U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

DOE Building Technologies Office Overview

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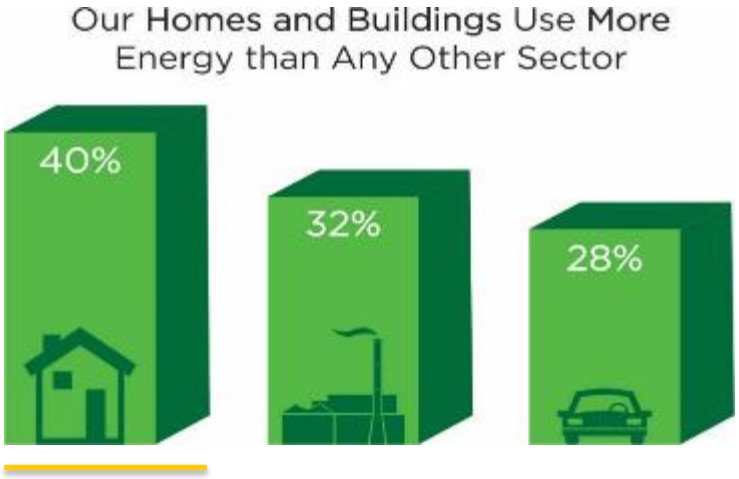
Our Homes and Buildings

There are **123 million buildings** in America.

More than 80% of them are **20 years old or older.**

They use **40%** of America's **energy** and **75%** of its electricity.

At least **20% of this energy is wasted away** in buildings.



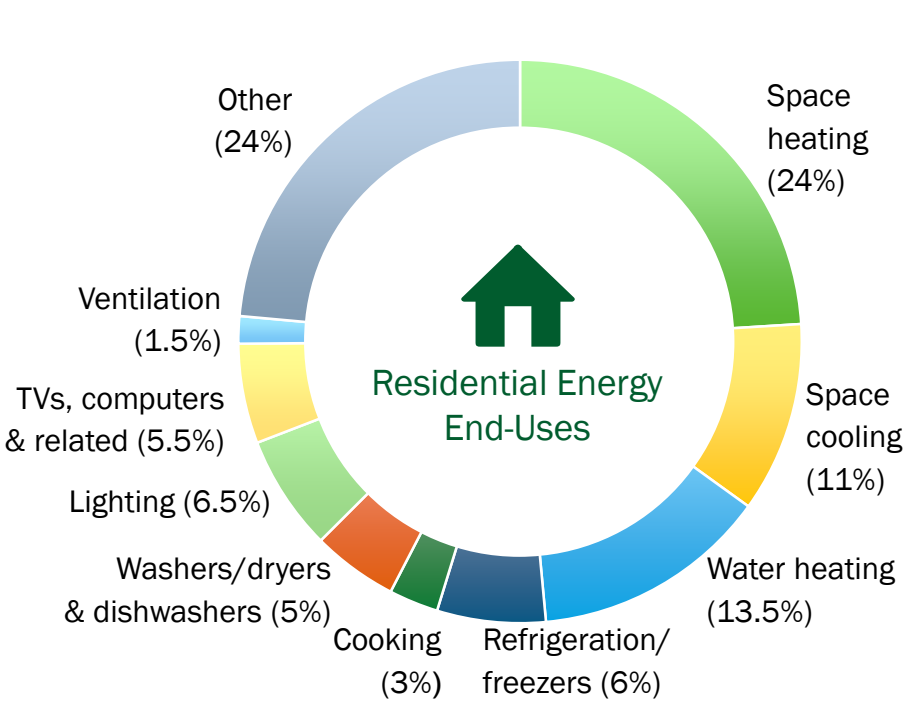
Buildings' **energy bill is ~$415 billion annually**, much of which is wasted

