



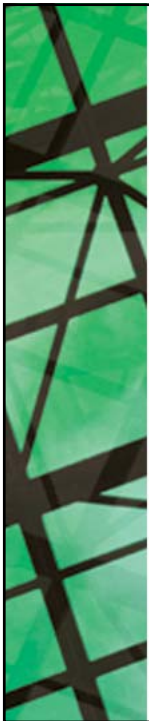
# Net-Zero Energy Buildings: How Do We Get There?

Metropolitan Washington Council of Governments  
January 22, 2014



**National Institute of BUILDING SCIENCES**  
*An Authoritative Source of Innovative Solutions for the Built Environment*

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## About the Institute

### Mission

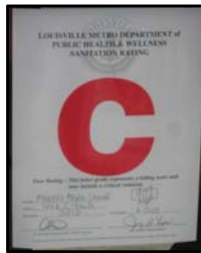
*To serve the nation and the public interest by supporting advances in building sciences and technology to improve the built environment.*

Congress directed the Institute to:

- Develop, promulgate, and maintain building-related performance criteria
- Evaluate and pre-qualify existing and new building technology
- Conduct related investigations
- Assemble, store, and disseminate building- and construction-related technical data and other information

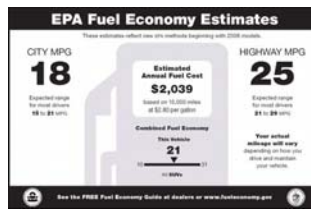


## Buildings are finally entering the information age



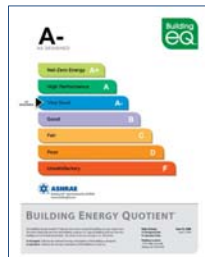
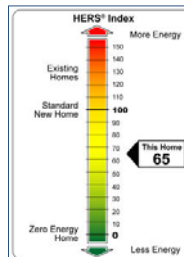
**Restaurant Sanitation Ratings**

**Car Fuel Economy Estimates**



**Nutrition Facts Label**

Nutrition Facts	
Serving Size 1 cup (249 g)	
Serving Per Container 4	
Amount Per Serving	
<b>Calories 80</b>	<b>Calories From Fat 0</b>
Total Fat 0g	
Sodium 0mg	
Total Carbohydrate 18g	
Dietary Fiber 5g	
Sugar 10g	
Protein 1g	
Vitamin A 0%	
Vitamin C 15%	



## The Age of Measurement and Verification

## Role of Codes in Achieving Net-Zero

- What is the current compliance rate?
  - Generally thought to be low
  - ARRA requires 90% by 2018
  - Need \$810 million annually to reach 90%
- No requirement to measure actual energy use relative to the code
- Not all energy uses covered in codes
  - Plug loads can be significant in overall energy use
- Codes based on perfect world
- Codes regulate proxies for energy
- Influence ends at Certificate of Occupancy

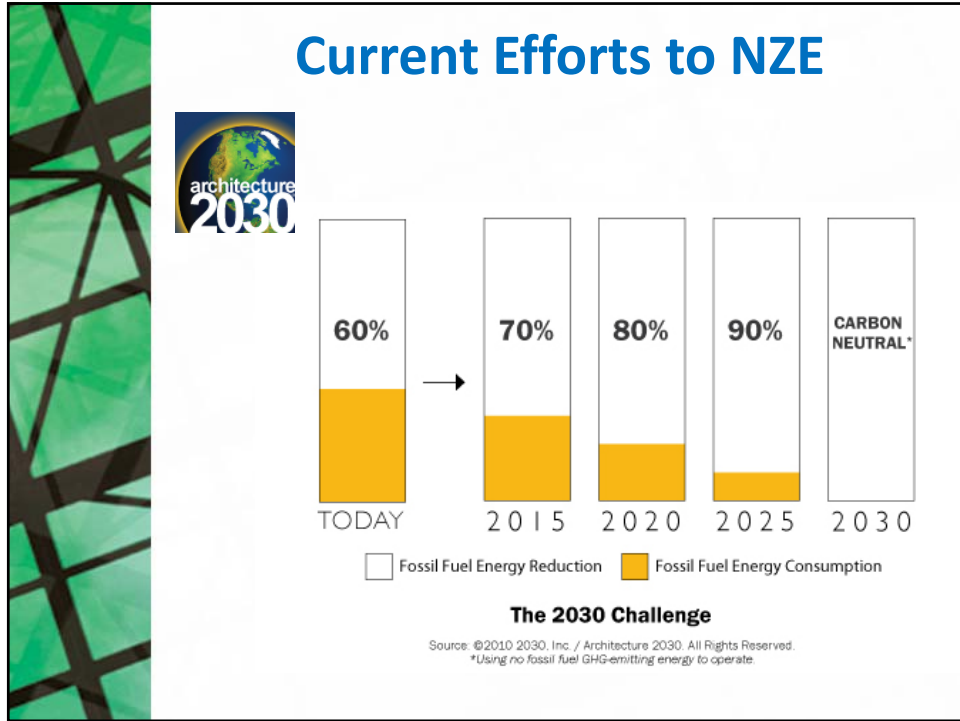
## Just Individual Buildings?

