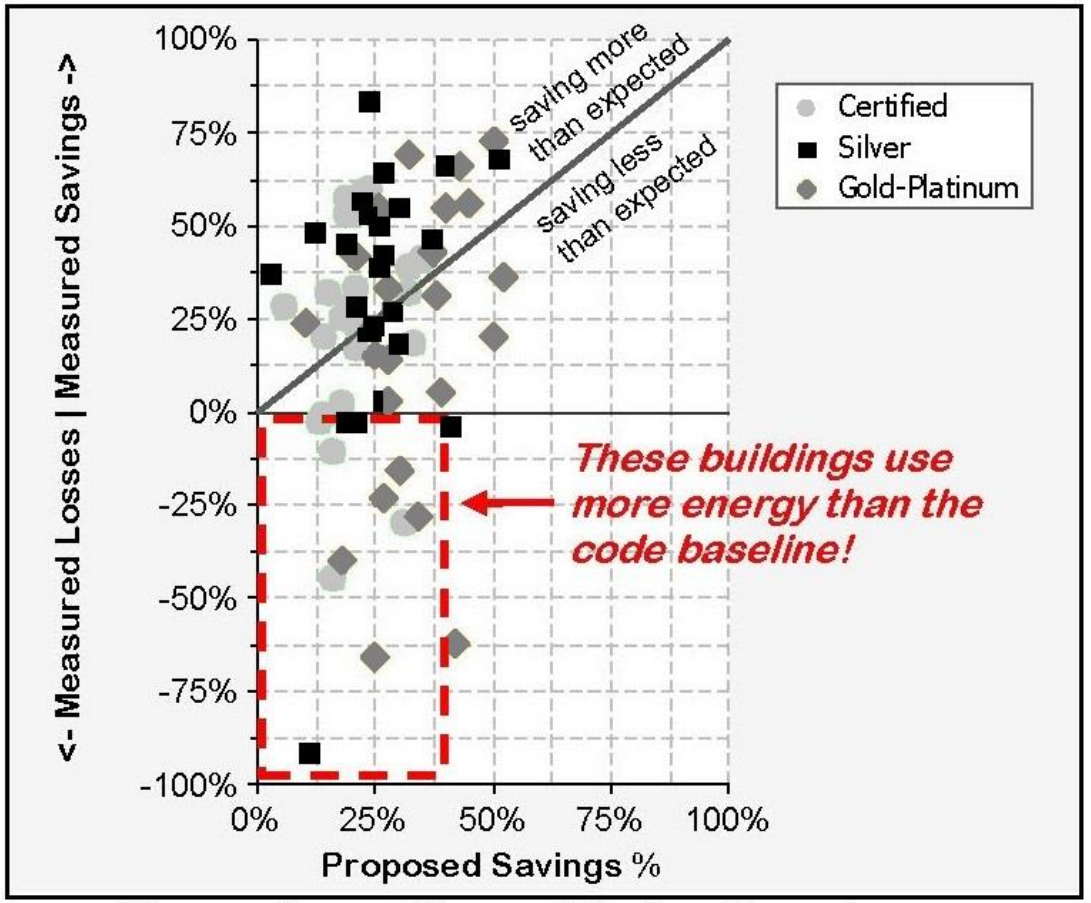
The Responsibilities Gap (A Stereotype)

Architects
Engineers
Contractors
Code Officials

Owners
Operators
Occupants
Communities

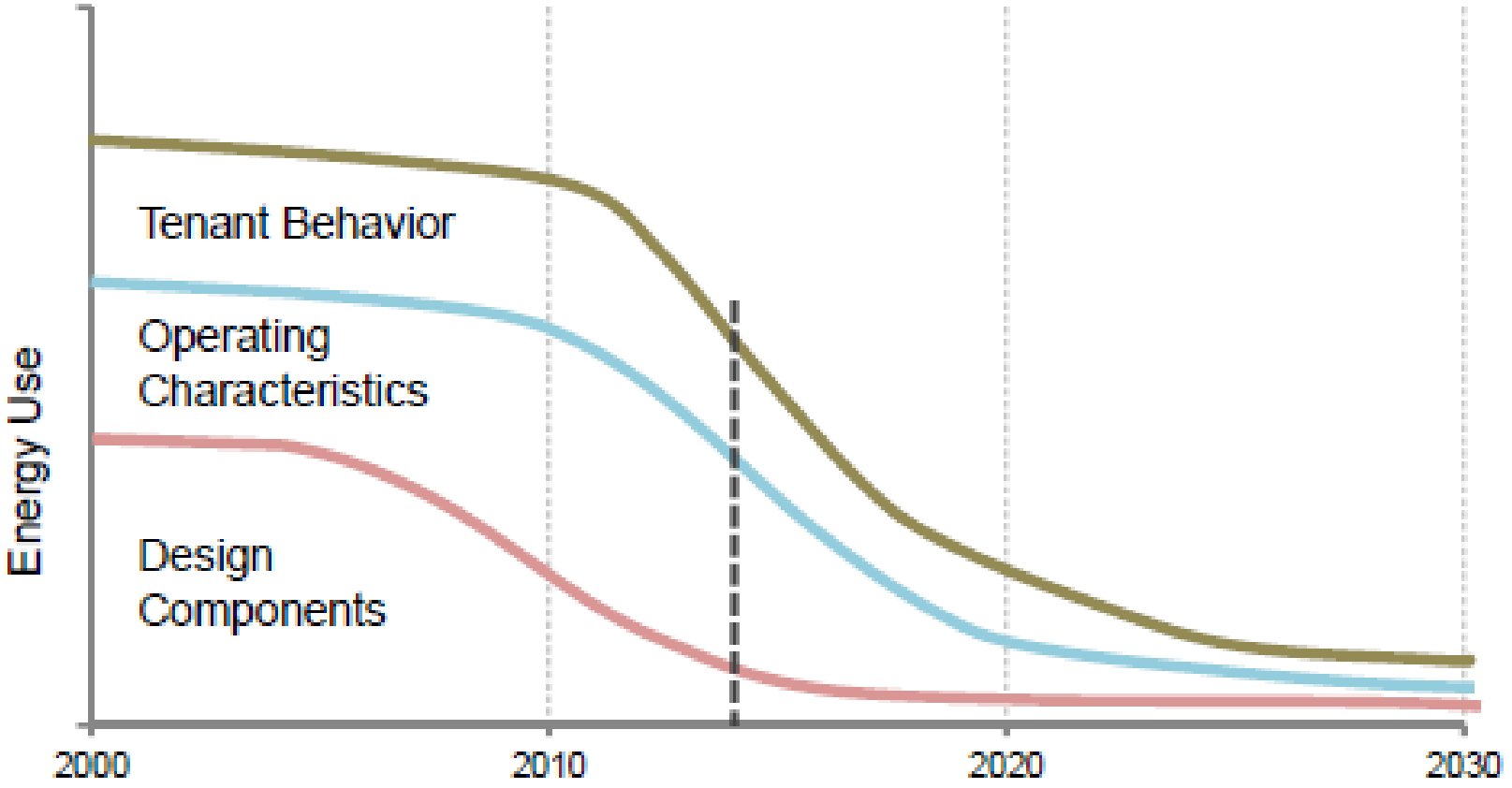
An Age Old Problem



Measured versus Proposed Savings Percentages

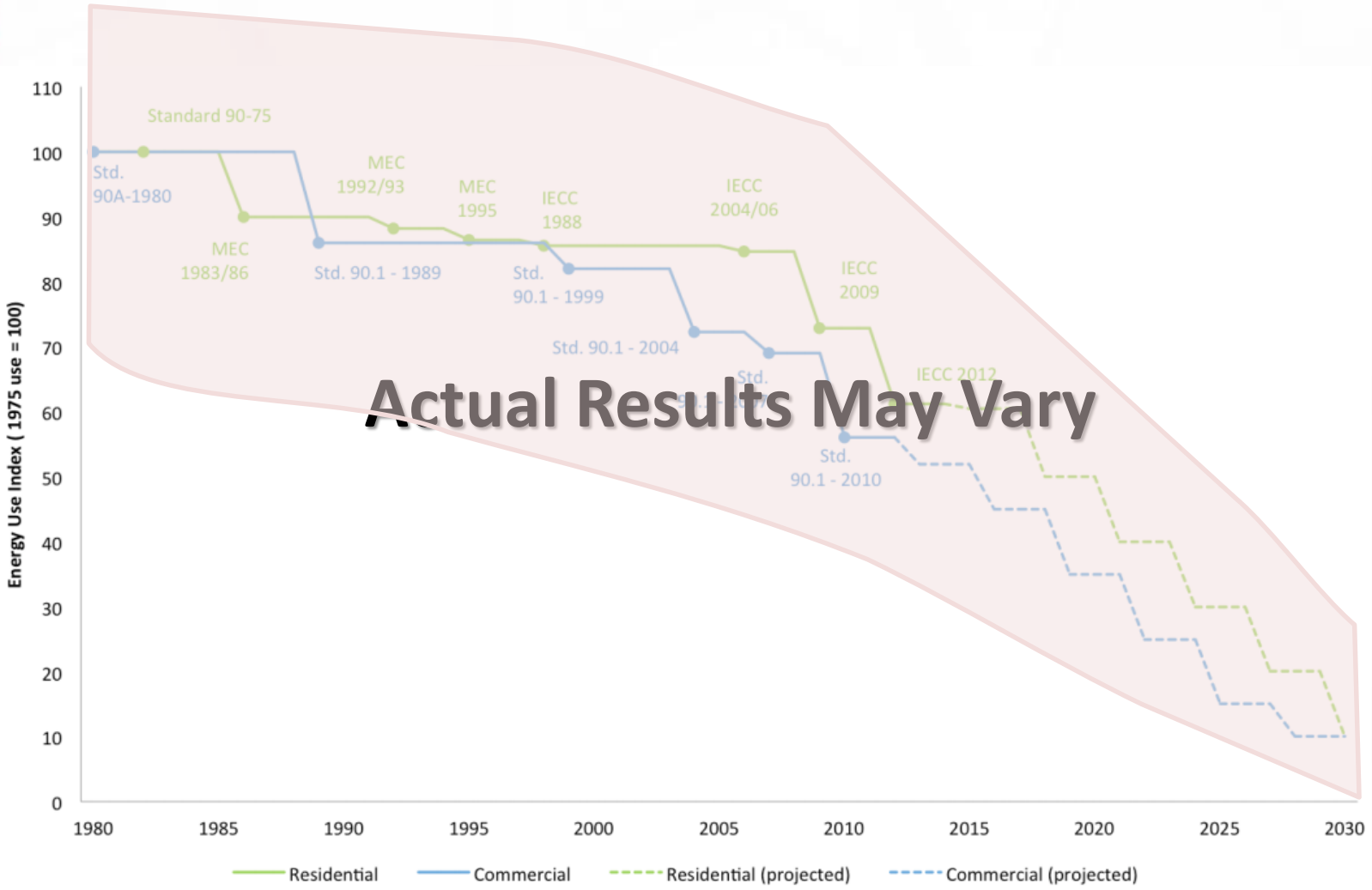
Turner, C., M. Frankel, "Energy Performance of LEED for New Construction Buildings," New Buildings Institute, March 4, 2008, http://newbuildings.org/wp-content/uploads/2015/11/Energy_Performance_of_LEED-NC_Buildings-Final_3-4-08b1.pdf.

