

Food, Water, Shelter:

Achieving Net-Zero Buildings

Ramsey Brown • 4 August 2010



*American Society of Heating, Refrigerating,
and Air Conditioning Engineers*



Overview

- Impact of Buildings
- Definition of Net-Zero & Commercial Buildings
- Codes and Standards
- The Barriers
- Potential Solutions
- The TREE
- Policy Recommendation

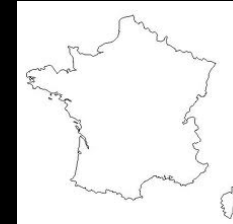


Impact of Buildings

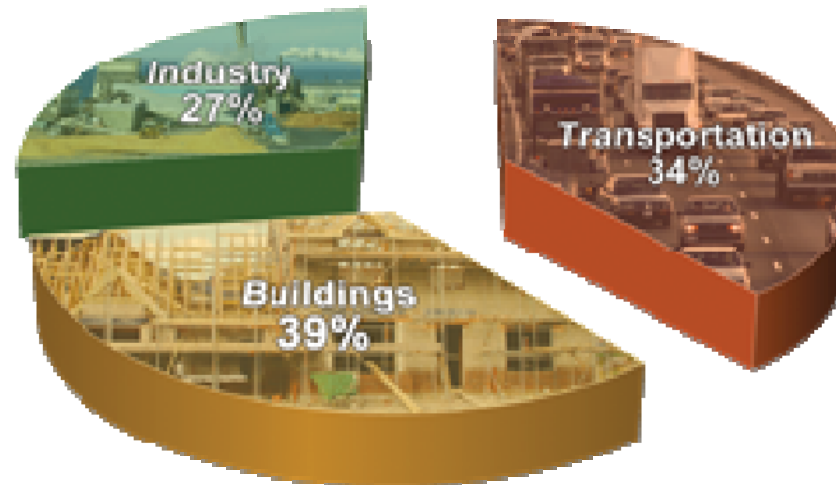
UK



France



Japan



Source: U.S. Energy Information Administration

- Commercial Buildings = 18 % U.S. CO₂ Emissions
- Building Sector = 72 % U.S. Electrical Energy



“Net-Zero” Definition

Has no electrical impact on
our national infrastructure



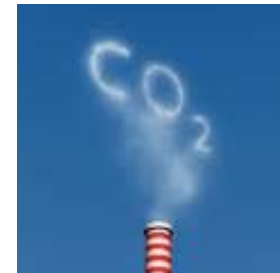
- Energy **Efficient Design**
- **On-site** renewable energy generation
- **Off-site** renewable generation
- **Natural gas**, mined using proven, benign methods



Net-Zero Benefits



- Save Money!
- Reduce GHG
- Reduce Power Plants
- Raise Awareness
- Create Jobs
- Create Healthier Environments



Commercial Buildings



BROAD BUILDING CATEGORIES
Education
Food Sales
Healthcare
Lodging
Mall
Office
Public Assembly
Public Order and Safety
Retail
Service
Storage/Shipping/Non-refrigerated Warehouse
Wastewater Treatment Facility
Other

No more than half of its floor area used for residential, industrial, or agricultural purposes



Source: Commercial Building Energy Consumption Survey (CBECS)

Codes and Standards

- A building code is a law or regulation that sets forth minimum requirements for the design and construction of buildings and structures
- Importance: Safety & Energy



