U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

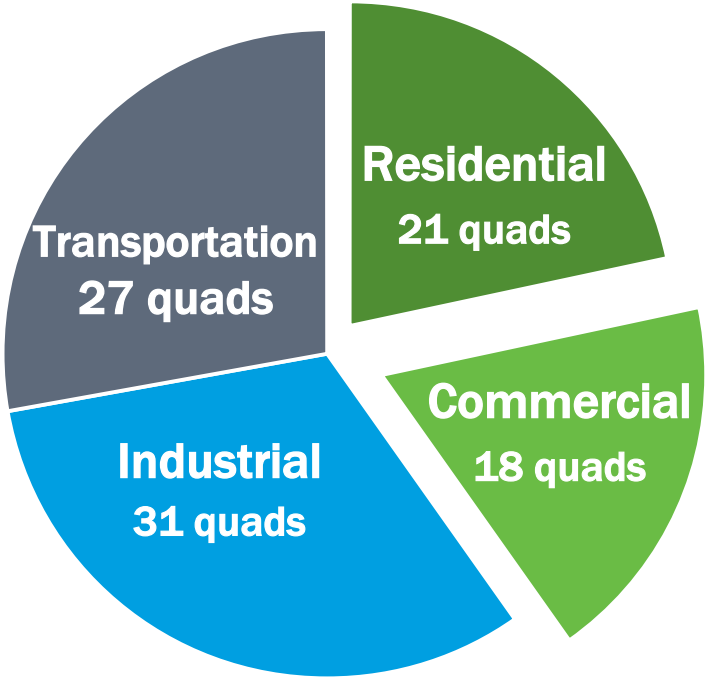
Building Technologies Office FY 17 FOA Kick-Off Meeting

