Buildings XIII – US DOE BTO Multi-year Plan with International Perspectives

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

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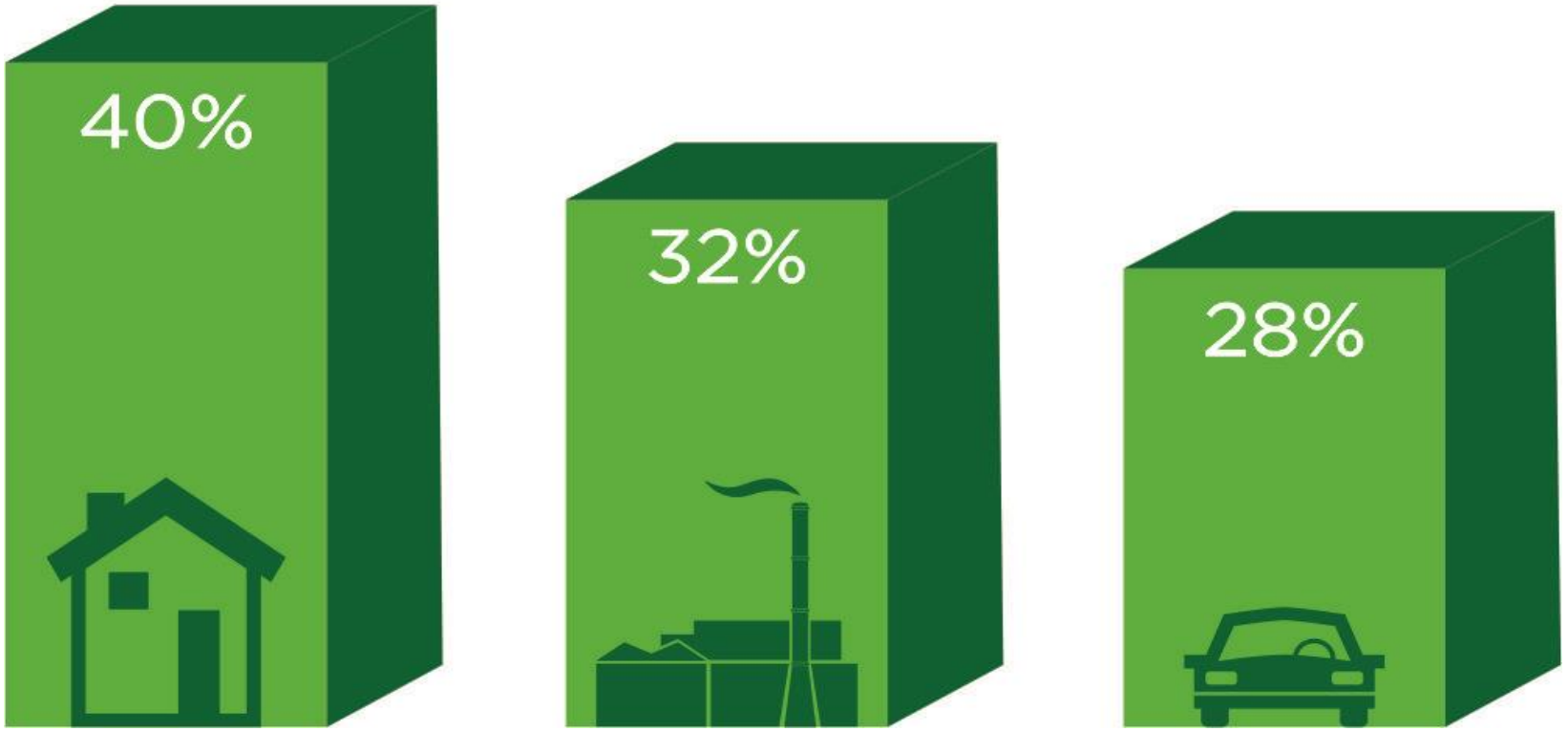
OVERVIEW

- US energy background and goals
- Global and international perspectives
- Residential sector policies
- IEA Building reference publications