The Limits of Design Focused Solutions



Mark Frankel, NBI

Energy Code Stringency



Energy Code Challenges

- Component-by-component=limited opportunity
  - Miss system-level, synergistic effects
- Not all energy uses/influencers covered
- Development fraught with material interests
- Based on perfect world
- Not necessarily most cost-efficient strategies

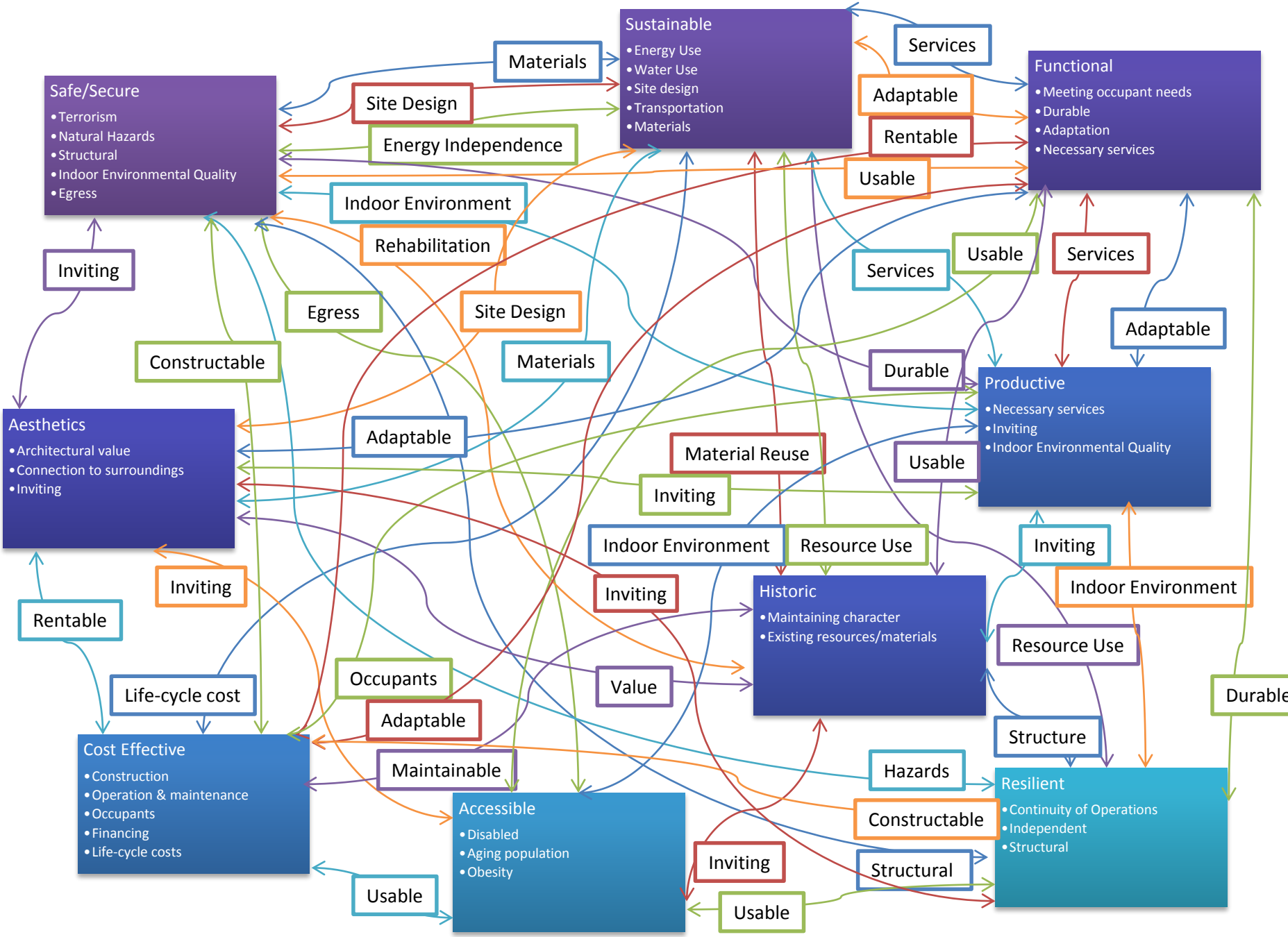
Energy Code Challenges

- 2nd Tier Priority @ code departments
  - Despite policymaker priority
  - Perception not HSW
  - Limited resources ($, staff, technical, etc.)
    - 80% retiring in next 15 years, 30% in next five
    - Most departments 9 employees or less
- Compliance thought to be low
- Design focused
  - But intended result is actual
  - Ends at occupancy, but operations=key factor
- Policymakers don't understand them

What's Your Problem?

1. Energy codes are unable to address a wide range of building energy loads that are not related to basic building design, but instead are driven by building use patterns, portable equipment controlled by tenants (plug loads) and other unregulated loads;
2. The codes do not (effectively) address poor building operation and maintenance strategies, which can significantly degrade overall building energy performance;
3. The codes are applied only to new construction or major renovations, which represent a small subset of the building stock at large, and therefore can only impact a fraction of building sector energy use in the near term.

The Complex Interactions of High-Performance Building Attributes

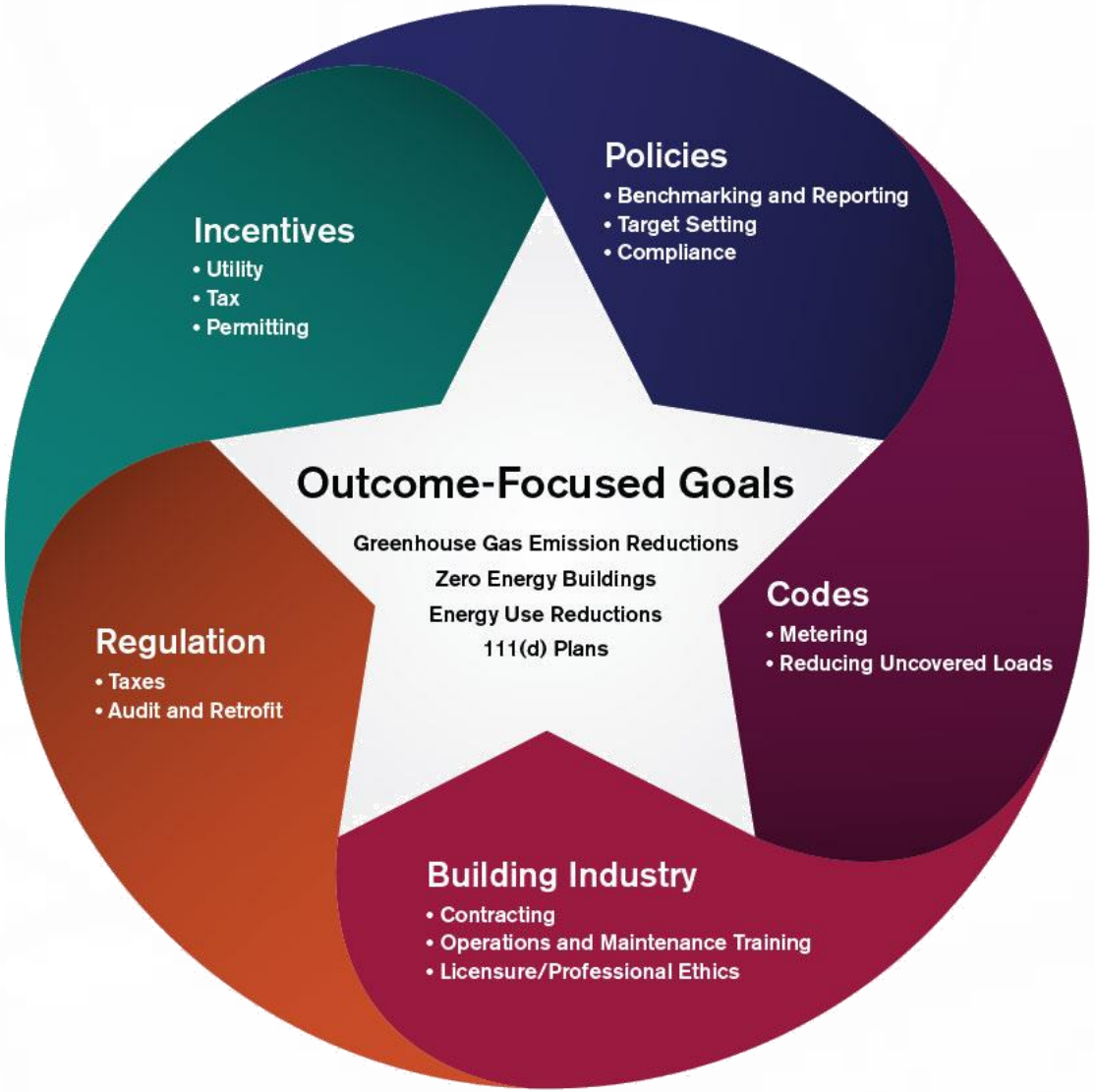


High-Performance Buildings Defined

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)

What is Going to Get us There?



Why Life-Cycle Performance?
… 'cause that's where the savings is

- Design focused solutions will only get us so far
- Existing building stock represents huge largely untapped opportunity
- Encourages more holistic approach to design, construction and operations
- Cities setting community-wide goals for energy use, greenhouse gas emissions
- The U.S. buildings sector alone accounted for 7% of global primary energy consumption
- U.S. buildings GHG emissions approximately equal the combined carbon emissions of Russia and Canada

WHY CITIES?

ENDING CLIMATE CHANGE BEGINS IN THE CITY

C40 CITIES

USDN | urban sustainability directors network

CLIMATE MAYORS

80 X 50

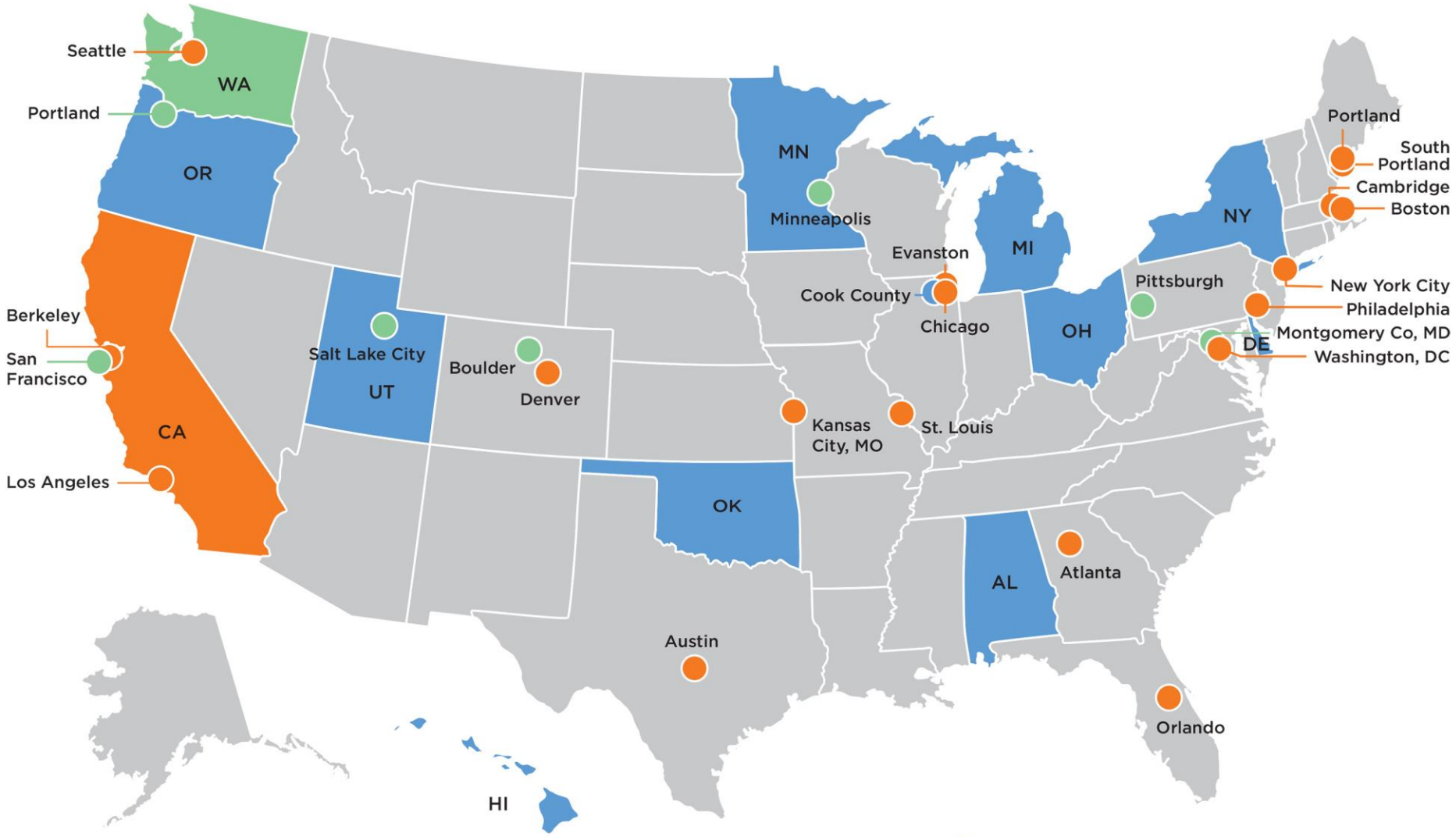
CITY ENERGY

A JOINT PROJECT of NRDC + IMT

2030 DISTRICTS

EcoDistricts

U.S. Building Benchmarking and Transparency Policies



Building Rating
SHARING TRANSPARENCY FOR A MORE EFFICIENT FUTURE

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Elements of A Life-Cycle Performance Strategy

	LEADERSHIP	DATA, ANALYSIS, AND APPLICATION			MECHANISMS			ENSURING RESULTS	
	Capacity and Commitment	**Data**	**Targets and Benchmarking**	**Application of Targets**	**Engagement / Triggers**	**Design and Construction Code**	**Operations**	**Enforcement**	**City Influence on Market**
Description	Administrative Resources, Framework and Commitment to Effectively Implement the Policy and Programs	Information about Building Performance and Mechanisms to Collect It	Where Does the Observed Metric for a Building Fall on a Scale that Includes the Target, the Ultimate Goal and the Performance of Other Buildings	How and When Targets are Applied to the Building Stock	Events that Initiate an Obligation to Take Action	Develop, Adopt and Enforce Energy Codes	Extension and/or Creation of Administrative Structure to Improve and/or Address Building Performance During Operation	Regulatory Mechanisms (and Implementation) to Ensure Compliance with Performance Requirements	Opportunities to Engage the Private Sector to Support Performance Outcome Goals
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Outcome	Consistent Support, Resources and Capabilities to Implement and Manage Building Performance Policies	Data is Collected Consistently and Comprehensively so the City can Track Progress to Goals	Providing a Consistent and Comprehensive Metric for Tracking Progress Toward Goals	Establish Meaningful Targets that can be Adjusted for Specific Building Conditions and are Adjusted Over Time to Meet Goals	Annual Performance Data is Routinely Reported and Required to Manage Building Operation within Targets	Buildings are Designed and Constructed for Energy Efficiency and City Goals, Configured to Operate as Designed and Provide Measurable Outcomes	Building Stock is Operating Optimally up to their Design Potential	Realization of the Community's Goals Based on the Established Metrics	The Market Delivers and Maintains Buildings that Achieve Performance Goals

Why Outcomes?