Codes and Standards Flow Chart

Codes = Law



Standard, Code, and Regulation
Developing Organizations

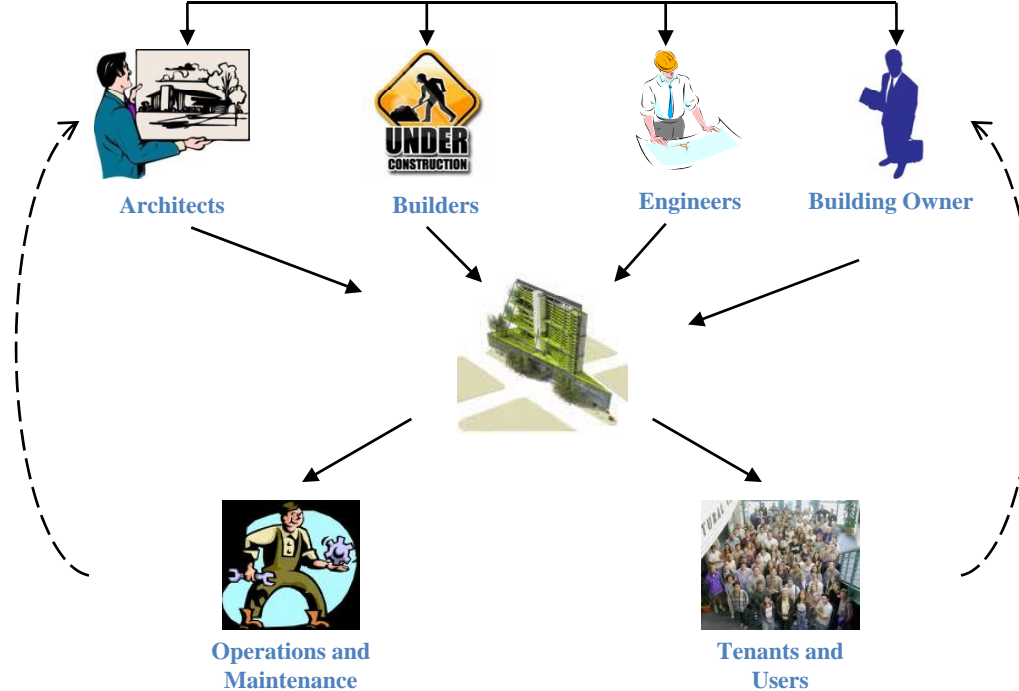
Standard =
Recommendation written
in code-intended language



US Federal Government



Standards, Codes, and Regulations

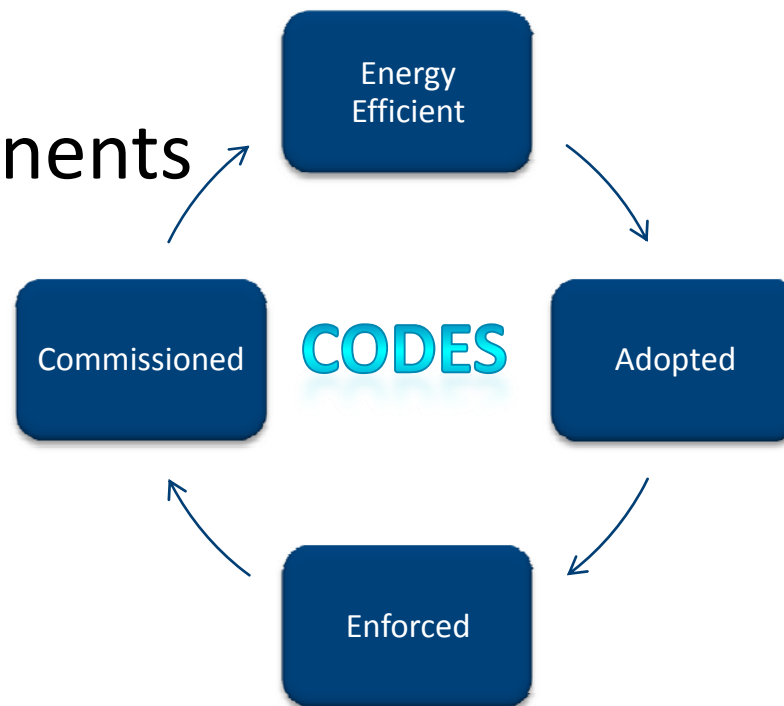


ANSI/ASHRAE/IES
Standard 90.1
Energy Standard

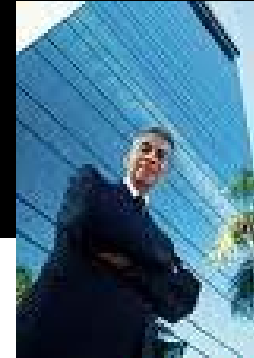
ASHRAE/IECC
Standard 189.1
Stretch Standard