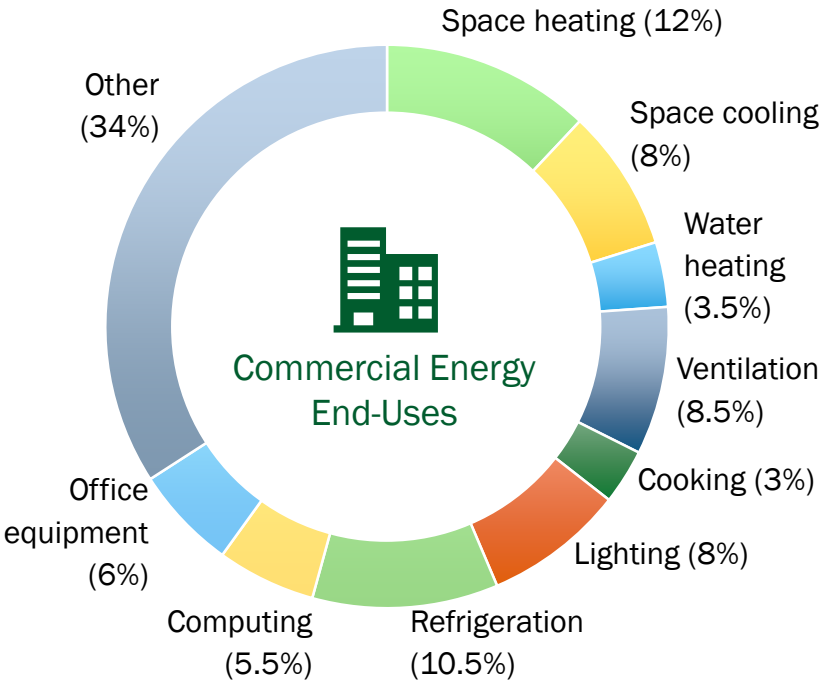
Buildings consume **up to 80% of peak electricity**, often the dirtiest and most expensive electricity utilities can make

Source: EIA Monthly Energy Review;; U.S. Energy Information Administration (CBECS 2012/RECS 2015); NAREIT Reits by the Numbers; Census Bureau Quarterly Retail E-Commerce Sales 4th Quarter 2016

Our Homes and Buildings

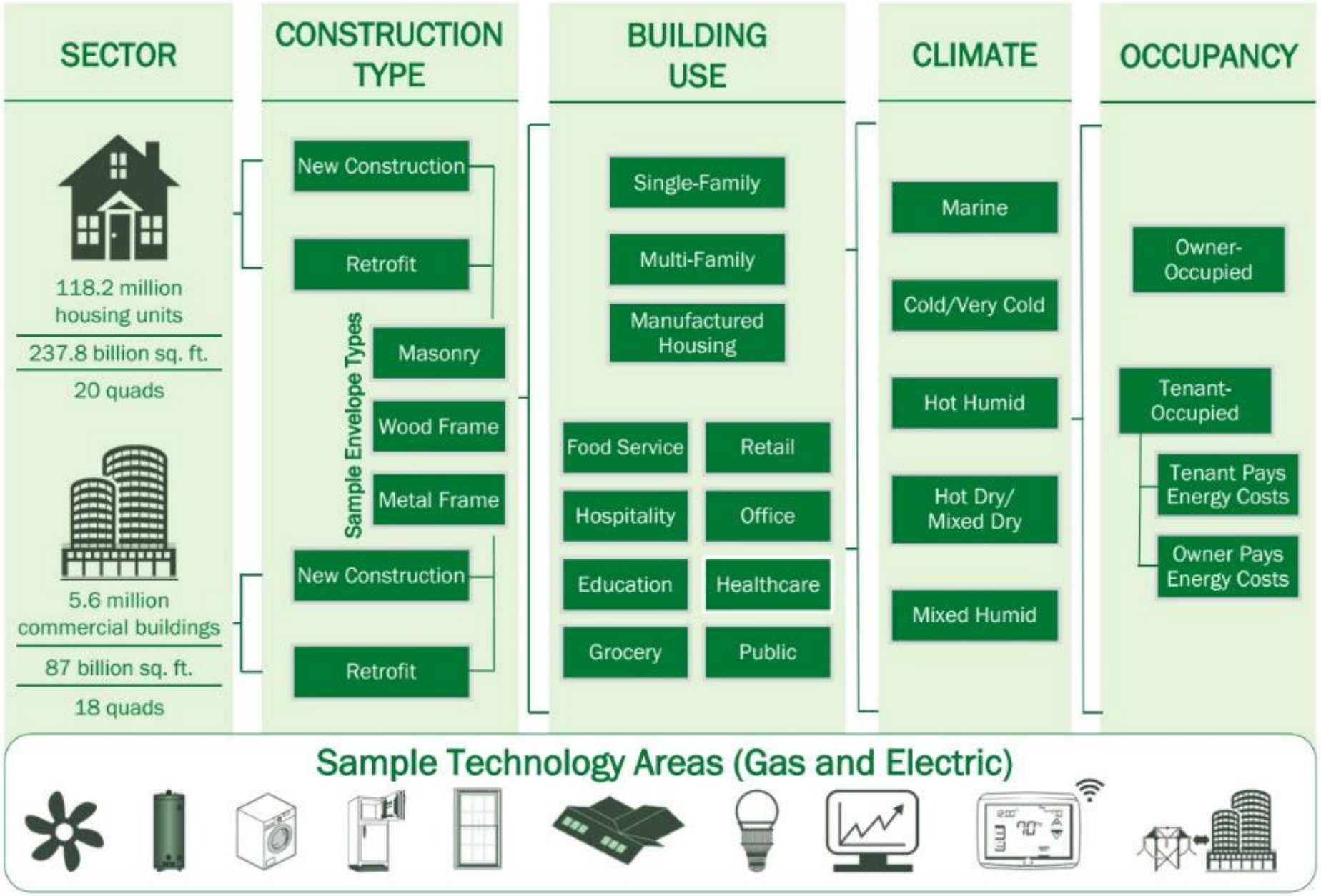
We consume energy in our homes and buildings in many ways, ranging from appliances, lighting, and mechanical equipment to personal electronics.