- Comprehensive strategy, collaborative approach
  - Integrated Design, BIM, Delivery Methods, Contracts, Commissioning
- Implementation of performance goals at community, industry, owner, project level
  - Zero Energy Buildings
  - GHG Reductions
  - Measurable value for finance & insurance
  - 111(d) opportunities for validated reductions
- General recognition of need to move beyond prescriptive (GSA P100)

Why Outcomes?

Optional	Flexible	Actual	Accurate	Effective	Results
A code appendix implementing an additional pathway for compliance with the IECC.	The design team and building owner have flexibility in selecting features, attributes and specifications.	Compliance is based on the achieve-ment of the building's actual energy performance, not theoretical performance.	Compliance is demonstrated by referencing the building's utility bills for a 12-month period.	Recognizing fiscal, technical and per-sonnel constraints on code depart-ments, the burden for demonstrating compliance falls on the building owner.	The building owners and jurisdiction are provided some assurance that the building will perform at target levels.

Tackling the Energy Code Challenges

- Bring wider focus to

  design → construction → operations
- Tie to actual, measured results
- Limit burdens on departments
- Incent smooth handover
- Move beyond prescriptive to outcome-based compliance
- Expand metering and sub-metering
- Link through comprehensive building energy policy

Prescriptive Codes	Performance Codes
• **Sets minimum characteristics for individual components** • Easy to use/enforce • Slow to incorporate new technologies • Depends on increasing efficiencies in individual components • Do not reward efficient design decisions • No assurance or requirement to measure results are met	• **Set desired end-state—often based on anticipated results from prescriptive code** • Flexibility for the design team (but more difficult for code officials) • Technology neutral • Based on building energy models • No assurance or requirement to measure results are met

Outcome-Based Codes

- Establish a target energy use level and measurement and reporting to assure performance at established level
- Includes all energy uses
- Flexibility for design team
- Assure actual results
- Can recognize diversity across building types, even existing and historic buildings

Outcomes in Code

- Seattle Target Performance Path
- 2015 International Green Construction Code
  - Working with ASHRAE 189.1 for inclusion in standard and 2021 IgCC
- Proposed as Appendix in 2018 International Energy Conservation Code
- Guidance for Cities Released

National Institute of BUILDING SCIENCES

nbi new buildings institute

Implementing an Outcome-Based Compliance Path in Energy Codes: Guidance for Cities

Endorsed by:

IMT INSTITUTE FOR MARKET TRANSFORMATION

October 2017

Outline of Outcome-Based Code Provisions

1. Set Energy Use Target
2. Design team demonstrates capability to meet target
   a. Model Approach or
   b. Pre-Approved Prescriptive Approach
3. Inspection based on design provided
4. Issue TCO or POVP
5. Building owner reports energy use within defined period
6. Compliance determined
   a. CO issued or POVP closed or
   b. Enforcement action undertaken

A Role for Commissioning?

- Bridge Between Design and Operations
- Operations and Maintenance Training
- Verification of Capability to Meet Targets
- Be a Building Performance Professional

Key Milestones for Outcome-Based Compliance

Performance-Focused GSA P100

SUSTAINABLE LOCATIONS

SITE SUPPORTS NEIGHBORHOOD CONNECTIVITY, WALKABILITY, AND BIKEABILITY

BASELINE	★ TIER 1 HIGH PERFORMANCE	★★ TIER 2 HIGH PERFORMANCE	★★★ TIER 3 HIGH PERFORMANCE
• Site selection process addressed EOs 12072, 13006, 13514, and Implementing Instructions for Sustainable Federal Locations (CEQ 09/2011)) • Principal functional entry on front façade faces public space • Connectivity of site and adjacent land is at least 90 intersections/sq. mi. as measured w/in a 1/2-mile distance from center of the facility • Primary functional entrance is (a) w/in 1/4-mile walk distance of at least 5 diverse uses or (b) w/in 1/2-mile walk distance of at least 7 diverse uses.	• The site meets the Baseline requirements, AND: • Connectivity of site and adjacent land is between 90-250 intersections/sq. mi. as measured w/in a 1/2-mile distance from center of the facility, AND • Primary functional entrance is (a) w/in 1/4-mile walk distance of at least 7 diverse uses or (b) w/in 1/2-mile walk distance of at least 10 diverse uses."	• The site meets the Baseline requirements, AND: • Connectivity of site and adjacent land is between 251-290 intersections/sq. mi. as measured w/in a 1/2-mile distance from center of the facility, AND • Primary functional entrance is (a) w/in 1/4-mile walk distance of at least 10 diverse uses or (b) w/in 1/2-mile walk distance of at least 12 diverse uses."	• The site meets the Baseline requirements, AND: • Connectivity of site and adjacent land is greater than 291 intersections/sq. mi. as measured w/in a 1/2-mile distance from center of the facility • Primary functional entrance is (a) w/in 1/4-mile walk distance of at least 12 diverse uses or (b) w/in 1/2-mile walk distance of at least 15 diverse uses."

VERIFICATION

Measurements & Verification
ODC Review of Site Acquisition Package and presentation at relevant reviews

Plans & Specifications
Site Acquisition and Design Concept materials

Calculations & Analysis
N/A

Design Basis of Design
EOs 12072, 13006, 13514, and Implementing Instructions for Sustainable Federal Locations (CEQ 09/2011); LEED ND, v2009

Construction Verification
Verify relevant design elements from approved Concept presentation.

National Performance Based Design Guide

1.1 Whole Building Performance

Click the cells below to choose a level of standard for each attribute. ☐ Show Tooltips

PRE-RELEASE WORKING DRAFT FOR REVIEW PURPOSES ONLY

Metric	Baseline	P+	P++	HP	Verification				
					M&O	P&S	C&A	Design Basis of Design	Construction Verification
Reference	EISA 2007 Section 433, Executive Order 13423, Executive Order 13514, Guiding Principles for Sustainable New Construction and Major Renovations,ASHRAE 90.1-2007	EISA 2007 Section 433, Executive Order 13423, Executive Order 13514, Guiding Principles for Sustainable New Construction and Major Renovations,ASHRAE 90.1-2007	EISA 2007 Section 433, Executive Order 13423, Executive Order 13514, Guiding Principles for Sustainable New Construction and Major Renovations,ASHRAE 90.1-2007	EISA 2007 Section 433, Executive Order 13423, Executive Order 13514, Guiding Principles for Sustainable New Construction and Major Renovations,ASHRAE 90.1-2007					
Whole Building Energy Utilization	30% reduction in energy usage compared to an ASHRAE Standard 90.1-2007 baseline building as analyzed using the informative Appendix G	40% reduction in energy usage compared to an ASHRAE Standard 90.1-2007 baseline building as analyzed using the informative Appendix G	50% reduction in energy usage compared to an ASHRAE Standard 90.1-2007 baseline building as analyzed using the informative Appendix G	The expected annual EUI when the building is designed in compliance with a goal to achieve zero-net-energy (ZNE)	Baseline: No P+: No P++: No HP: No	Baseline: No P+: No P++: No HP: No	Provide 90.1-2007 Appendix G energy model demonstrating whole building energy performance.	Provide written narrative showing how energy model meets energy reduction target.	Cx agent to confirm energy model material and equipment performance assumptions on design reviews and submittal reviews. Calibrate building energy model to first year building historical data and compare energy performance to actual measured energy performance.

Go to http://npbdg.wbdg.org for latest version

Tackling Productivity in the Building Industry

Collaboration

People and their effective engagement in project teams are the foundation of a project's success. Project management and the project manager's role must transform to achieve integrated, cohesive teams that enable productivity.

Contracts/Risk Allocation

Contract and risk allocation structures should enable collaborative and cohesive relationships. Contracts should support collaborative and performance-focused delivery processes that engage design, construction and operations stakeholders. Risks should be identified, discussed openly, shared fairly, and problems resolved cooperatively and be allocated to the entity in the best position to mitigate that risk.

Technology/BIM

Technology including BIM, virtual and augmented reality, gaming, and 3D printing provide a wide range of opportunities to improve productivity throughout the project life cycle, as well as to attract new talent to the industry. Effectively capitalizing on these tools and their underlying data—particularly its interoperability—will allow the industry to improve quality, make process improvements and incorporate transformative innovation.

Metrics & Knowledge Sharing

Consistent metrics must be developed and adopted for use across projects and the industry. Systems and processes that encourage the sharing of knowledge to drive continual improvement should be implemented.

Safety & Quality

Hazards during the design stage for the entire facility life cycle should be eliminated through use of strategies like Prevention through Design. Such strategies can reduce injuries, the physical challenges of construction work to reduce manpower needs and increase attractiveness of the industry to young people. A proactive and effective focus on quality, from early design and throughout the project, will enable productivity improvements and deliver higher quality facilities.

Life-Cycle Focus

Projects should be focused on delivering the best possible performance across it's life cycle to include design, construction, operations and reuse/deconstruction. Contracts and project teams should be set up to focus on optimizing life-cycle performance. Performance verification is a key piece in assuring long-term project performance.

Workforce

Efforts should continue and expand to expose more high school and college-age students to career opportunities and provide them with the basic skills they need to work in the industry. Such programs include career and technical education opportunities. Advance training of the existing industry workforce through competency-based programs that demonstrate individual mastery which leads to performance improvements.

Off-Site Construction

Off-site construction offers many advantages including better control of quality, schedule, jobsite safety and budgets. Consider utilization of off-site construction early in the project and in a collaborative manner to capture the most benefit. Other productivity enablers facilitate the expansion of off-site construction including BIM, collaborative delivery methods and project management strategies.

Recommendations from a Representative Hearing on Productivity and the Workforce

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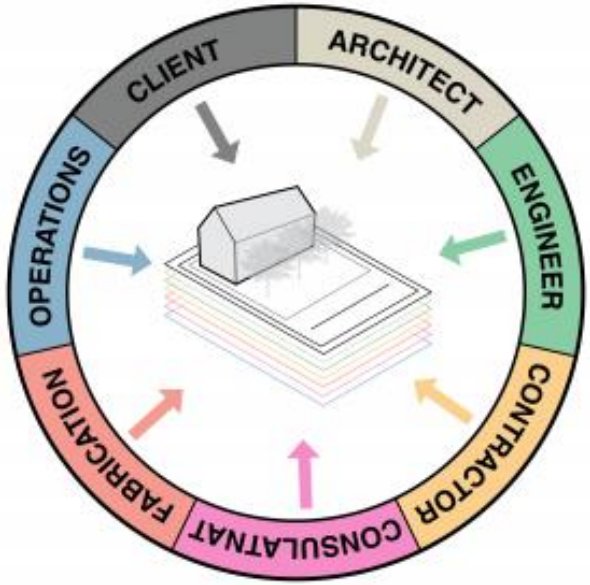
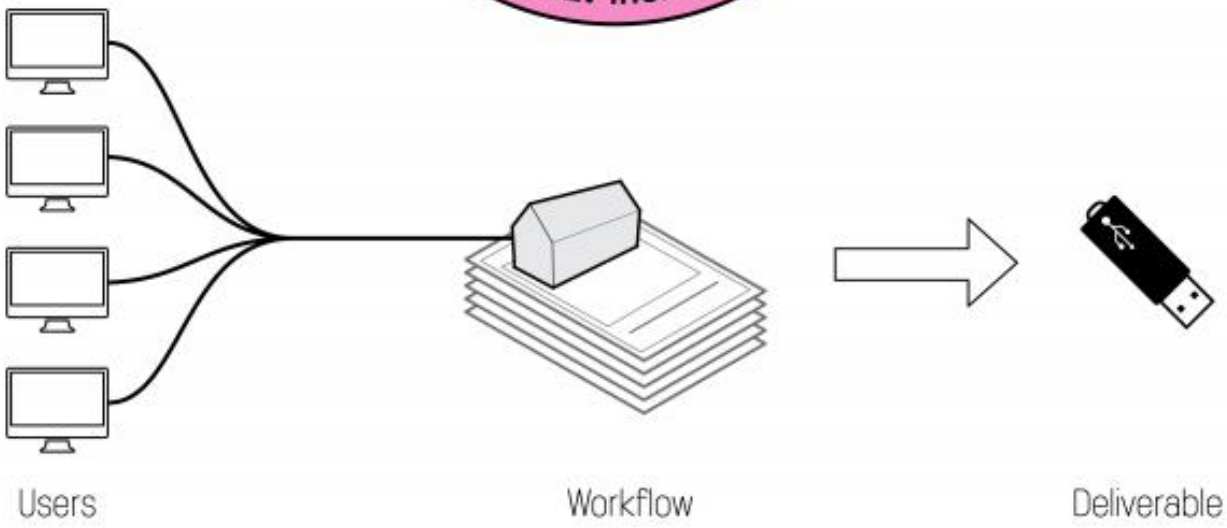
Transforming the Process





http://www.popsci.com/building-information-modeling-how-construction-industry-getting-smart

The UK Approach. . .