**COMMERCIAL BUILDING FLOORSPACE, ENERGY CONSUMPTION, AND ENERGY INTENSITY, BY BUILDING ACTIVITY**

Building Activity	Total Floorspace (%)	Primary Energy Consumption (%)	Energy Intensity (Thousand Btu per Square Foot)
Vacant	4	1	21
Product Order and Safety	2	2	116
Religious Worship	5	2	44
Other	2	4	164
Service	6	4	77
Food Sales	5	2	200
Public Assembly	6	5	94
Food Service	6	2	258
Warehouse and Storage	14	7	45
Lodging	7	7	100
Health Care	7	4	188
Education	14	11	83
Mercantile	16	18	91
Office	17	19	93

Average Energy Intensity: ~100 Thousand Btu per Square Foot

- Some building types just won't get there cost effectively
- Focus on community approaches
- Buildings for people
- Effective O&M, Cx workforce








## Current Efforts to NZE

**Table A: 2030 Challenge Interim Code Equivalents**

CODE / STANDARD	COMMERCIAL	RESIDENTIAL
ASHRAE 90.1-2004	30% below	
ASHRAE 90.1-2007	25% below	
ASHRAE 189 (in progress)	0	
IECC 2006	30% below	30% below
California Title 24 2005		15% - 20% below <sup>13</sup>
California Title 24 2008	10% below <sup>14</sup>	
Oregon Energy Code <sup>15</sup>	25% below	30% below
Washington Energy Code	25% below	25% - 30% below <sup>16</sup>
RESNET HERS Index		65 or less
LEED NC 2.2 / Homes	New - EA Credit #1: 6 pts Renovation - EA Credit #1: 8pts	HERS Index: 65
LEED 2009 (in progress)	New - EA Credit #1: 7 pts Renovation - EA Credit #1: 9pts	
GBI Standard (in progress) <sup>17</sup>	PATH A, 8.1.1.1: 150pts	
EICC Option <sup>18</sup> (prescriptive path)		EC - 154
NBI Option <sup>19</sup> (prescriptive path)	New - Core Performance w/ enhanced measures	

## Current Efforts to NZE






- Sarasota County, FL
- Santa Fe County, NM
- Boulder County Consortium of Cities, CO
- Fulton County, GA
- Marin County, CA
- Albuquerque, NM
- Santa Fe, NM
- Cambridge, MA
- Santa Barbara, CA
- Durango, CO
- Portland, OR
- Lafayette, CO
- Vancouver, Canada
- Seattle, WA
- Richmond, VA
- Dallas, TX
- Aspen, CO
- San Antonio, TX
- Portland, ME
- Union City, CA
- Los Altos, CA
- Austin, TX