David Nemtzow, Director

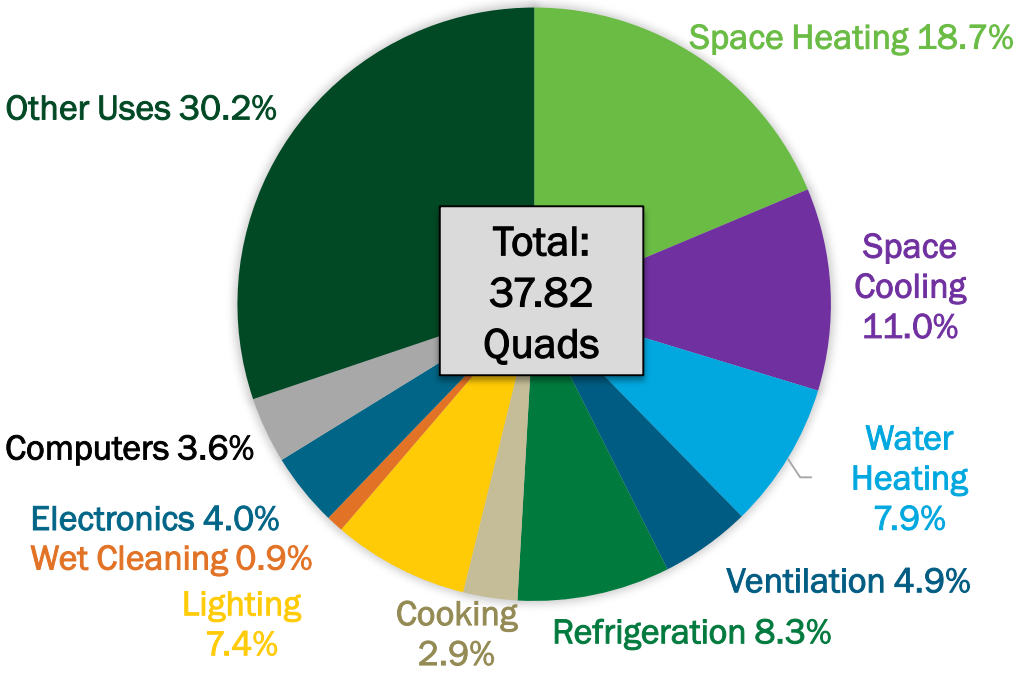
December 12, 2017

U.S. Energy and Electricity Consumption by Sector

Energy Use



Building Energy Use



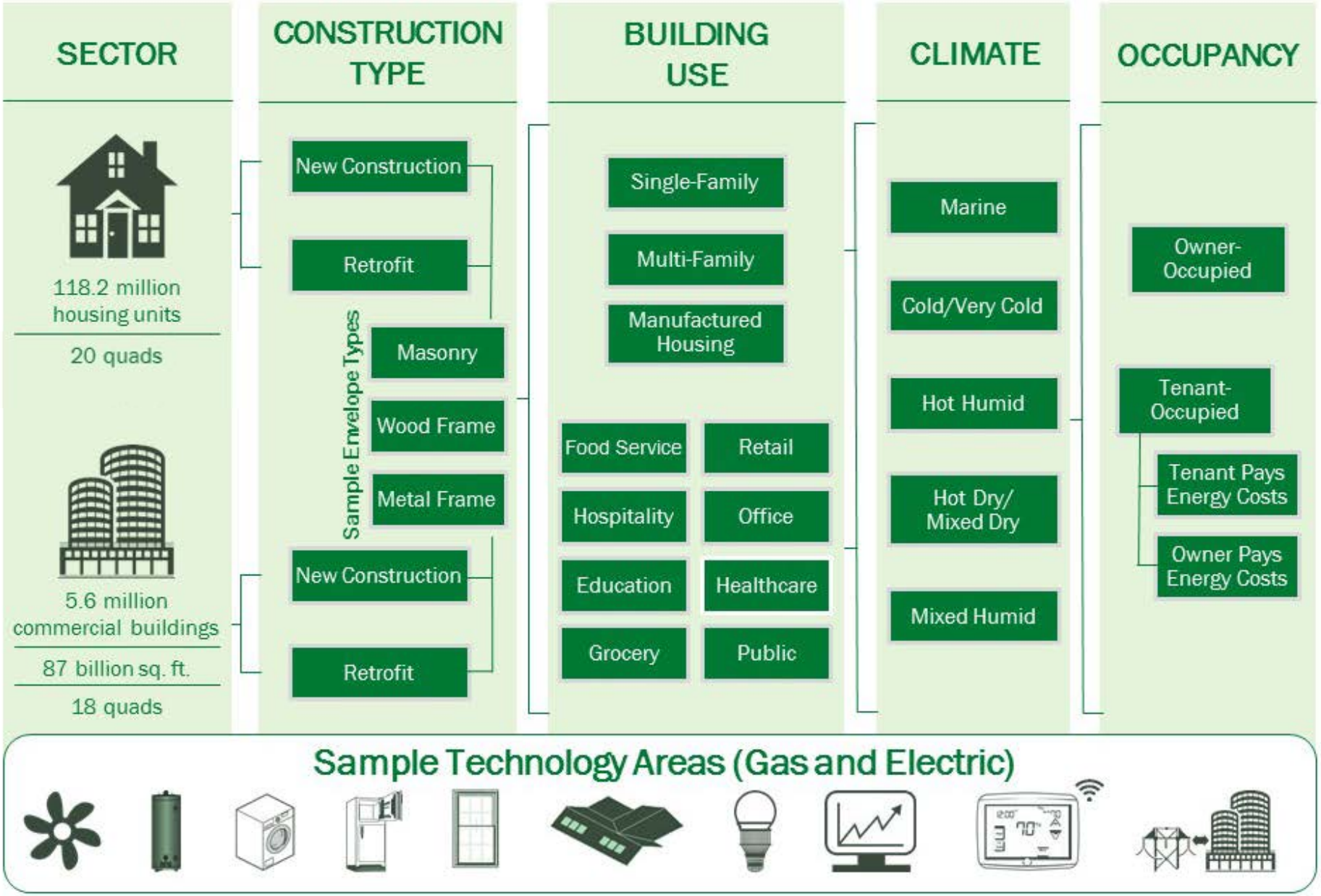
Buildings Energy Use: 40% of U.S. total

Buildings Electricity Use: 74% of U.S. total

U.S. Building Energy Bill: $380 billion per year

Sources: US EIA, (Monthly Energy Review, Annual Energy Outlook 2017, Electric Power Monthly, Natural Gas Summary)

The Complexity of Energy Use in the Buildings Market



Market Barriers for Building Energy Efficiency

Diversity of Businesses serving the buildings sector, making scale difficult

Lack of Reliable Information on the energy use and efficiency of specific end uses

Performance Uncertainties and the perceived risk of making significant investments in energy efficiency

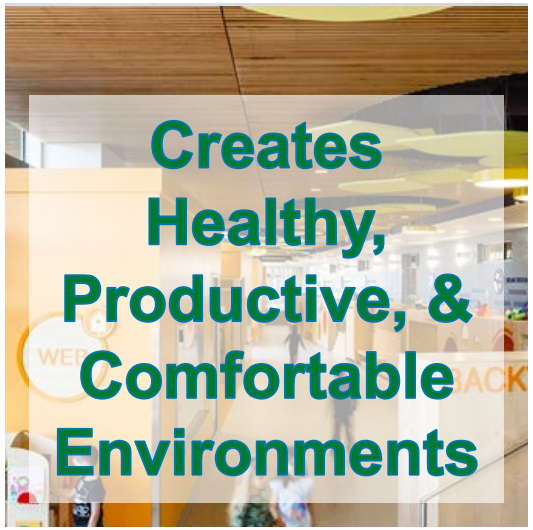
Lack of Mechanisms for establishing the market value of more energy-efficient properties

Split Incentives between owners and occupants of rental properties in both the residential and commercial sectors.