- UK Government leading the way
  - Soft Landings

As stated in the Government Construction Strategy, May 2011, Soft Landing objective:

Aligning the interests of those who design and construct an asset with those who subsequently use it

Specific Action : Trial introduction of a period (say 3 to 5 years) of post completion proving of the asset by constructors. Note connection with BIM and its potential to connect design and construction information to asset management.

Outcome sought : Project designed and delivered to required operational standards; and to allow asset to operate to the required standard for the whole of its life.

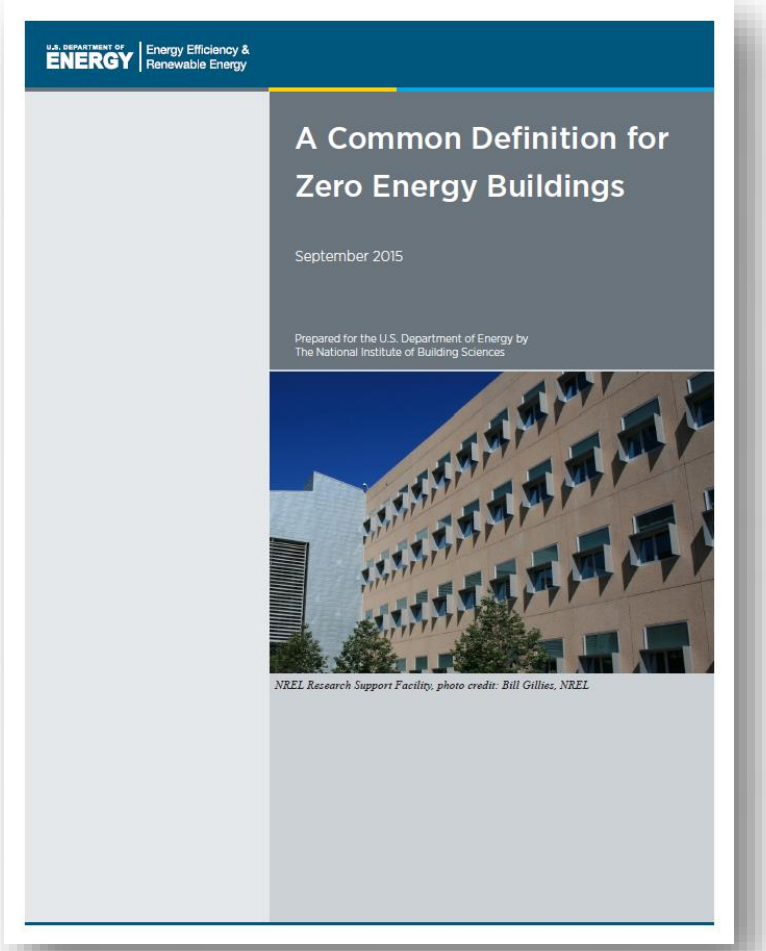
  - Focus on the "Golden Thread"
    - Why we build the building in the first place

Traditional vs. Performance Based Procurement

	PLANNING	RFP	DESIGN	CONSTRUCTION	OPERATIONS
Owner / design team effort					
Current practice	Little or no interaction	Respond to RFP Prepare contracts	Design building, fit energy utilization into design	On-site inspections	Program incentive paid
Energy performance-based procurement	Concept modeling Establish energy requirements Prepare RFP	Interact with A&Es to ensure RFP compliance Respond to RFP Prepare contracts Review submittal	Build RFP requirements into design Review design team submittals	On-site inspections Conduct measurement & verification on site Compare to RFP requirements	Program incentive paid Realize high performing building

Seventhwave, Accelerate Performance, http://www.seventhwave.org/accelerateperformance/about

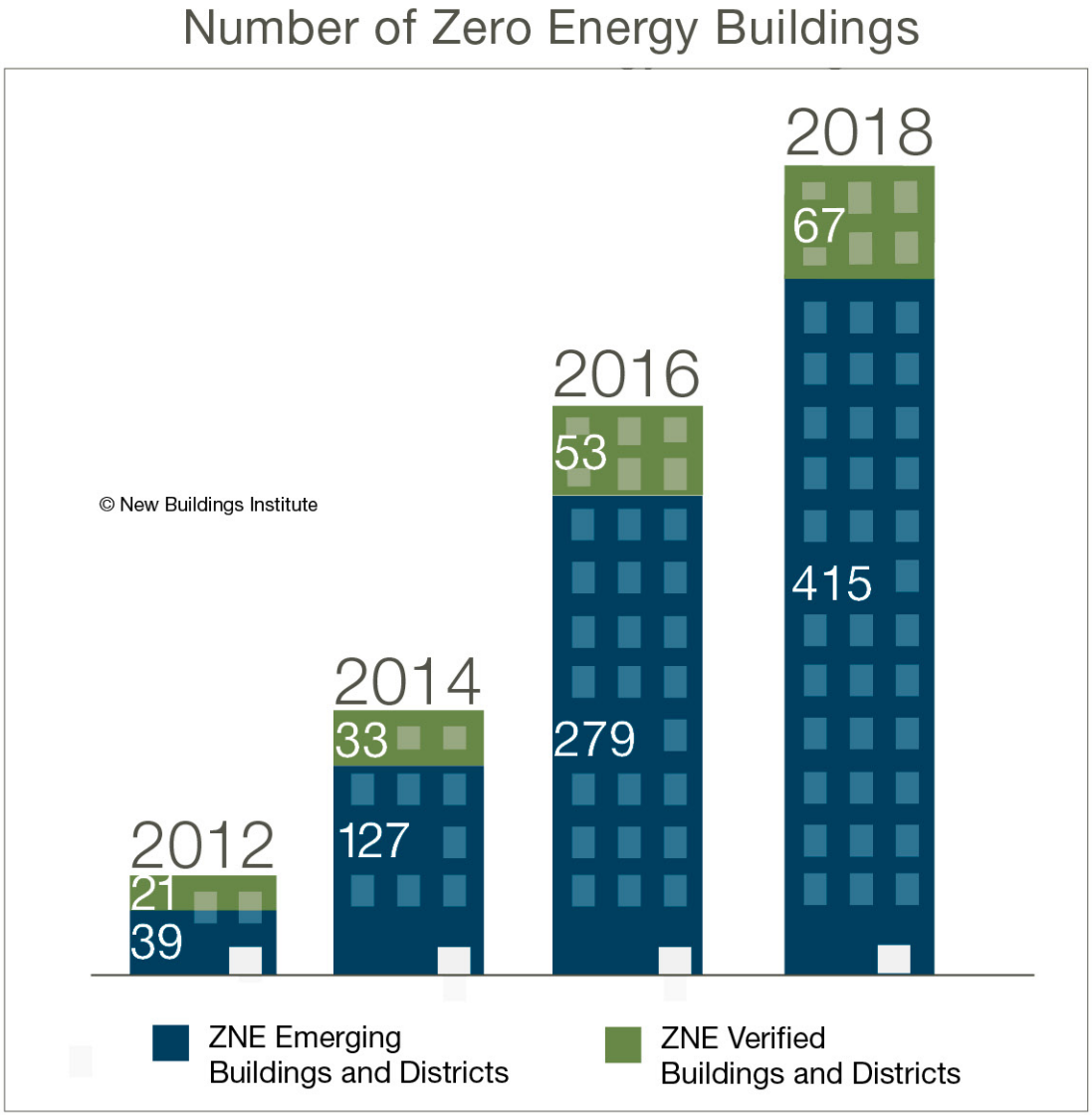
ZEBs are all about Performance



http://energy.gov/eere/buildings/downloads/common-definition-zero-energy-buildings

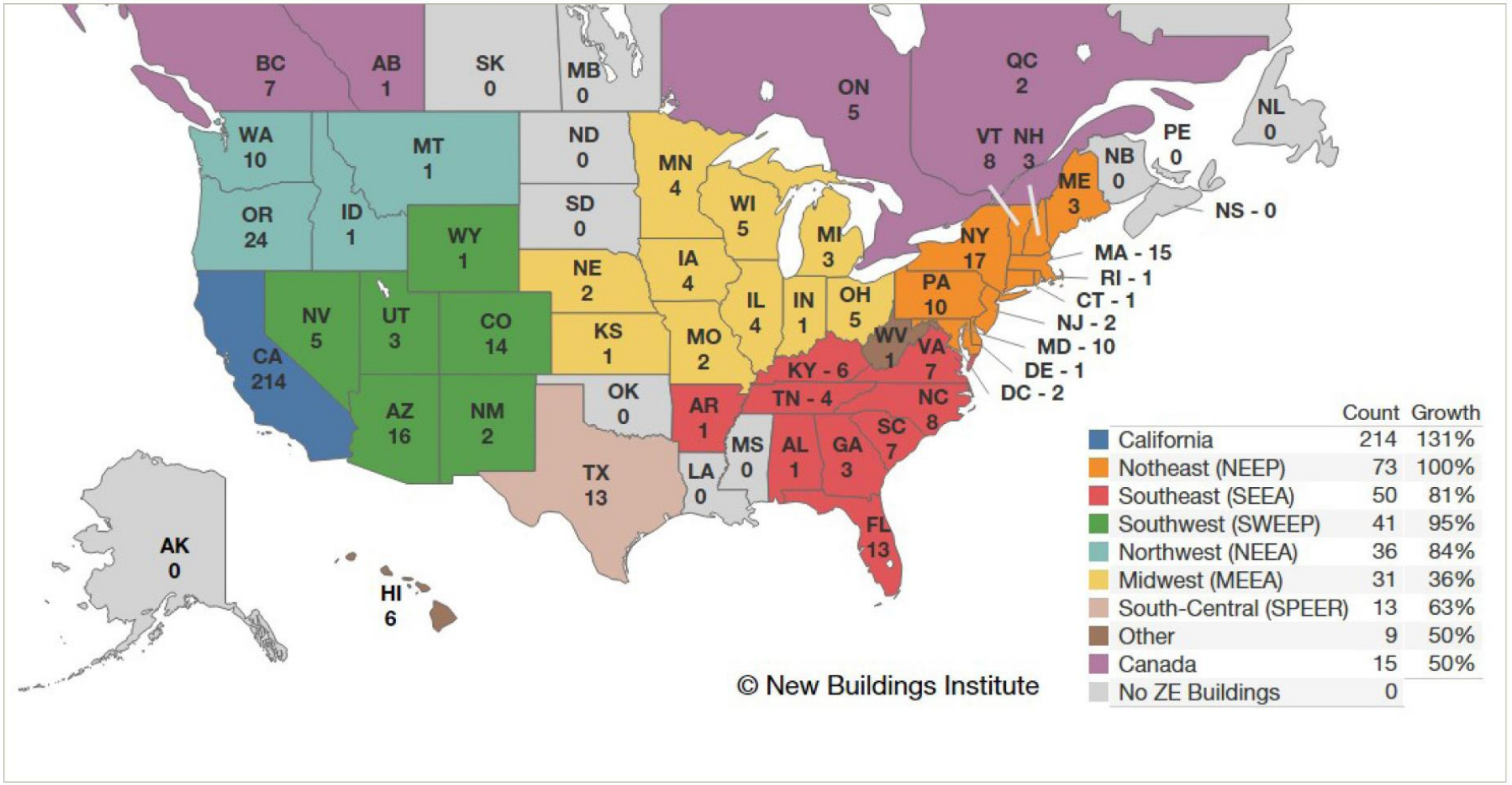
- Zero Energy Building (ZEB):
  - An energy-efficient **building** where, on a **source energy** basis, the actual **annual delivered energy** is less than or equal to the on-site renewable **exported energy**.
- The designation *Zero Energy Building (ZEB)* should be used only for *buildings* that have demonstrated through actual annual measurements that the *delivered energy* is less than or equal to the *on-site renewable exported energy*.
- Also similar definitions for campus, community, portfolio