Efficiency Critical for Energy and Climate Goals

Our Homes and Buildings Use More Energy than Any Other Sector



Residential & Commercial

Industrial

Transportation

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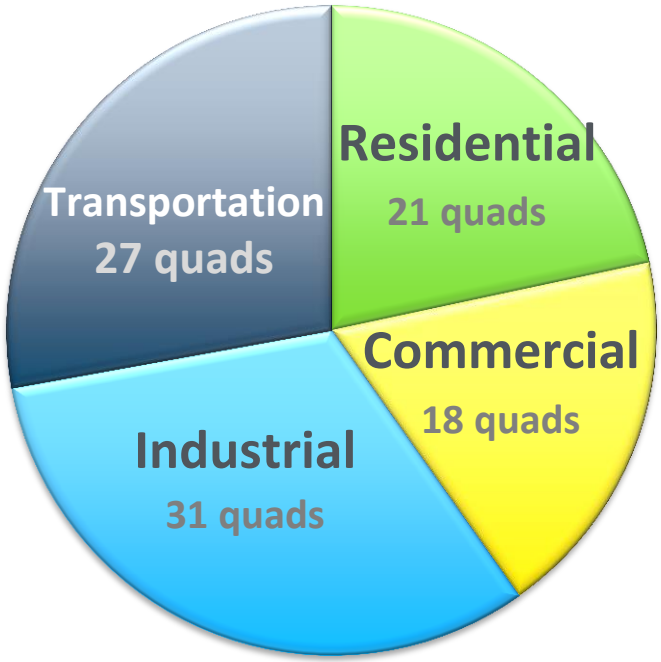
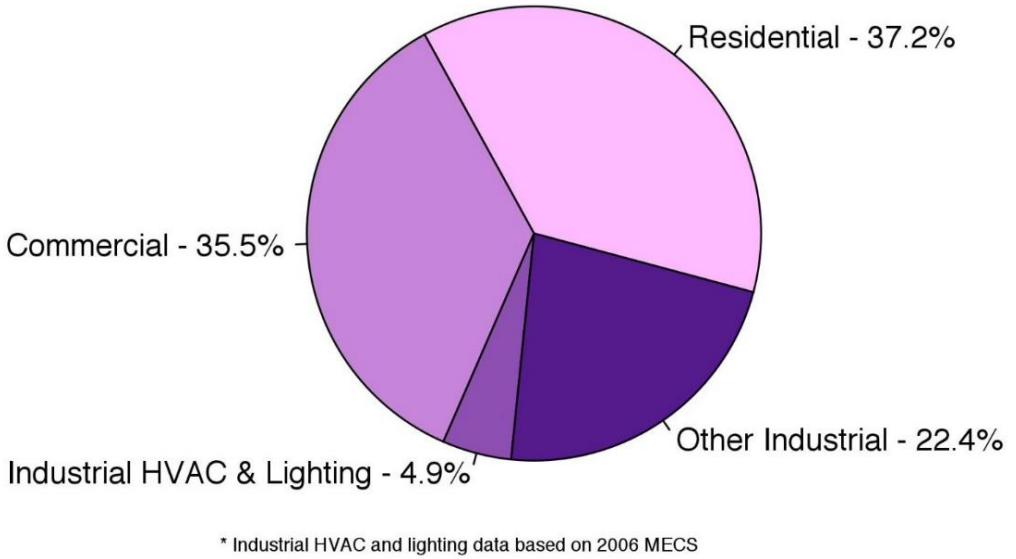
U.S. Energy and Electricity Consumption by Sector

Energy Use



Electricity Use



* Industrial HVAC and lighting data based on 2006 MECS

Buildings Energy Use: 40% of U.S. total

Buildings Electricity Use: 76% of U.S. total

U.S. Building Energy Bill: $410 billion per year

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BTO Releases 2016-2020 Multi-Year Program Plan

BTO Goal:

- **2030 goal:** Reduce average energy use per square foot of U.S. buildings by **30%** below 2010 levels
- **Long-term goal:** reduce average EUI of U.S. buildings by **50%**

National Goals:

- By 2030, double energy productivity relative to 2010
- Reduce greenhouse gas emissions 26%–28% below 2005 levels by 2025

http://energy.gov/eere/buildings/downloads/multi-year-program-plan

US COP 21 – Intended Nationally Determined Contribution

- Under the Energy Policy Act and the Energy Independence and Security Act, the United States Department of Energy has finalized multiple measures addressing buildings sector emissions including energy conservation standards for 29 categories of appliances and equipment as well as a building code determination for commercial buildings.

- Under the Clean Air Act, the United States Environmental Protection Agency has approved the use of specific alternatives to high-GWP HFCs in certain applications through the Significant New Alternatives Policy program.

United Nations
Framework Convention on
Climate Change

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

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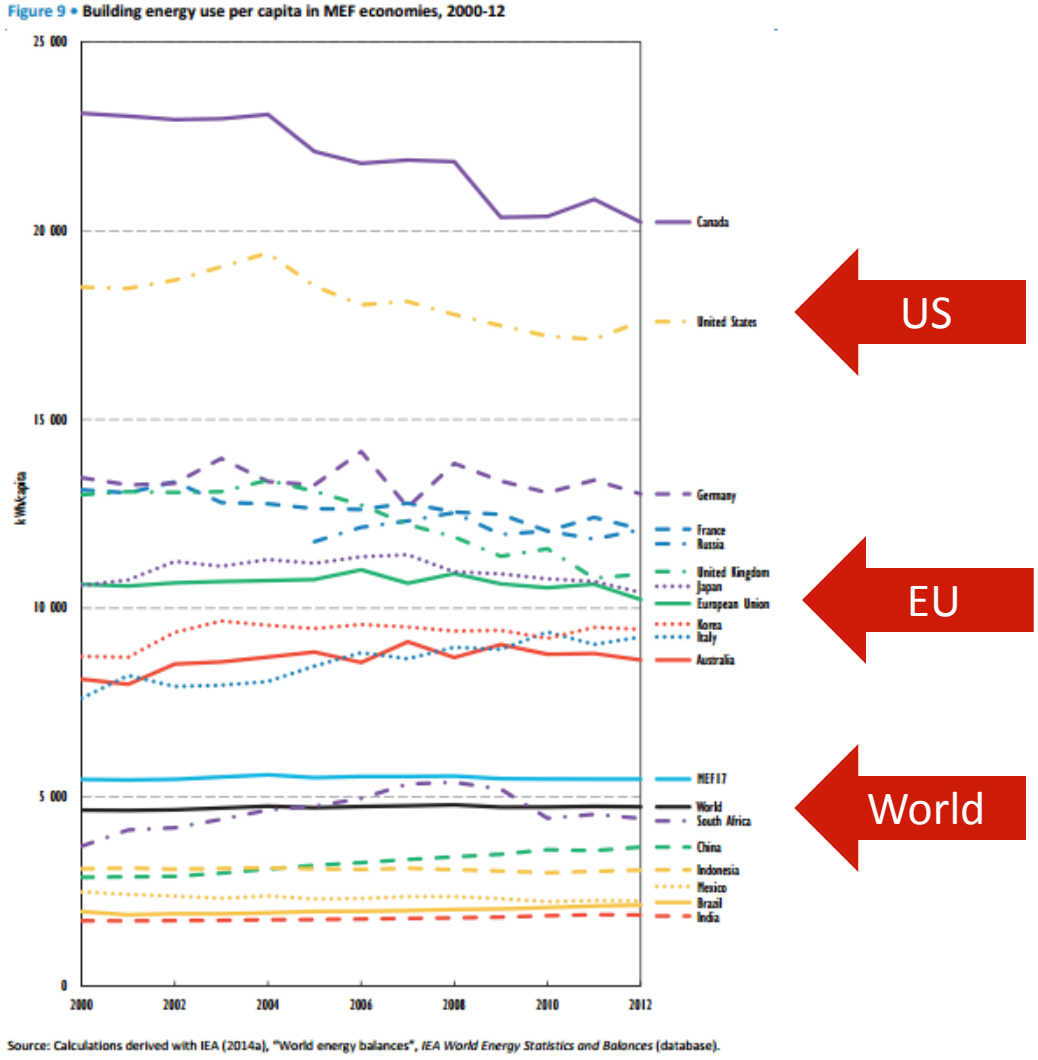
Building Energy Consumption per Capita