Photo Credit: Clean Energy Resource Team; dalioPhoto, Flickr Creative Commons

Multiple Tools, Multiple Benefits

DOE's Building Technologies Office



BTO's 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 energy use per square foot of U.S. buildings by **50%**

National Goals:

- By 2030, double energy productivity relative to 2010

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

BTO Goals Drive Substantial National Impacts

BTO Goal

Reduce energy use **30% per square foot by 2030**, and **50% per square foot long term.**

Cost Savings

- Meeting goals will **save consumers $460 billion** between 2016 and 2030. In 2030, savings will be **$65 billion**.

Energy Savings

- Meeting goals will **reduce cumulative energy consumption by nearly 38 quads** between 2016 and 2030. In 2030, savings will be over **5 quads**.

All numbers are relative to the 2015 AEO Reference Case Forecast.

DOE Research Has Saved Energy

Past

- $1,200 purchase
- $200/year to operate
- 18 cubic feet

- $8/year
- 60 Watts
- 1,000 hour life

- Single-pane
- High heat loss

Present

- $550 purchase
- $50/year to operate
- 22 cubic feet

- $2/year
- 15 Watts (or less)
- Up to 25,000 hours

- Double-pane & low-e
- Low heat loss
- 3x more efficient

Due to appliance standards alone, a typical household saves about **$320** per year off their energy bills today, and as people replace their appliances with newer models, they can expect to save about **$530 annually** by 2030.

BTO Peer Review

- Independent experts assess the progress and contributions of each project toward BTO's mission and goals.
- These assessments are used to enhance the management of existing efforts, gauge the effectiveness of projects, and design future programs.
- Save the date – we expect the next Peer Review in **May 2018**

2017 Peer Review Presentations and Report available on BTO website.

Participating BTO Funding Opportunity Awards

Scaling Up the Next Generation of Building Efficiency Packages	*Building Energy Efficiency Frontiers & Innovation Technologies (BENEFIT)*	*Building America Industry Partnerships for High Performance Housing Innovation*
CBI	**ET**	**RBI**

Emerging Technologies Program

Goal

Develop cost-effective technologies capable of reducing a building's energy use per square foot by **45%** by 2030, relative to 2010.

Strategy

- Use **Scout** to analyze building energy efficiency technology potential impacts
- **Fund R&D** through competitive solicitations and National Lab technical capabilities

Technology Areas

BTO Validates How Technologies Work Together

Experimentation and Development → **Testing, Scalability & Application, Integration** → Market

- 3rd party, objective evaluation
- Real-world conditions: dynamic loads and human interactions

Why?

- Answer critical R&D questions (feedback loop).
- Document interactions with other existing building systems.
- Share energy and cost savings information with owner/operators.
- Collect, store and share building performance data (utilities, scientists, manufacturers, architects/engineers).

This also guides future R&D opportunities to overcome technical hurdles encountered in the field.

Commercial Buildings Integration Program

Goal

By 2025, market leaders will achieve in their buildings an improvement in energy consumption per square foot of at least 35% relative to typical commercial buildings in 2010.

Strategy

- Conduct whole-building and systems integration R&D
- Validate energy performance of targeted, high-impact technologies (HITs)
- Develop modeling and analysis tools that provide opportunities for identifying pathways for energy performance
- Support research needed for zero energy buildings

Residential Buildings Integration Program

Goal

By 2025, reduce the energy used for space conditioning and water heating in single-family homes by 40% from 2010 levels.