Zero-Energy Buildings



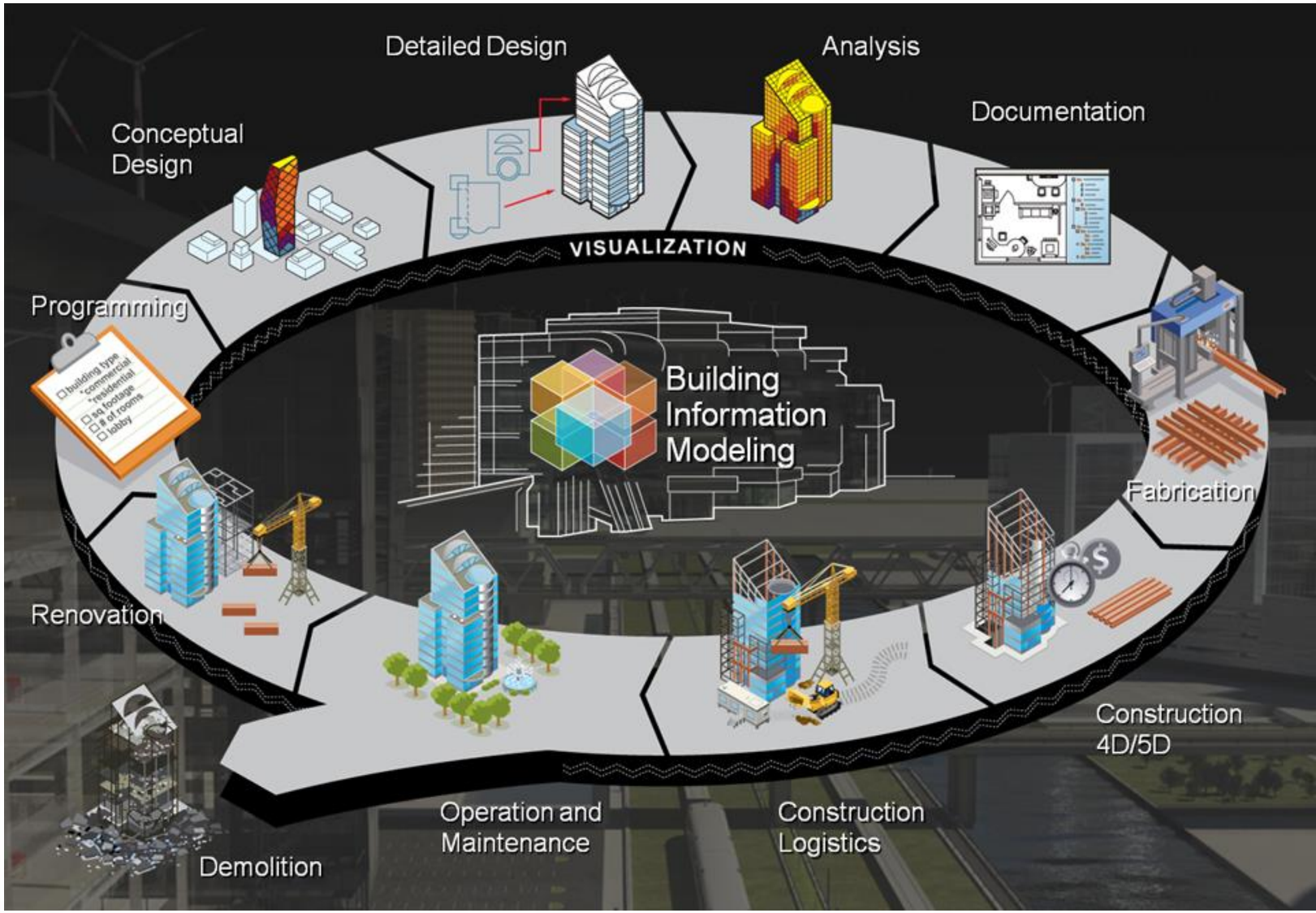
Zero-Energy Buildings

2018 Buildings List Project Locations



	Count	Growth
California	214	131%
Notheast (NEEP)	73	100%
Southeast (SEEA)	50	81%
Southwest (SWEEP)	41	95%
Northwest (NEEA)	36	84%
Midwest (MEEA)	31	36%
South-Central (SPEER)	13	63%
Other	9	50%
Canada	15	50%
No ZE Buildings	0	

The Facility Lifecycle



Courtesy of Autodesk

IFC - Building Information Model

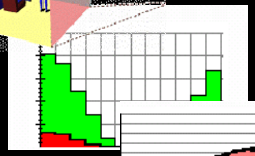
Laws and regulations
-Building regulations
-Building specifications

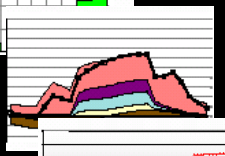
Design and Analysis
-Drawings, calculations
-Architect, engineer,…

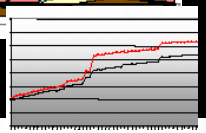
Knowledge databases
-Best practise knowledge
-Own practice

Modeling
-Visualisation, 3D models

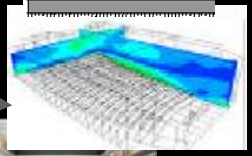
Briefing
-Functional req.
-Estimates
-Conditions
-Requirements







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



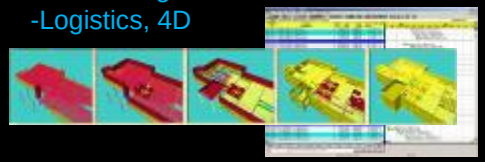
Demolition, refurbishment
-Rebuild
-Demolition
-Restoration

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

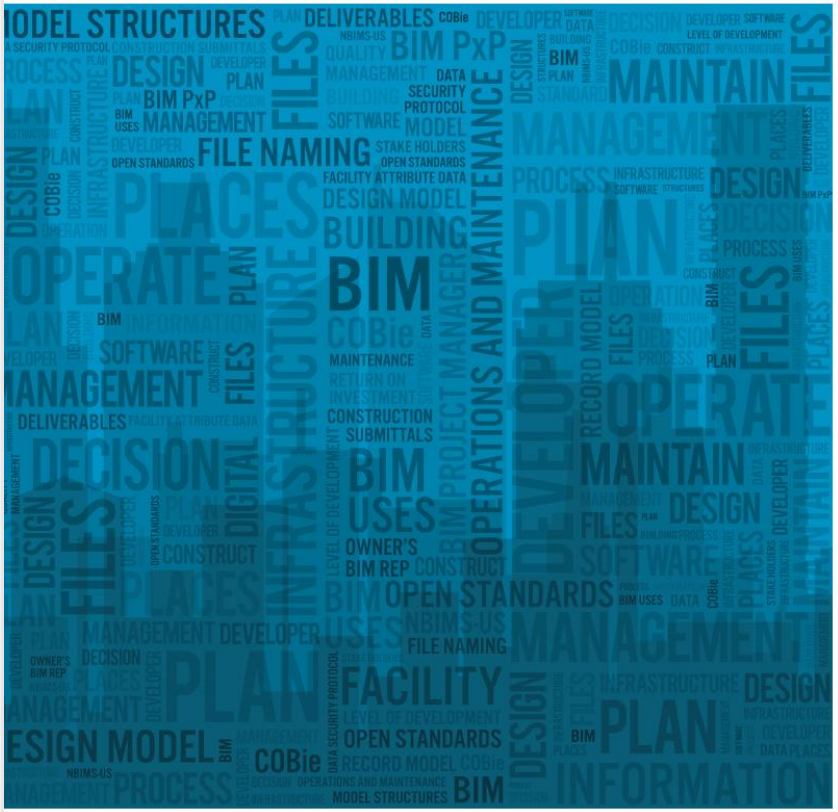


Procurement
-Product databases
-Price databases

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

National Institute of
BUILDING SCIENCES

National BIM Guide for Owners



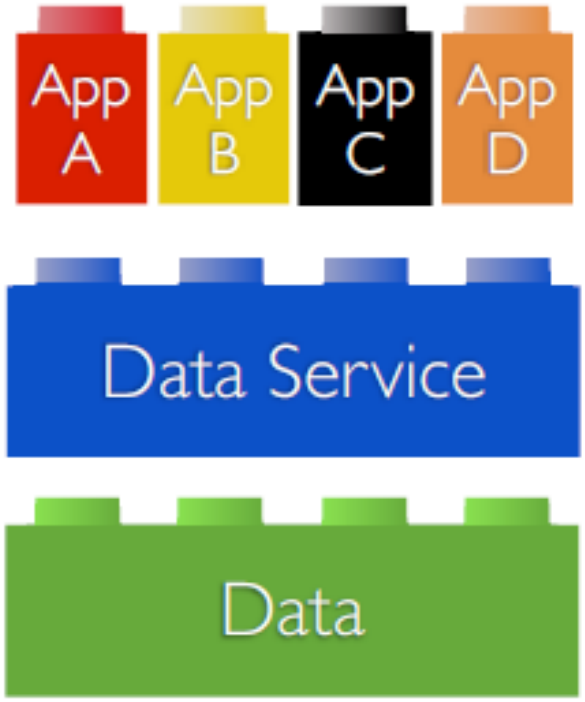
An Authoritative Source of Innovative Solutions for the Built Environment

September 2016

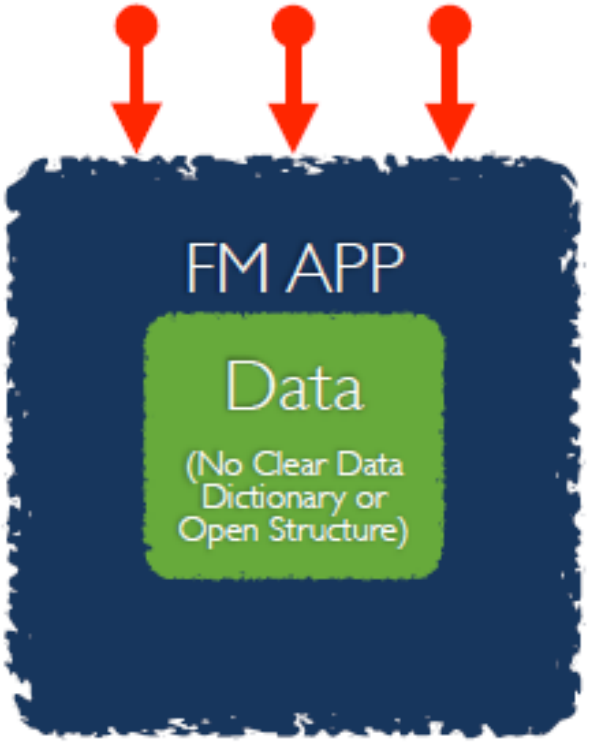
Rethinking the Data Ecosystem

iFM vs. Closed App

Open Connections

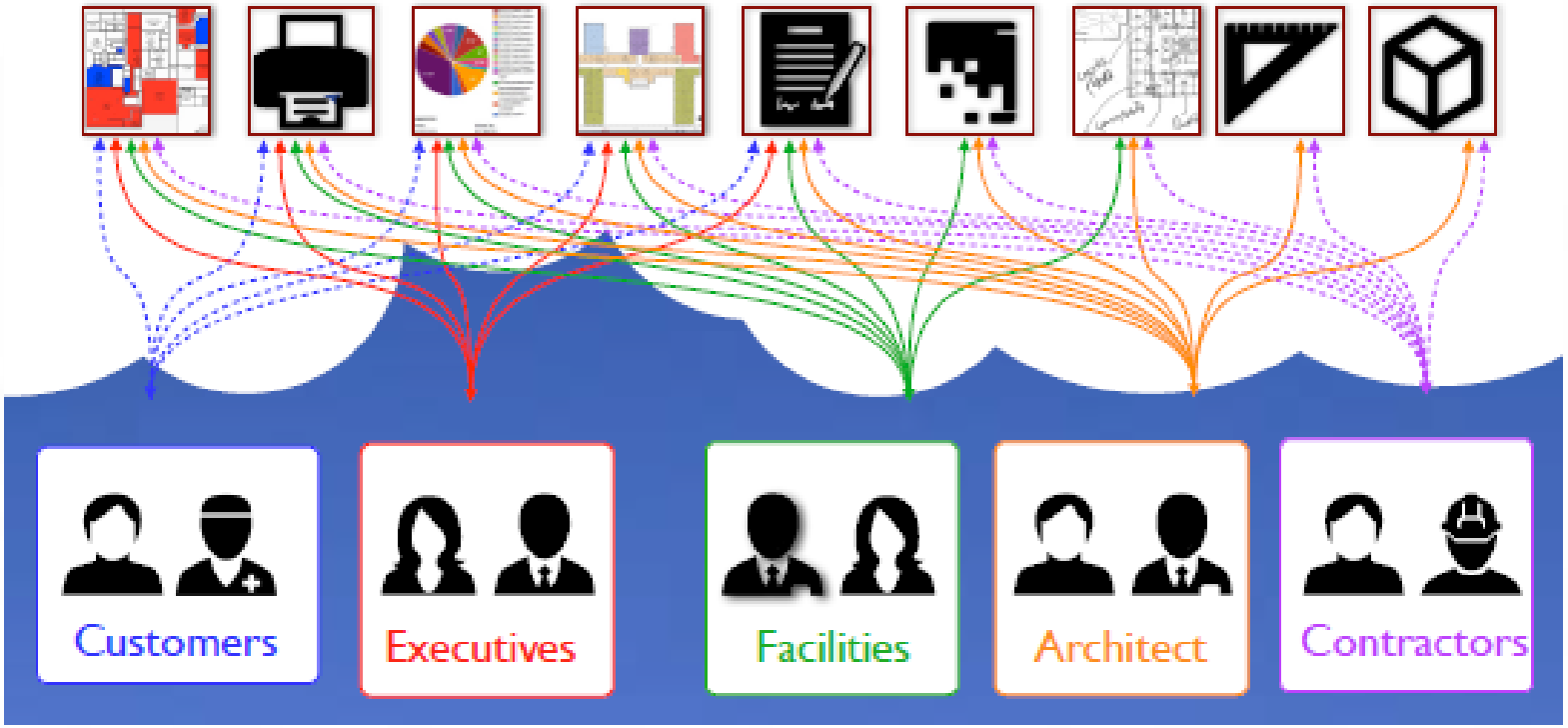


No Open Connections



"Black Box" Application with Application Locked to the Data

Shared Services + Access to Data



National Institute of BUILDING SCIENCES

Council on Finance, Insurance and Real Estate

Financing Small Commercial Building Energy Performance Upgrades: Challenges and Opportunities