Key Conflicts and Concerns

- Consensus Process
- Prescriptive vs. Performance vs. Outcome
- Building Type
- Renovating Components
- Occupant Use



Consensus



CHALLENGE

- Creates Equality, but not without trade-offs



RECOMMENDATION

- Incentivize Building Owners
 - Revolving Loan Funds
 - Density Bonuses
 - Expedited Processing
 - Marketing Assistance
 - Awards and Recognition



Outcome-based Standards



CHALLENGE

- Prescriptive vs. Performance
- No common definition of Outcome-based

RECOMMENDATION

- Define Metrics
- Building Type and Location

PRESCRIPTIVE	PERFORMANCE	OUTCOME-BASED
Lays out the specific technologies and techniques necessary to achieve compliance with building codes and standards	Predicts the level of energy efficiency to be achieved relative to a hypothetical building model	Outcome-based standards use building modeling in conjunction with a calculated energy minimum .



This allows us to **compare** different buildings



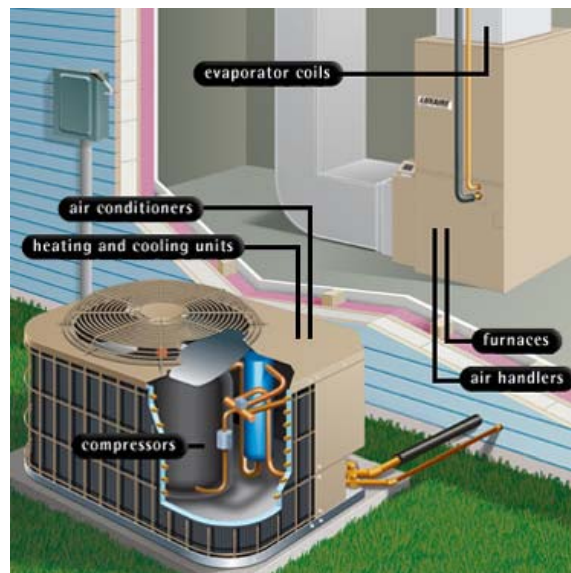
Retrofit Process

CHALLENGE

- Replacing single components
- Entire system integration

RECOMMENDATION

- Prescribe ways in which retrofits can include and account for systems



Occupant Use



CHALLENGE

- Lifetime Building Cost:
2 % = Initial Cost
6 % = Maintenance
92 % = Occupant Use
(avg 30-40 year lifespan)



RECOMMENDATION

- Provide conservation methods
- Employ user-friendly energy interfaces
- Inform occupants of building energy consumption
- Educate building users



Question: Are you ready for us?

- Problems Presented
- Solutions Presented
- But before I present policies...