- US has one of the highest building energy use per capita of the world
- UK has had one of the fastest declines
- Energy efficient materials and products, building codes and overall energy policy drive reductions

Source: IEA, Building Energy Performance Metrics Report, 2015



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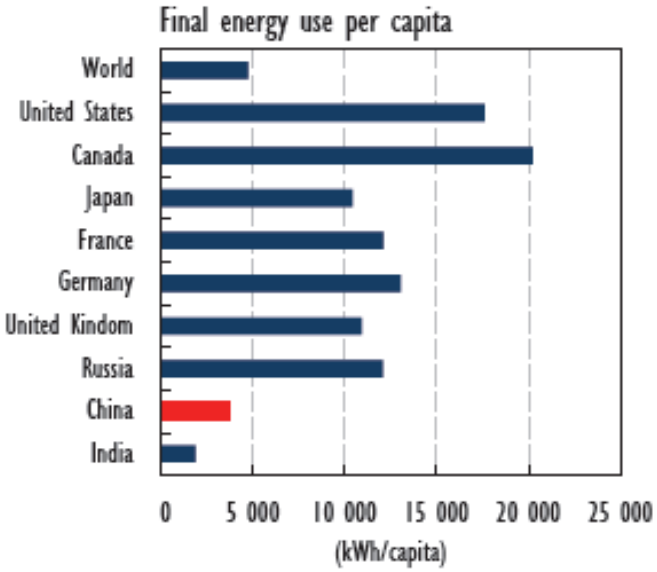
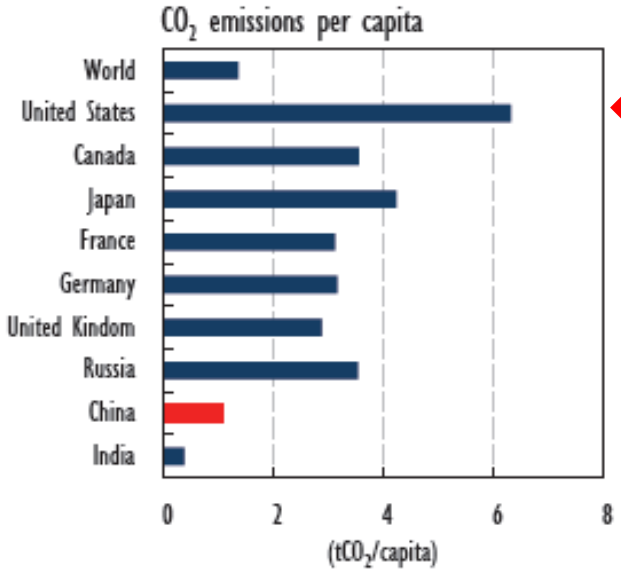
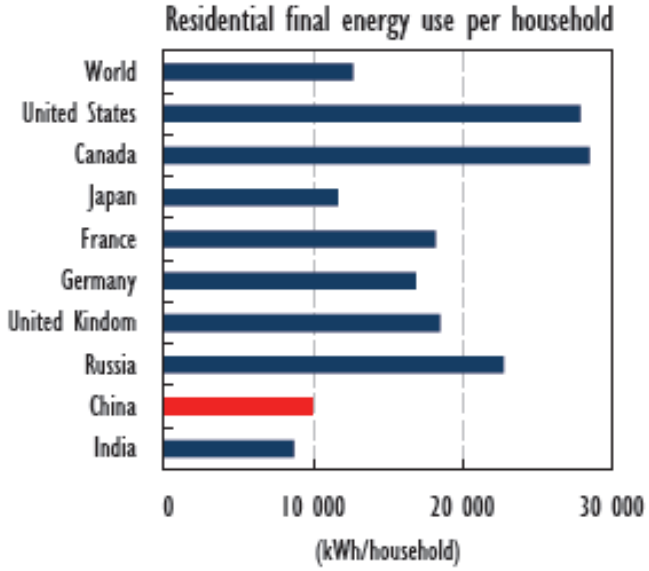
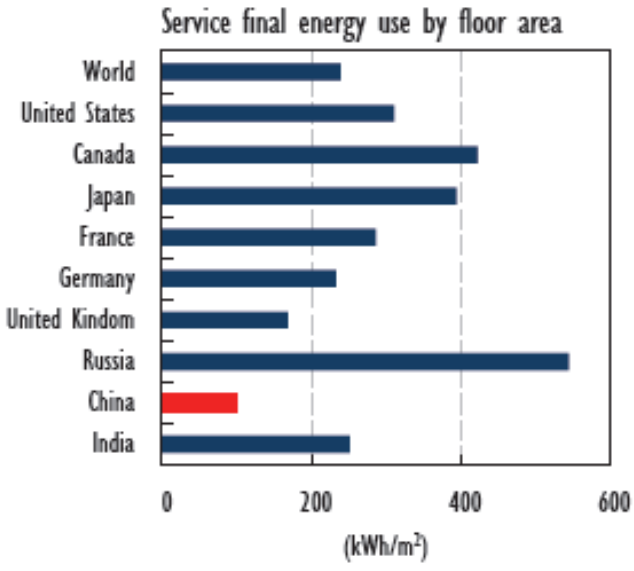
Building Performance Metrics