## Current Efforts to NZE

SEATTLE




DISTRICT

CLEVELAND




DISTRICT

PITTSBURGH




DISTRICT

LOS ANGELES

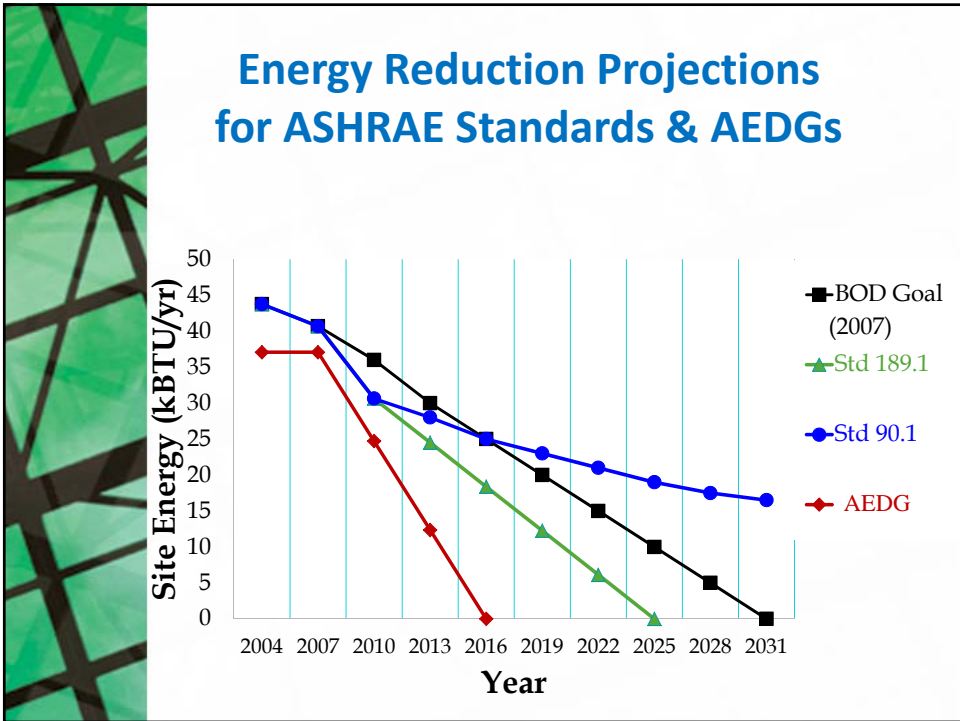


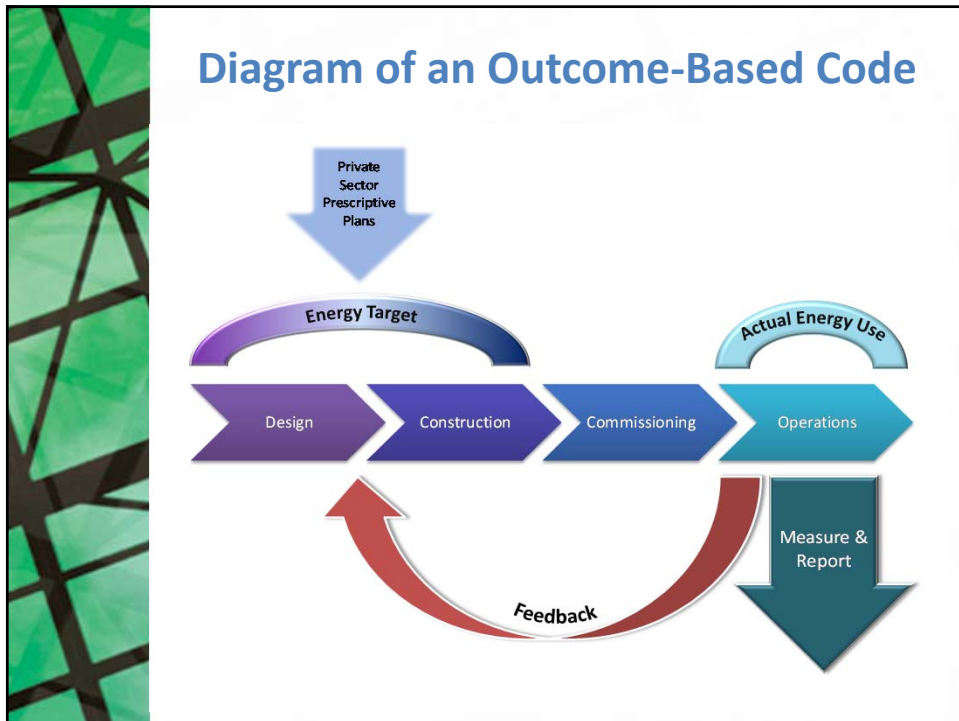
DISTRICT

DENVER



DISTRICT







## Seattle Target Performance Path


- Outcome-based pathway
- Establishes energy use targets
- Requires demonstration of operational energy use
- Financial security to be used as penalty (\$4sqft)
  - Proportion eligible for mitigation



## Impacts on the Design & Construction Industry


- How long is the design & construction team liable for noncompliance?
- How are design fees determined if the design and construction team are responsible over a longer time period?
- Opportunities for ongoing income streams
- No control over O&M, therefore unwilling to guarantee results
- How will records of noncompliance impact professions?






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