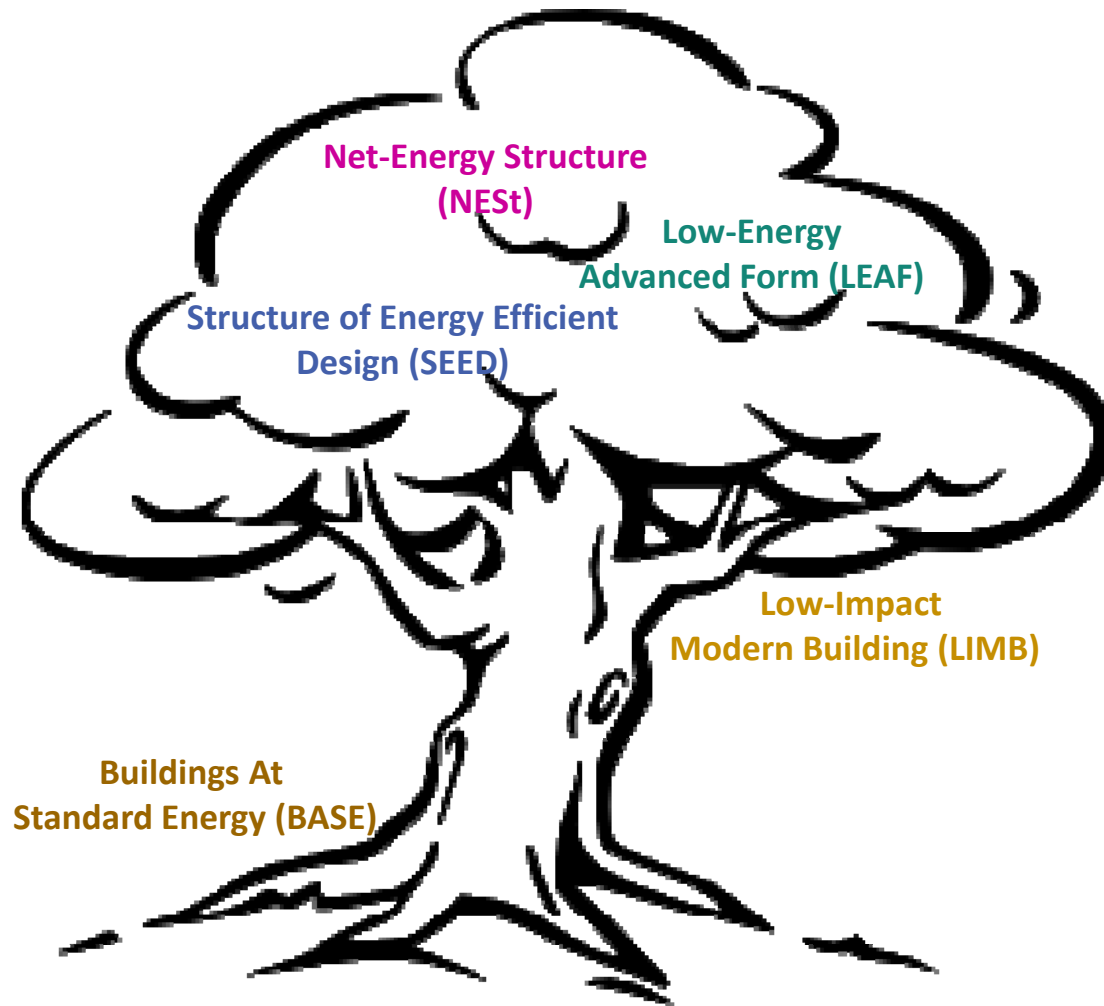
**Are you ready for a
Generation of Sustainability?**



The Tactical Reach for Energy Equilibrium (TREE)

- Efficient Design
- On-site
- Off-site
- Natural gas

Zero-Energy Network (ZEN)



STRUCTURE TYPE	DEFINITION
ZEN	Net-Zero Electrical Independence
NESt	Net-Zero Efficiency On-site Renewable
LEAF	Efficiency On-Site Renewable Off-site Renewable Natural Gas
SEED	Above-average efficiency Optional: On-site Renewable Off-site Renewable Building Labeling
LIMB	Minimum of ASHRAE 90.1- 2001 energy standards.
BASE	Constructed to pre-ASHRAE 90.1-2001 energy standards.

Policy Recommendations

CODES & STANDARDS

- **Outcome-based** Standards
- Retrofit **Systems**
- Empower **Occupants**
- Future: **Stretch** Codes

GOVERNMENTS

- Incentivize **Building Owners**



Questions?

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