US - highest carbon emissions per capita





Source: IEA, Building Energy Use in China, 2015

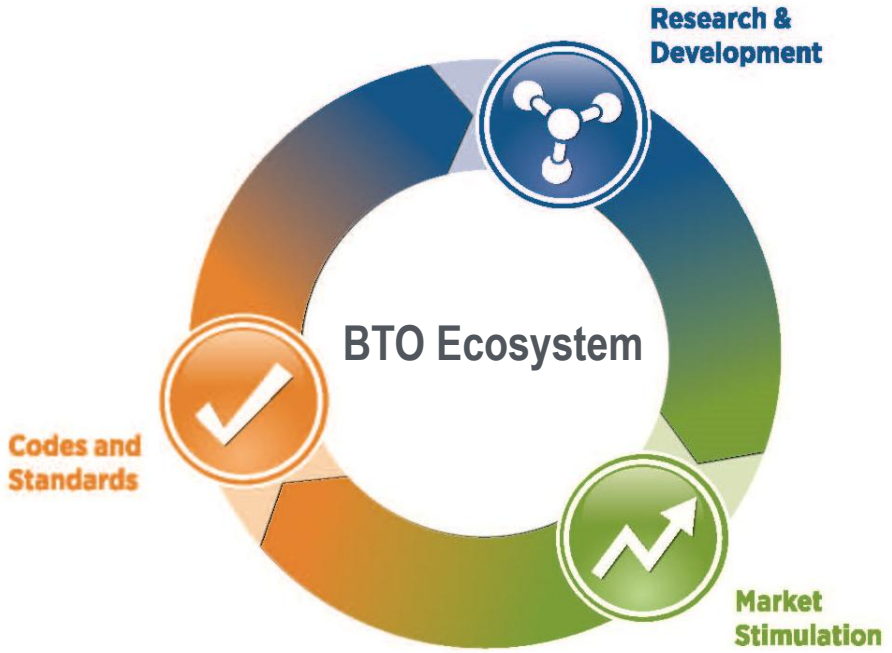
BTO's Integrated Approach

Research & Development

- Develop technology roadmaps
- Prioritize opportunities
- Solicit and select innovative technology solutions
- Collaborate with researchers
- Solve technical barriers and test innovations to prove effectiveness
- Measure and validate energy savings

Market Stimulation

- Identify barriers to speed and scale adoption
- Collaborate with industry partners to improve market adoption
- Increase usage of products & services
- Work through policy, adoption, and financial barriers
- Communicate the importance and value of energy efficiency
- Provide technical assistance and training

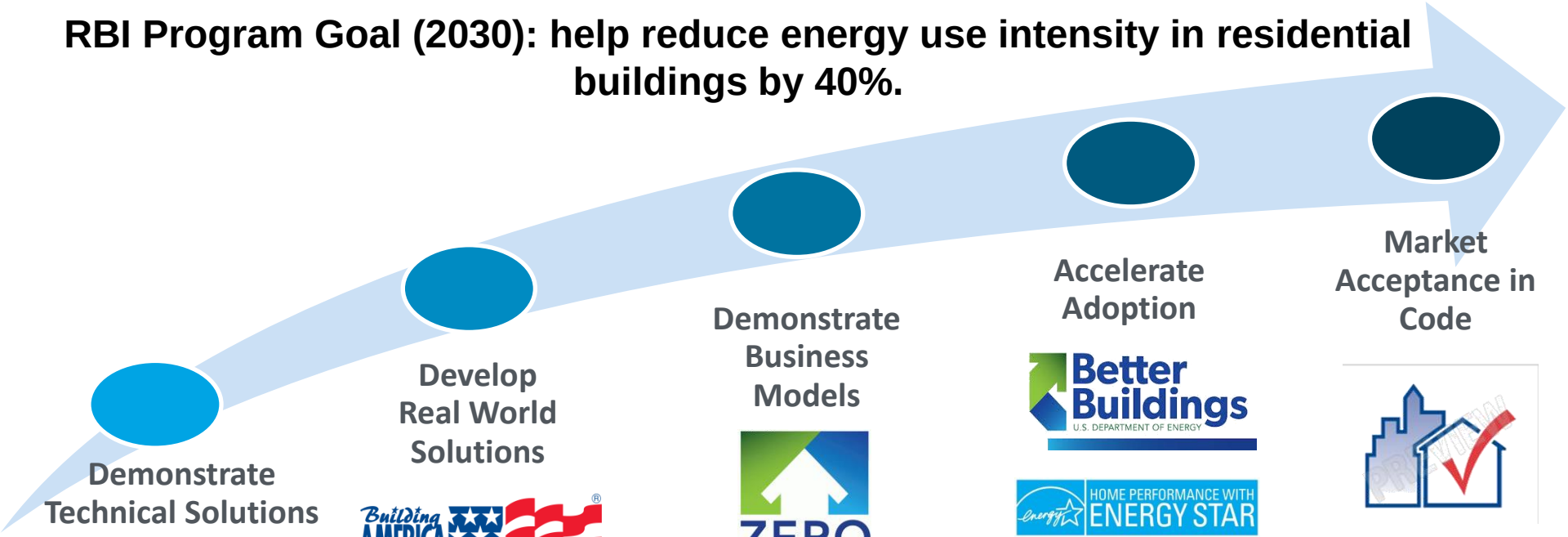


Codes and Standards

- Establish minimum energy use in a transparent public process
- Protect consumer interests
- Reduce market confusion
- Enhance industry competitiveness & profitability
- Expand portfolio of EE appliances & equipment
- Raise the efficiency bar

Residential Program Strategy

RBI Program Goal (2030): help reduce energy use intensity in residential buildings by 40%.