An Authoritative Source of Innovative Solutions for the Built Environment

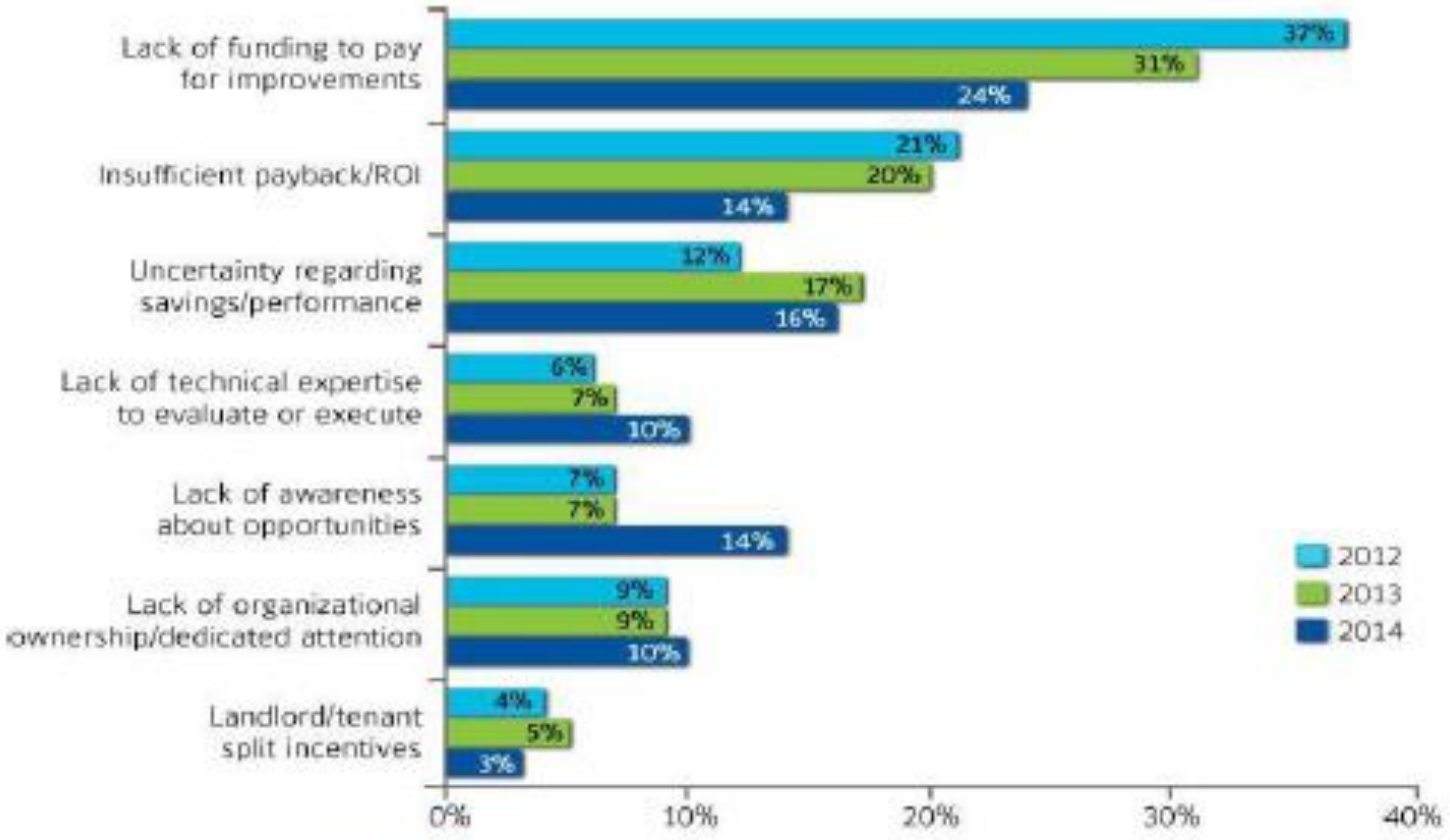
Summary of Energy Efficiency Impact by Market Size, Climate and Employment Categories

	Residential	Commercial	Institutional	Total
Economic/Financial Impact				
Energy Savings (Trillion Btu)	1,892	848	293	**3,033**
Total Investment ($ Bn)	182	72	25	**279**
Social Impact				
Cumulative Job Years Created (# FTEs over course of investment program, '000s)	2,152	857	296	**3,305**
Environmental Impact				
Greenhouse Gas Emission Reduction (million metric tons of CO_2 mitigated per year)	382	175	59	**616**

Source: Rockefeller Foundation, 2012. McKinsey, Unlocking Energy Efficiency in the U.S. Economy (2009); Center for American Progress, The Economic Benefits of Investing in Clean Energy (2009); Energy Information Administration Commercial Building Energy Consumption Survey 2003, Residential Energy Consumption Survey 200. Note: Analysis is based on an assumption of 30% energy savings in buildings built before 1980. Category impact information represents an aggregation of the values calculated for the segments associated with that category. TBtu = Trillion Btu.

Fulton Mark, et al., *United States Building Energy Efficiency Retrofits, Market Sizing and Financing Models*, DB Climate Change Advisors, Deutsche Bank Group, March 2012. https://www.db.com/cr/en/docs/Building_Retrofit_Paper.pdf.

Barriers to Pursuing Energy Efficiency



institute for building efficiency

Institute for Building Efficiency | www.InstituteBE.com

Retrofit of Small Commercial Buildings

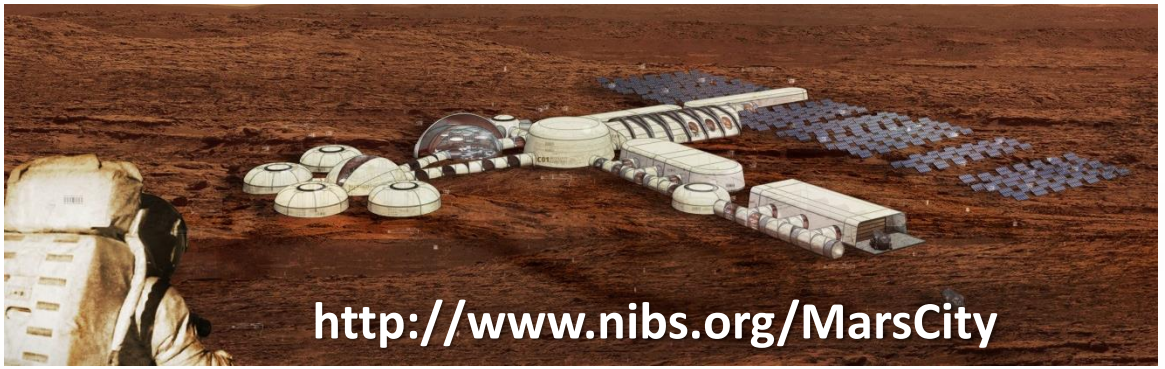
Contractor Based Financing/Execution

While there are inherent issues of conflict and performance, financing approaches, which rely upon a master "contractor" that is also the source for financing, make a lot of sense for smaller building retrofits. Service providers that design and execute retrofits are currently involved in all types of financing schemes. One example of such financing was recently announced by Joule Assets, which has arranged strategic financing partnerships for 10 U.S.-based energy efficiency contracting firms, with a total pipeline projected at $270 million, of which Joule Assets will undertake an initial $90 million deployment.[37] The benefit to contractors is that such project financing enables small- to mid-sized contractors to offer in-house financing, significantly shortening sales cycles and extending their project pipelines. Other companies like Noesis and Kilowatt Financial have related approaches and more are expected to emerge as private capital sources seek partners to source energy efficiency investment opportunities.

Preparing the High-Performance Building Workforce

- Pre-Career
  - Enhance Collaborative Learning/Doing
  - Focus on Building Science
  - Codes, Standards and Guidance
- Career
  - Credentials Recognizing Competence
  - Fostering Collaboration and Project Focus
  - Professionalizing Operations Workforce

Attracting The Next Generation



Building Sciences Career Center

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

ABOUT | SITE MAP | CONTACT | CREATE ACCOUNT | LOG IN | SEARCH WBDG

DESIGN RECOMMENDATIONS | PROJECT MANAGEMENT - O & M | FEDERAL FACILITY CRITERIA | CONTINUING EDUCATION | ADDITIONAL RESOURCES

RESOURCE PAGES / BUILDING SCIENCES CAREER CENTER

BUILDING SCIENCES CAREER CENTER

In support of the Mars City Facility Ops Challenge
Updated: 11-25-2016

INTRODUCTION

Little has more impact on our lives than the built environment around us. That built environment exists because of the professionals and skilled tradespeople from multiple disciplines that plan, design, construct, operate, and manage it. They focus on meeting important needs of citizens including providing sustainable, cost effective and safe environments for living, working, playing and learning.

Today's buildings-related professionals and tradespeople make use of cutting edge technology including building information modeling (BIM), computerized maintenance management systems (CMMS), smart controls and renewable energy systems such as solar photovoltaics and wind to deliver high-performance buildings.

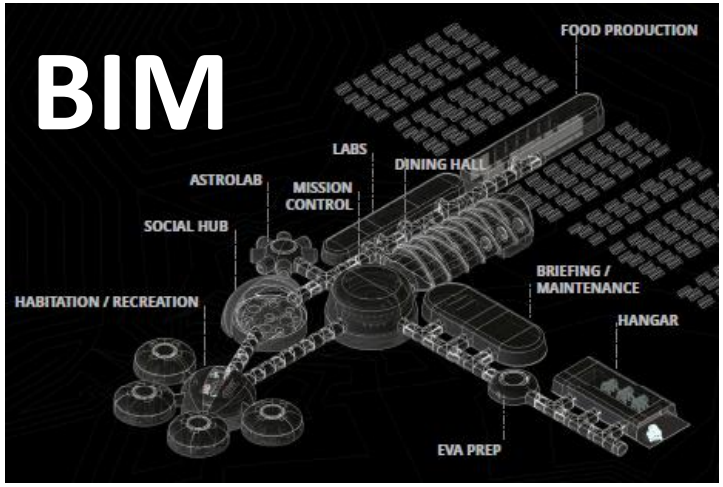
The information contained here is intended to provide an introduction to the various disciplines and opportunities within the buildings industry. You are encouraged to explore the rest of the Whole Building Design Guide and contact the organizations identified below for additional insight into career opportunities.

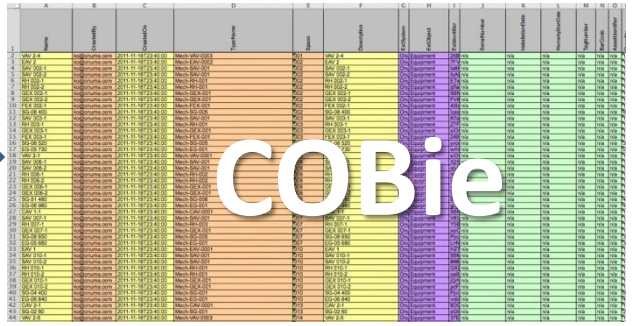
This career center supports the Mars City Facility Ops Challenge developed by the National Institute of Building Sciences, Total Learning Research Institute and National Aeronautics and Space Administration but provides tools for anyone considering a career in the buildings-related disciplines.

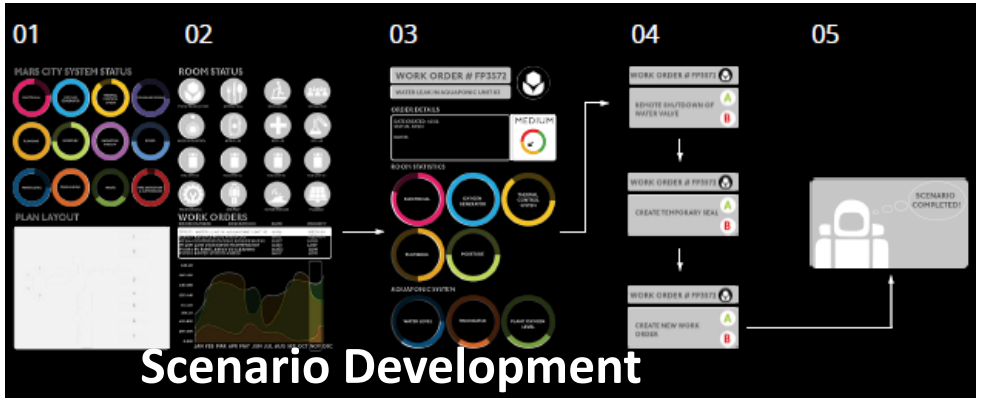
HVAC AND REFRIGERATING ENGINEERING

- Dunstan Macauley, Mechanical Engineer, WSP Group
- ASHRAE K-12 Activities
- HVAC&R Foundation: Careers In HVAC
- Why Become an HVAC Technician
- Why Choose a Career in HVACR