Strategy

- Conduct systems integration R&D for new and existing homes
- Validate energy performance of targeted building technologies and improvements in real-world homes
- Research, validate, and facilitate learning and leadership opportunities that result in new strategies and practices in residential energy efficiency
- Support research needed for zero energy buildings

Building AMERICA
U.S. Department of Energy

HOME PERFORMANCE WITH ENERGY STAR

ZERO
ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

Better Buildings
U.S. DEPARTMENT OF ENERGY

Grid-Interactive Efficient Buildings (GEB)

- A significant portion of BTO's current activities contribute to a more efficient and interactive electric grid, all united around the concept of "grid-interactive efficient buildings"
- These activities support DOE's larger Grid Modernization Initiative, which works across DOE to create the grid of the future

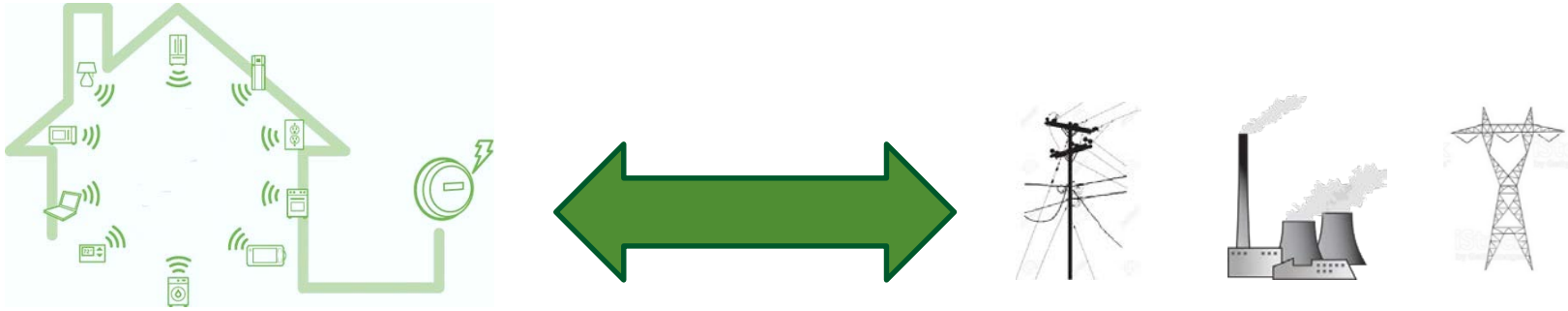
DOE Grid Modernization Initiative: Characteristics of a Modern Grid

A modern grid must have:

- Greater RESILIENCE to hazards of all types
- Improved RELIABILITY for everyday operations
- Enhanced SECURITY from an increasing and evolving number of threats
- Additional AFFORDABILITY to maintain our economic prosperity
- Superior FLEXIBILITY to respond to the variability and uncertainty of conditions at one or more timescales, including a range of energy futures
- Increased SUSTAINABILITY through energy-efficient and renewable resources.

Coming Soon: BTO's GEB Strategy

BTO is currently developing a new GEB strategy that will outline specific technical challenges and goals related to building-grid interaction.



GEB Technical Areas

- Modeling and Analysis to Support Planning
- Buildings-to-Grid Interoperability and Security
- Grid-Responsive Building Controls
- Sensing, Measurement, and Data Analytics
- Flexible and Resilient Building Technologies

Setting Up for Success

- **Why does BTO utilize FOAs?**
  - Contribute to meeting our overarching goal in commercializing energy efficient technologies for buildings
  - Improve agility – R&D can produce unexpected results or for unexpected applications
  - Expand our network of talented researchers to solve critical challenges facing building energy efficiency

- **Successful projects…**
  - Read and follow the rules (schedules, budgets, paperwork)
  - Communicate bad news early – and good news often!
  - Leverage BTO's resources – embrace the public/private partnership
  - Connect early to potential private sector investors and partners – plan for commercial success
  - Identify challenges encountered that could be solved by future R&D

Today's Agenda

8:30-9:00	Keynote Address: Welcome to BTO	David Nemtzow
9:00-9:50	Project Presentations	Envelope
9:50-10:20	Break	
10:20-11:00	Scout & ResStock	Jared Langevin (LBNL); Eric Wilson (NREL)
11:00-11:50	Project Presentations	Sensors and Controls
11:50-12:30	Customer Discovery & Validation & Market Fit	Edmund Pendleton (UMD)
12:30-1:30	Lunch	
1:30-2:30	Project Presentations	Heating and Cooling
2:30-2:50	Fast Pitches – Federal and State Agencies	Tim Tetreault (ESTCP), Amy Bourne (GSA)
2:50-3:15	Break	
3:15-4:15	Project Presentations	Whole Building Integrated Solutions
4:15-4:45	Building Technologies and the Enernet	Brian Patterson (Emerge Alliance(
4:45-5:00	Closing Remarks	Karma Sawyer, Jason Hartke, David Lee

Today's Goals

Education

- Find out about BTO and the opportunities across programs
- Better understand perspectives of new stakeholders
- Learn about different areas of building energy efficiency

Community Building

- Foster inter-program coordination
- Create community of performers

Networking

- Facilitate connections between and across project teams and key stakeholders

Questions?