Demonstrate Technical Solutions

Building America U.S. Department of Energy

Better Buildings U.S. Department of Energy

Develop Real World Solutions

Building America U.S. Department of Energy

Better Buildings U.S. Department of Energy

Demonstrate Business Models

ZERO ENERGY READY HOME U.S. Department of Energy

Better Buildings U.S. Department of Energy

Home Performance with ENERGY STAR

Accelerate Adoption

Better Buildings U.S. Department of Energy

Home Performance with ENERGY STAR

Home Improvement Catalyst

Market Acceptance in Code

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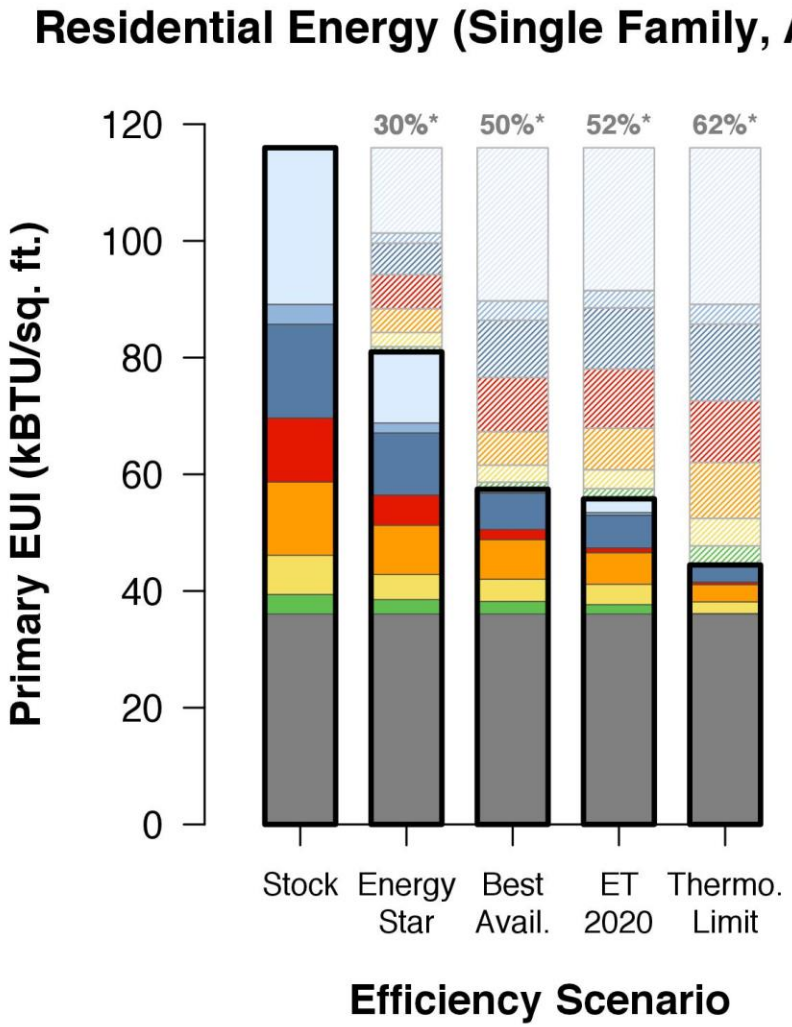
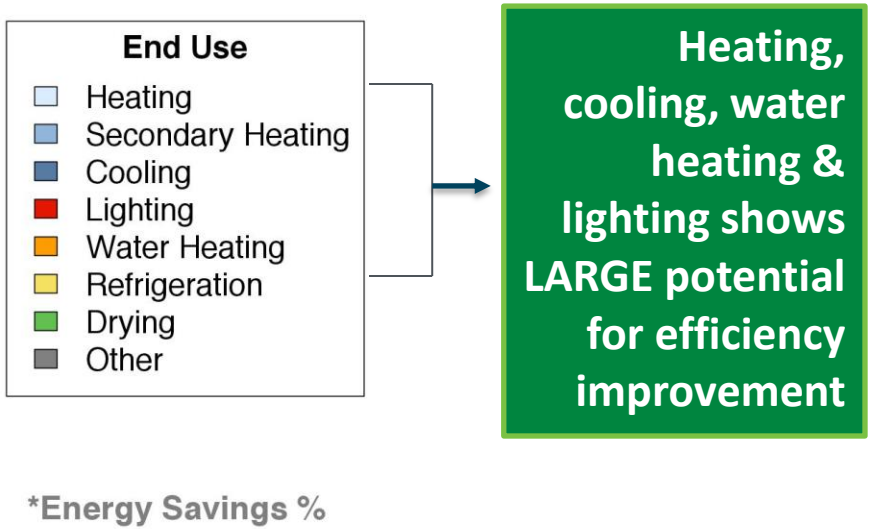
Potential Opportunities of Residential Building Energy Efficiency