Using BIM, Gaming & VR to Optimize Facility Performance





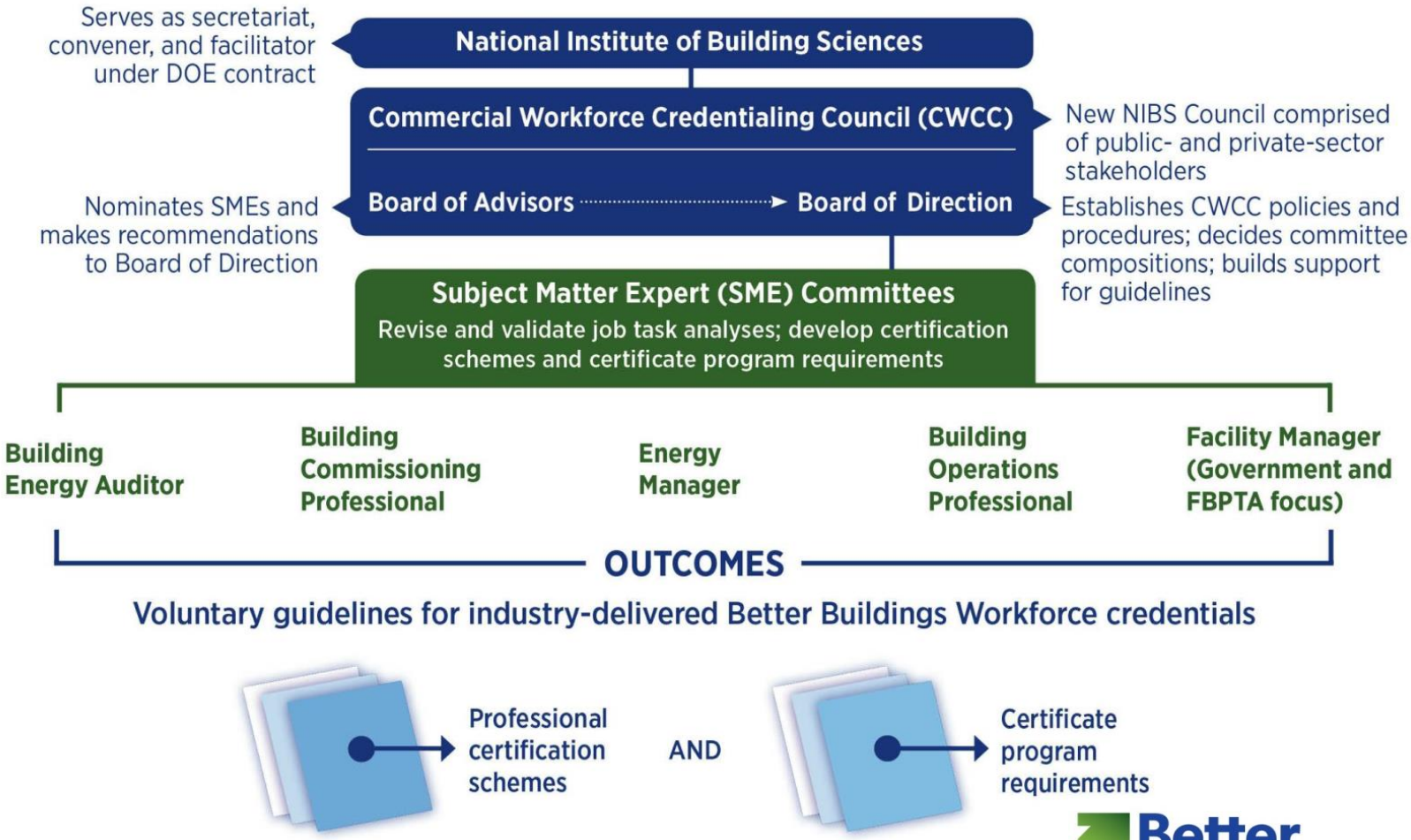


Certifications

- With increasing complexity who is qualified?
  - Certifications
  - Certificates

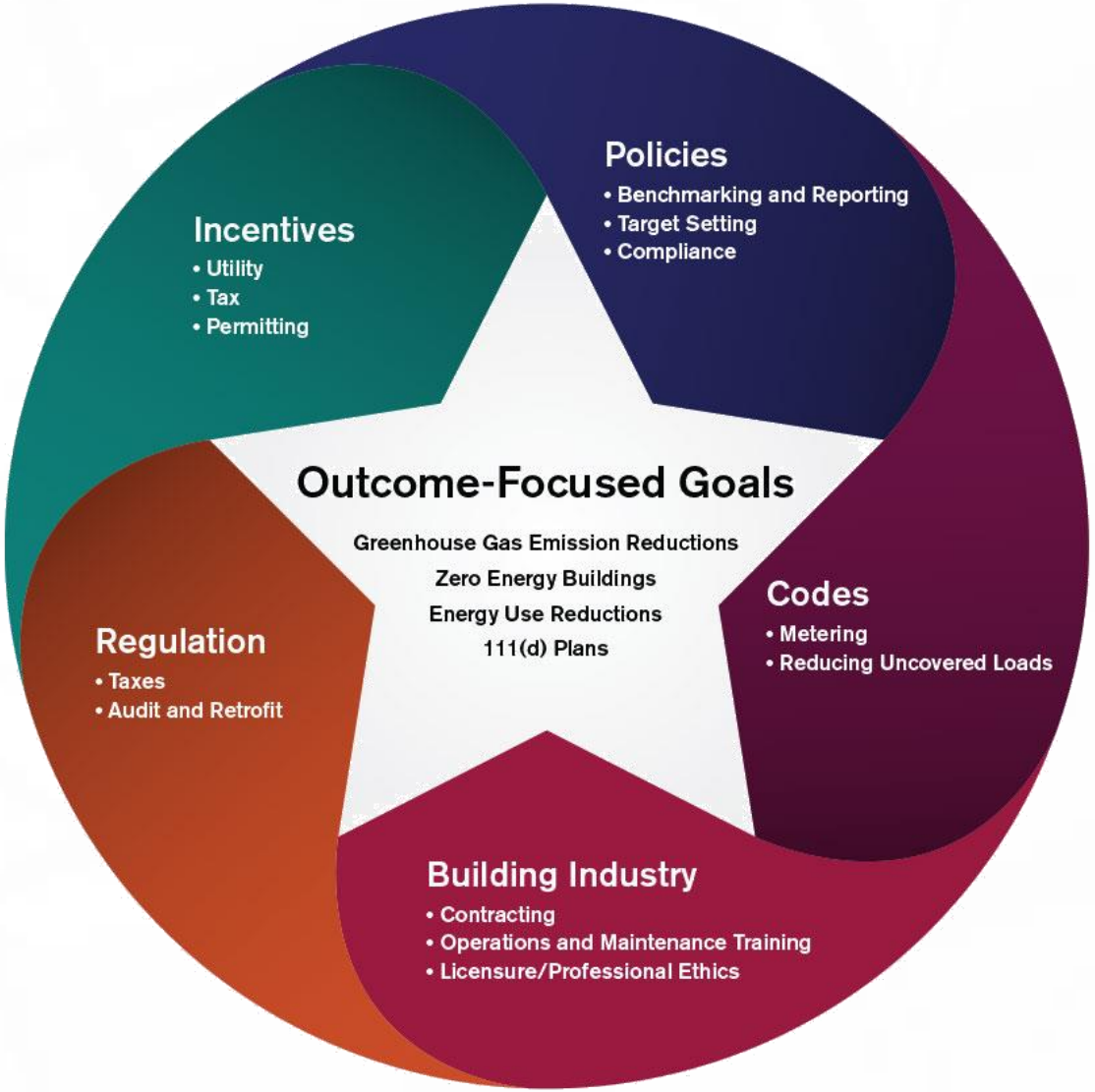
- Link with procurement and specifications

Preparing the Workforce



Better Buildings
U.S. DEPARTMENT OF ENERGY
RECOGNIZED PROGRAM
MEETS U.S. DEPARTMENT OF ENERGY GUIDELINES

Establishing Life-Cycle Focused Policies



Fundamental Steps

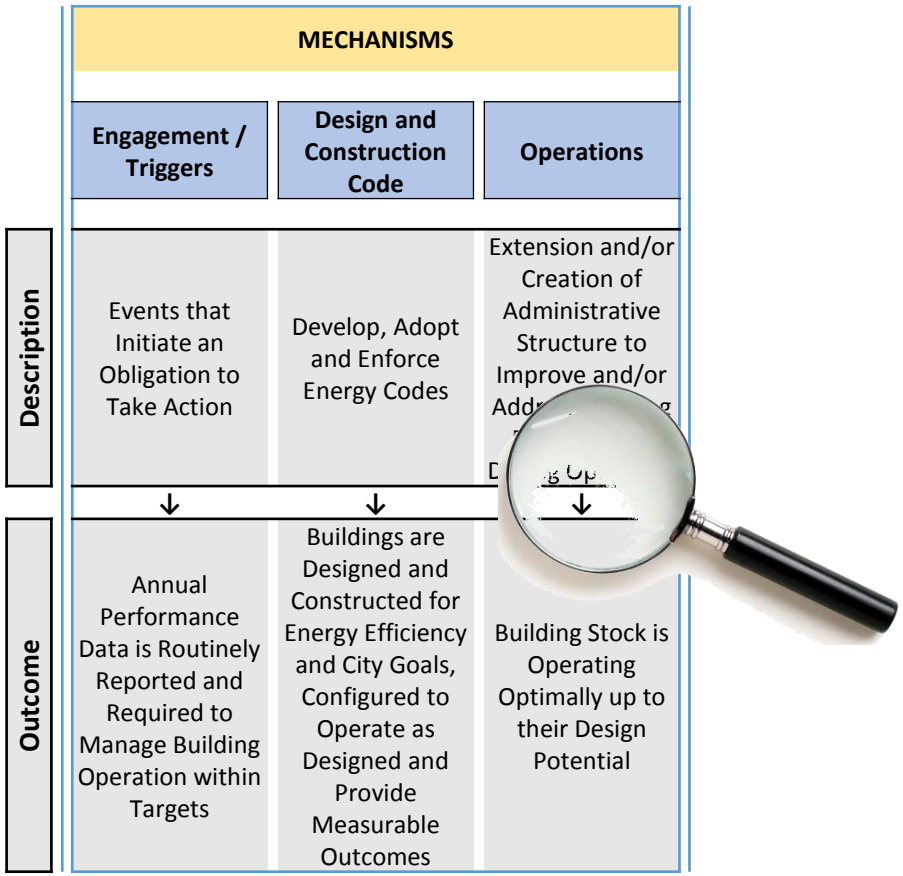
- Setting Policy Goals
  - Climate action plans, 80x50, C40, Climate Mayors. . .
- Establishing System(s) for Tracking Performance
  - Determine performance relative to goals
- Setting Policy-Level Performance Targets
  - Realistic interim targets, evaluation of progress
- Setting and Implementing Building-Level Performance Targets
  - Individual buildings to achieve city-wide goals

Activities and Mechanisms

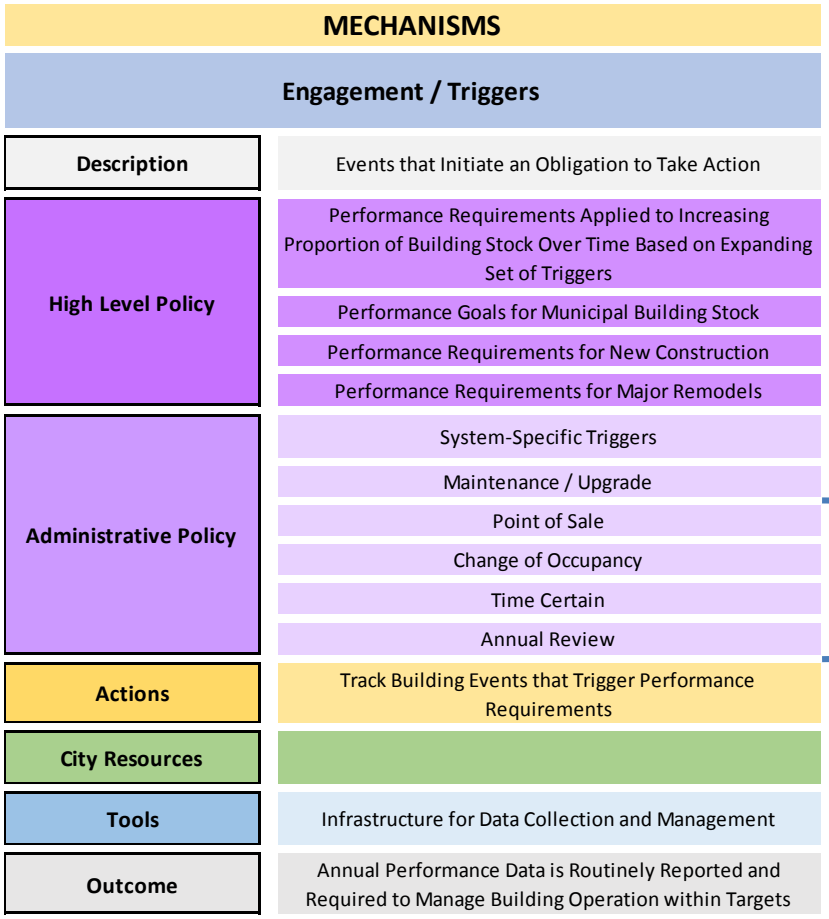
- Policies require legislative or regulatory action by city leadership (mayor, city council, etc), or within administrative agencies.
- Actions are steps that should generally be undertaken at an administrative level.
- Resources are either investments or capabilities that support realization of program goals.
- Tools can be developed internally at the city level or at a national level by the Department of Energy or others and provide the mechanism to accomplish a specific strategy.