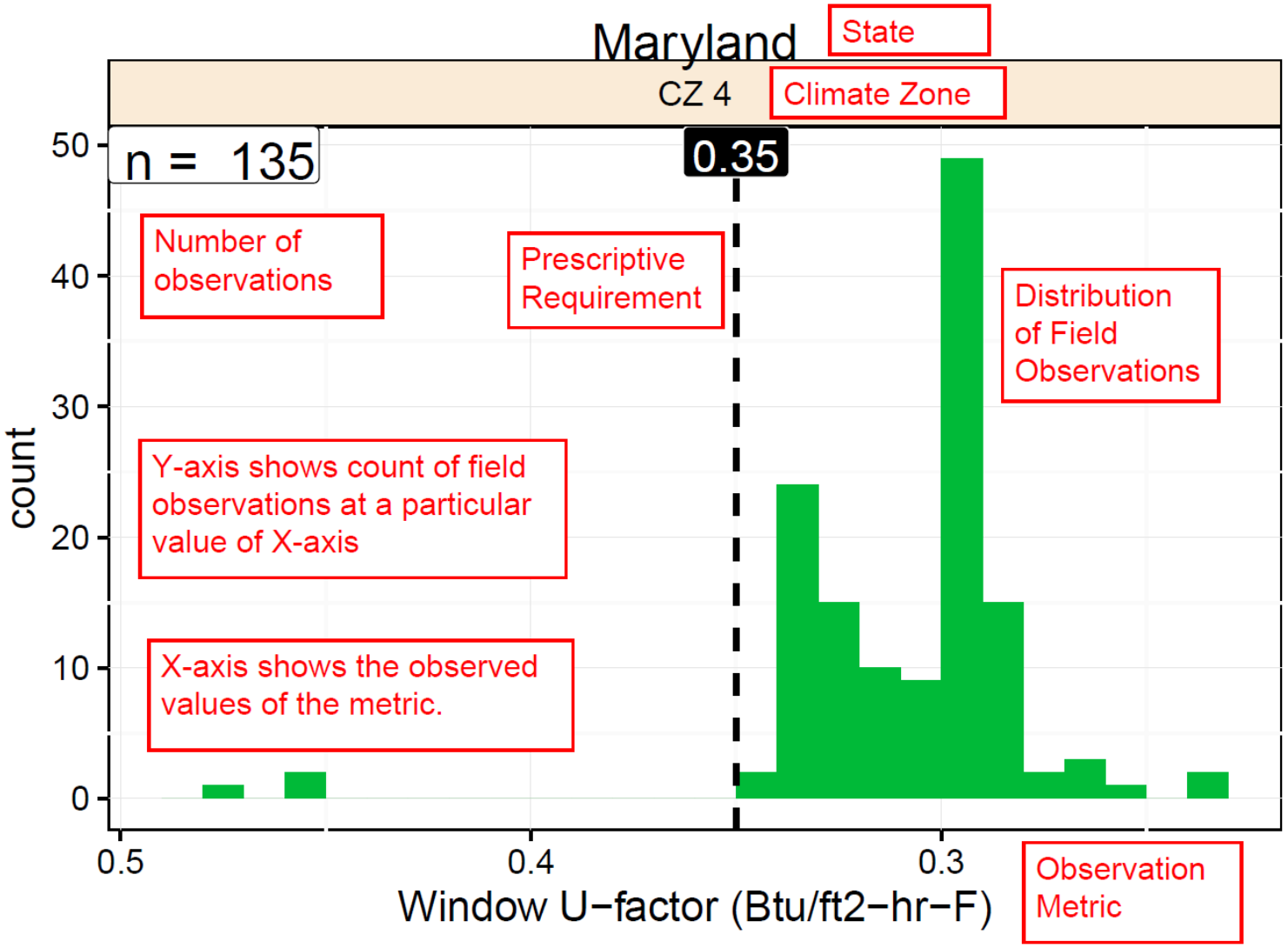
*Energy Savings %

"Other" dominates in the future: Small electric devices, heating elements, outdoor grills, exterior lights, pool/spa heaters, etc.

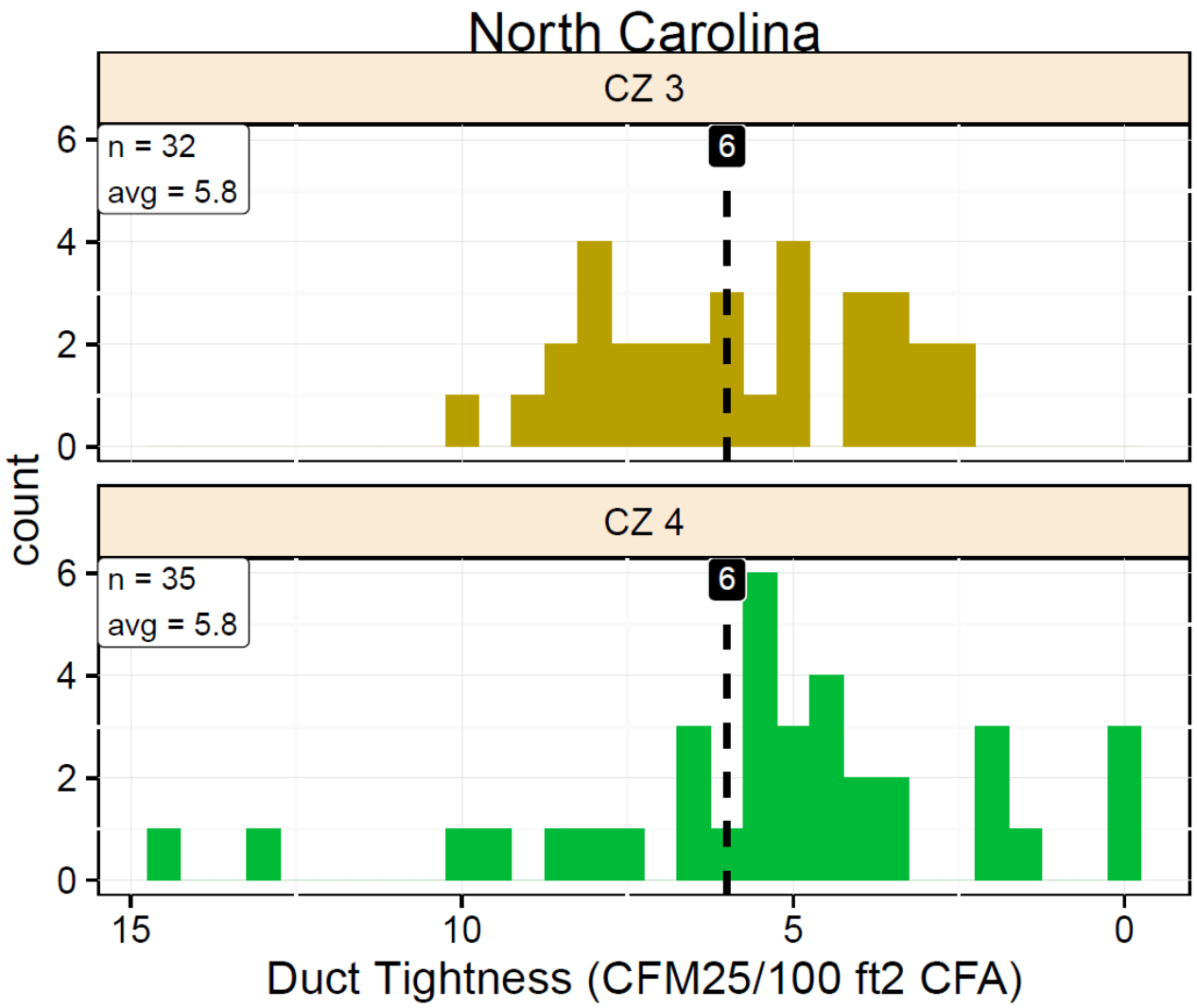
Best available does not consider cost

ET 2020 includes cost effectiveness

Residential Code Field Study – Window Example

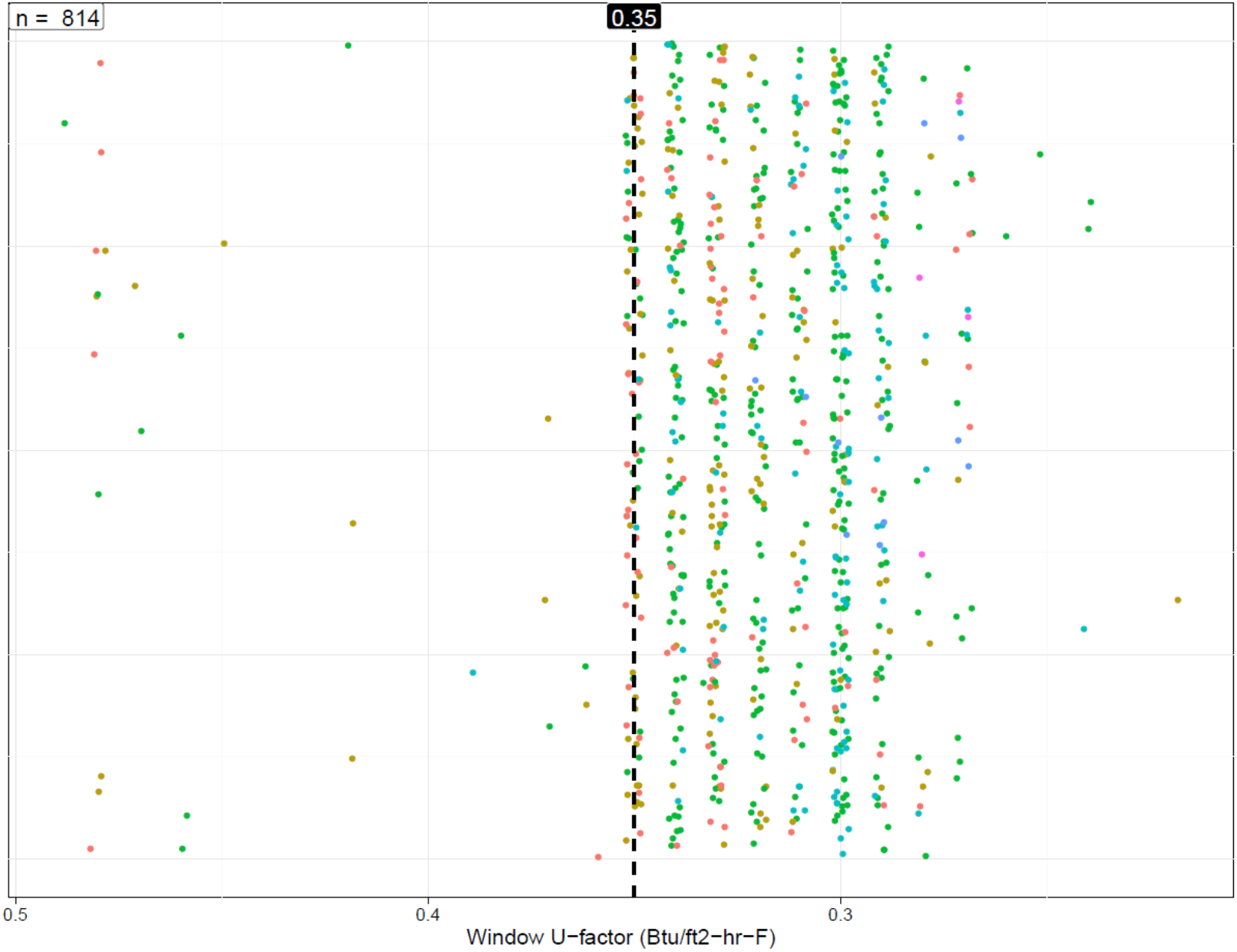


Residential Code Field Study - Duct Tightness



Vertical black line = 2012 North Carolina State Code Requirement

Window U-Factor – Very High Level of Compliance



Existing Building Stock – Largest Impact

- In 2050, 75% of existing building stock of OECD countries will still be in-service
- Largest scale retrofit occurred in Germany after reunification, achieved energy savings approaching 45% reduction; typical upgrades in US achieve 15% to 25%
- Renovate Europe (group of industry and non-profit organizations) is calling for renovations that achieve 60% to 90% energy savings
- Energy Performance Certificates in EU are mandatory but quality concerns still exist; in US, program stringency is more robust but market uptake is low