Elements of A Life-Cycle Performance Strategy

	LEADERSHIP	DATA, ANALYSIS, AND APPLICATION			MECHANISMS			ENSURING RESULTS	
	Capacity and Commitment	**Data**	**Targets and Benchmarking**	**Application of Targets**	**Engagement / Triggers**	**Design and Construction Code**	**Operations**	**Enforcement**	**City Influence on Market**
Description	Administrative Resources, Framework and Commitment to Effectively Implement the Policy and Programs	Information about Building Performance and Mechanisms to Collect It	Where Does the Observed Metric for a Building Fall on a Scale that Includes the Target, the Ultimate Goal and the Performance of Other Buildings	How and When Targets are Applied to the Building Stock	Events that Initiate an Obligation to Take Action	Develop, Adopt and Enforce Energy Codes	Extension and/or Creation of Administrative Structure to Improve and/or Address Building Performance During Operation	Regulatory Mechanisms (and Implementation) to Ensure Compliance with Performance Requirements	Opportunities to Engage the Private Sector to Support Performance Outcome Goals
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Outcome	Consistent Support, Resources and Capabilities to Implement and Manage Building Performance Policies	Data is Collected Consistently and Comprehensively so the City can Track Progress to Goals	Providing a Consistent and Comprehensive Metric for Tracking Progress Toward Goals	Establish Meaningful Targets that can be Adjusted for Specific Building Conditions and are Adjusted Over Time to Meet Goals	Annual Performance Data is Routinely Reported and Required to Manage Building Operation within Targets	Buildings are Designed and Constructed for Energy Efficiency and City Goals, Configured to Operate as Designed and Provide Measurable Outcomes	Building Stock is Operating Optimally up to their Design Potential	Realization of the Community's Goals Based on the Established Metrics	The Market Delivers and Maintains Buildings that Achieve Performance Goals



	MECHANISMS		
	Engagement / Triggers	**Design and Construction Code**	**Operations**
Description	Events that Initiate an Obligation to Take Action	Develop, Adopt and Enforce Energy Codes	Extension and/or Creation of Administrative Structure to Improve and/or Address Building Performance During Operation
High Level Policy	Specific Triggers of Policy Application at the Building Level	Enforcement Mechanisms during Design and Construction	Policies and Mechanisms to Influence Building Operation
Administrative Policy	Targeted Events that are the Basis for Administration and Enforcement of Building Performance Policies	Administrative Mechanisms and Policies for New Construction Requirements	Administrative Mechanisms to Influence Building Operations
Actions	Develop Mechanisms to Track and Trigger Performance Requirements	New Construction Code Evolution to Support Policy	Implement Requirements for Improving Operational Performance
City Resources	Staff and Support Resources at City		
Tools	Tools Needed or Available to Support Implementation		
Outcome	Annual Performance Data is Routinely Reported and Required to Manage Building Operation within Targets	Buildings are Designed and Constructed for Energy Efficiency and City Goals, Configured to Operate as Designed and Provide Measurable Outcomes	Building Stock is Operating Optimally up to their Design Potential



- Other Triggers

  Once a city develops requirements for categories within the fundamental trigger points, there may be a desire for capturing additional savings through a broader set of triggers. These recommended triggers represent further opportunities for engaging building owners.

  - Point of Sale

    Sale of a property serves as a potential intervention points where buyer and seller may be motivated to take action. Additionally, the city is often notified of the event and has potential mechanisms for engagement including through title records, deed filings and tax filings. Burlington, Vermont has issued a "Time of Sale Energy Efficiency Ordinance" for residential rental housing which could be modified and applied elsewhere (https://www.burlingtonelectric.com/sites/default/files/Documents/Energy_Eff/time-of-sale-energy-ordinance.pdf).

  - Change of Occupancy

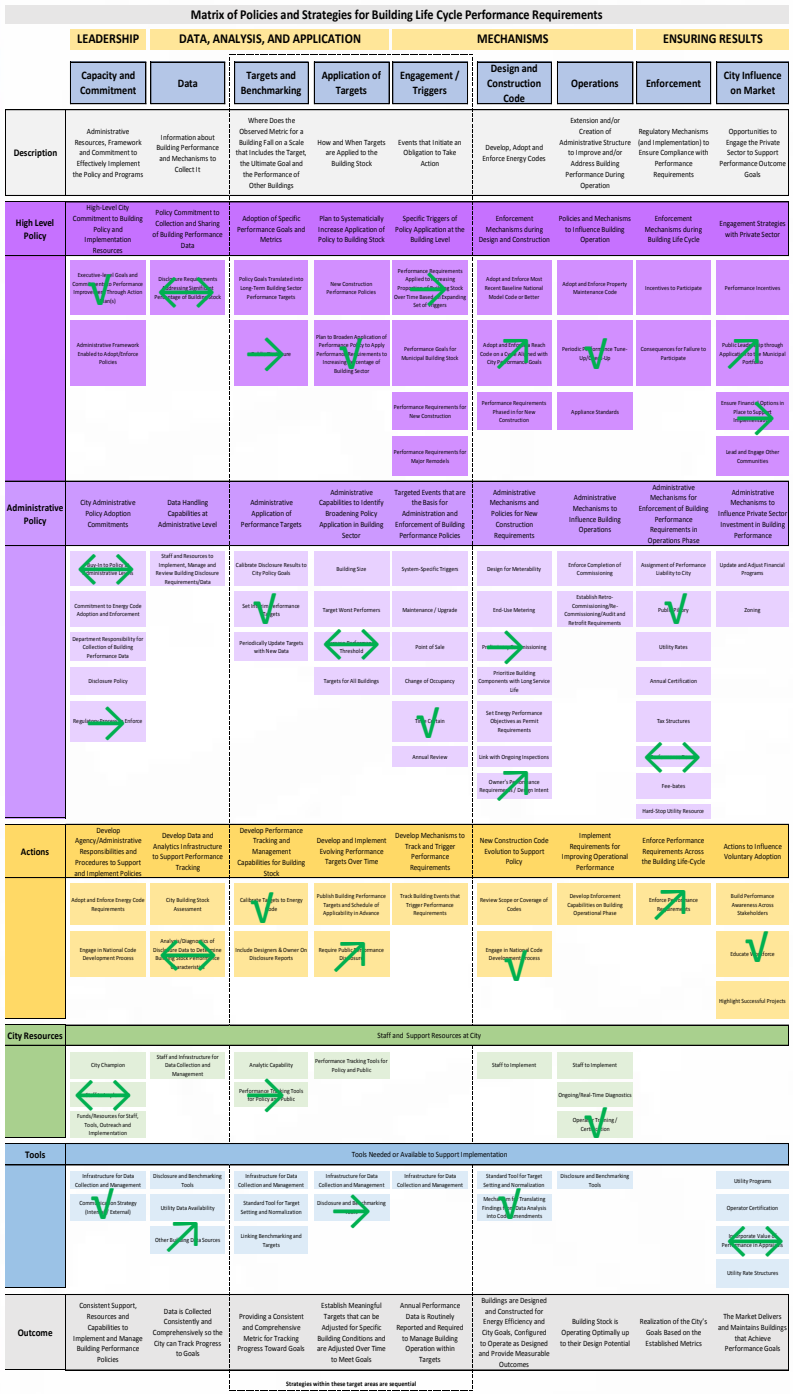
    When pursuing a change of occupancy, the building owner typically must provide notice to the jurisdiction and be required to comply with provisions of code applicable to the new occupancy type. The city may elect to use this owner initiated activity as an opportunity to implement energy performance focused requirements.

  - Time Certain

    Once the city establishes its long-term goal, targets for intermediate time periods should be developed to support the long term planning of building owners and building teams. Building owners may be required to report performance and achievement of an energy use target on a regular schedule (e.g., every 3 years). The targets may also be aligned to reflect these periodic requirements (e.g., the target will be decreased by 5 percent every 3 years).

  - Annual Review

    If city goals are particularly aggressive or the performance requirements apply to a highly regulated segment of the building stock, the city may elect to implement requirements for benchmarking, reporting and improvements that are triggered on an annual basis. The city should be mindful that such annual requirements do not place an undue burden on buildings that are already operating at a high level of efficiency. This may require establishing an absolute target accompanied by a relative target level of improvement for poor performers.



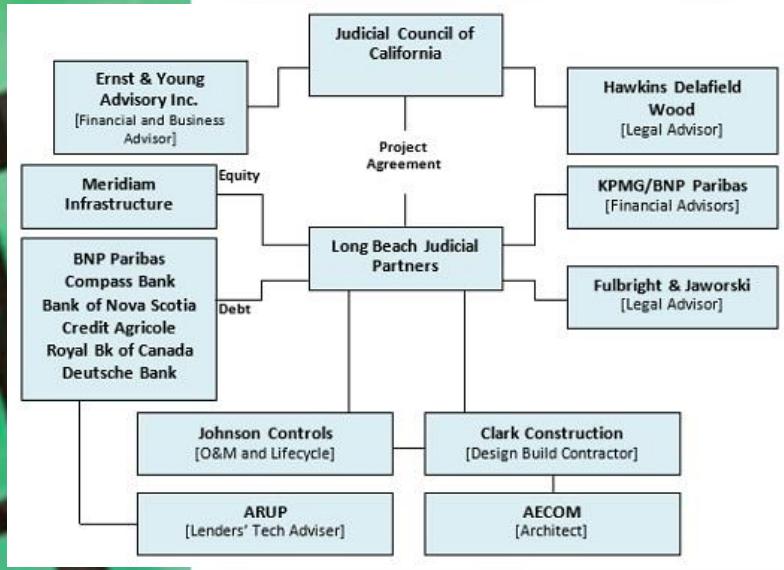
Tracking Progress

- In Place √
  - Executive Level Goals and Commitments to Performance Improvements Through Action Plan(s)
- In Process →
  - Performance Tracking Tools for Policy and Public
- In Planning ↔
  - Analysis/Diagnostics of Disclosure Data to Determine Building Stock Performance Characteristics
- In Projections ↗
  - Other Building Data Sources

GSA Federal Center South

7. CLIN 0005 – M&V and Warranty Period Verification. The Government will ***retain a pre-determined amount of dollars*** *from the overall contract award during performance evaluation. Release of* ***payment*** *for this withheld amount* ***will be contingent upon final confirmation that the energy performance standards for the facility (i.e. actual BTU/GSF saved) have been achieved*** *as verified by the M&V and Warranty Period testing to be conducted within 365 days from final completion. The basis for the pre-determined amount shall be equal to* ***.5%*** *of the proposed construction price.*

Governor Deukmejian Courthouse, Long Beach

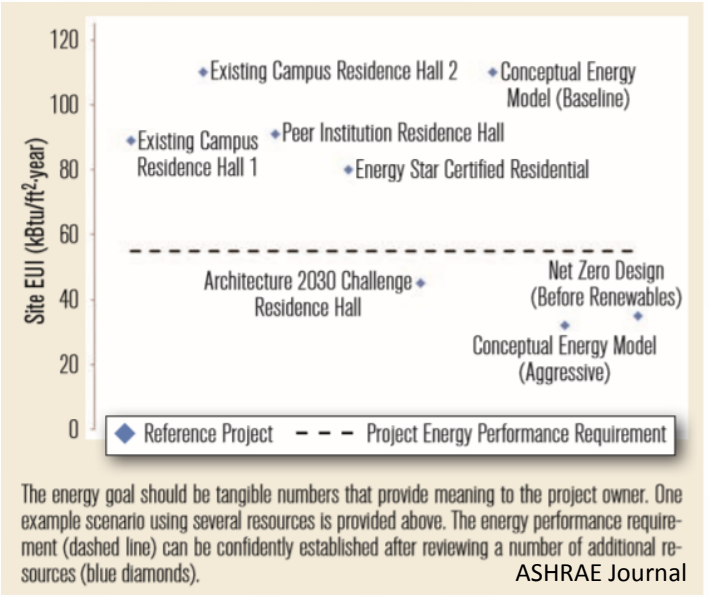


- Public-Private Partnership/DBFOM
- The performance-based contract allowed the courthouse to be constructed without any public funding and provides for the ongoing maintenance and performance of the facility.
- Judicial Council can deduct a specific amount from the availability payment if components of the building do not work.
- For example, there is a $5,000 deduct for every two hours that certain elevators are inoperable.

University of Chicago Campus North Residential Commons

- Site EUI contractual performance goal
  - 85 kBtu/ft^2/yr = Energy Star certification
  - 65 kBtu/ft^2/yr target set
  - Competition → four unique designs w/ modeled performance less than <55 kBtu/ft^2/yr
- Accelerated Performance Procurement Model


(Photo: Mortenson Construction)



The energy goal should be tangible numbers that provide meaning to the project owner. One example scenario using several resources is provided above. The energy performance requirement (dashed line) can be confidently established after reviewing a number of additional resources (blue diamonds).

ASHRAE Journal

Resources

- Outcome-Based Pathways for Achieving Energy Performance Goals, Whole Building Design Guide
  - http://wbdg.org/resources/outcomebasedpathways.php
- Implementing an Outcome-Based Compliance Path in Energy Codes: Guidance for Cities
  - http://www.nibs.org/resource/resmgr/docs/OBP-CityLevelGuide.pdf
- Outcome-Based Performance, New Buildings Institute
  - http://newbuildings.org/hubs/outcome-based-performance/
- Accelerate Performance Procurement Pathway
  - https://www.seventhwave.org/accelerateperformance

This concludes The American Institute of Architects
Continuing Education Systems Course

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acg

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