Source: IEA, Transition to Sustainable Buildings, 2013

EU and US Building Envelope Perspectives

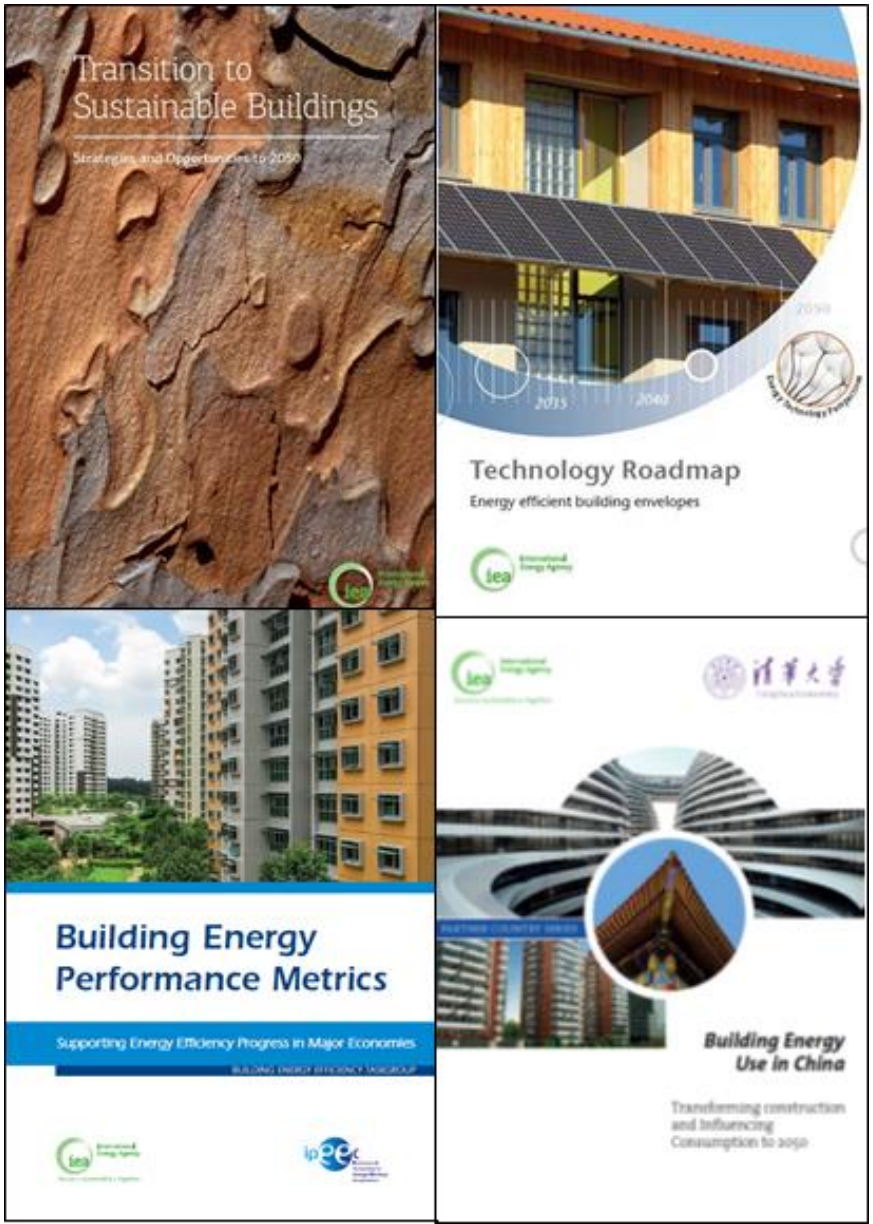
- Windows – Several EU countries have achieved over 50% market share for triple pane window sales, in the US market share is still in low single digits
- Insulation – Levels of insulation in new construction continues to improve and is fairly high in EU and US
- Air Sealing – Infiltration is much lower in new buildings today compared to the old building stock, but large gaps exist between the best available (e.g. zero energy/passive house) and typical new construction
- Passive Strategies – Exterior shades in EU can enable the elimination of cooling systems, but highly climate dependent
- Many more EU buildings have high thermal mass compared to the US
- Cool Roofs - In the US can significantly reduce cooling loads in older buildings with under insulated roofs, buildings with mechanical equipment in attics, and can also reduce urban heat island and reject heat from the planet

Source: IEA, Energy Efficient Building Envelope Technology Roadmap, 2013

Policies for Existing Buildings

- Major discussion and interest in the EU, especially since 60% of natural gas, much from Russia, is used to heat buildings
- Policies to aggressively pursue deep energy renovation have not been approved in EU; policies exist for zero energy homes by around 2020 but are not likely to be fully met despite some significant progress
- US renovation activity beyond the American Recovery and Reinvestment Act (Billions), has mostly been pursued at the local and state levels with significant utility incentive funds
- DOE seeks industry input on how to motivate market, come to the workshop on Thursday

IEA Reference Documents



Buildings Book
http://www.iea.org/publications/freepublications/publication/transition-to-sustainable-buildings.html
Envelope Roadmap
http://www.iea.org/publications/freepublications/publication/TechnologyRoadmapEnergyEfficientBuildingEnvelopes.pdf

Building Performance Metrics
http://www.iea.org/publications/freepublications/publication/building-energy-performance-metrics.html
China Report
https://www.iea.org/publications/freepublications/publication/PARTNERCOUNTRYSERIESBuildingEnergy_WEB_FINAL.pdf

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SUMMARY

- Building envelope is critical to achieving large reduction in heating and cooling loads in existing buildings
- Energy policy to aggressively pursue deep energy reduction in existing buildings is slow globally, but is of a high interest and continues to be debated
- Public policy will continue, however balance of activities will likely be adjusted based on new leadership's priorities
- DOE seeks to continue with stakeholder involvement to help drive program goals and seek ways to move market forward

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