Source: U.S. Energy Information Administration AEO 2018

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

BTO's Approach - Five Programs

R&D (**Building Energy Research & Development Program**)
Pre-competitive, early-stage investment in next-gen technology

Integration (**Commercial and Residential Programs**)
Technology validation, field & lab testing, decision tools, market integration

Codes & Standards Program
Codes & standards development and technical analysis, standards promulgation

We lead R&D on technologies that make our homes and buildings more affordable and comfortable, and make America more sustainable, secure, and prosperous.

Our investments strengthen America's $68 billion building energy efficiency marketplace.

Without a catalyst like BTO, the housing industry would take 10 to 25 years to adopt new technologies and techniques.

Source: AEE Advanced Energy Now 2017 Market Report, Wolfe, Raymond M. (2016). Business Research and Development and Innovation: 2013 Detailed Statistical Tables.

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

Future

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.

Commercial Buildings Integration

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.

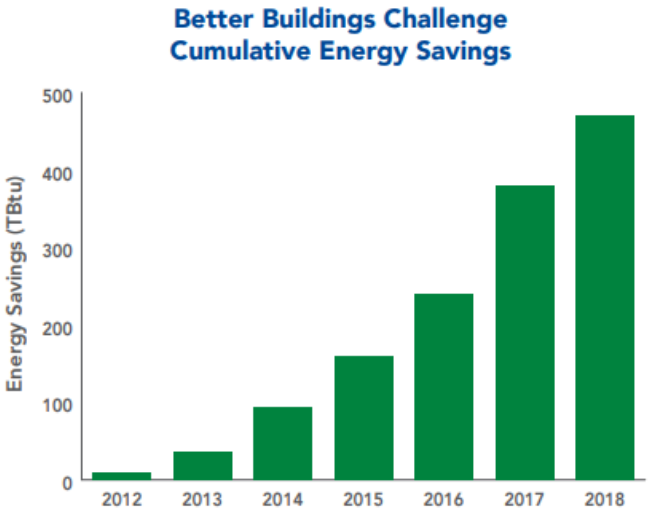
Strategy

- 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

Sub-Programs Wireless Metering Challenge, Analysis Tools, Design & Decision Support Guides, Workforce Development & Training, Zero Energy Buildings

Better Buildings Initiative

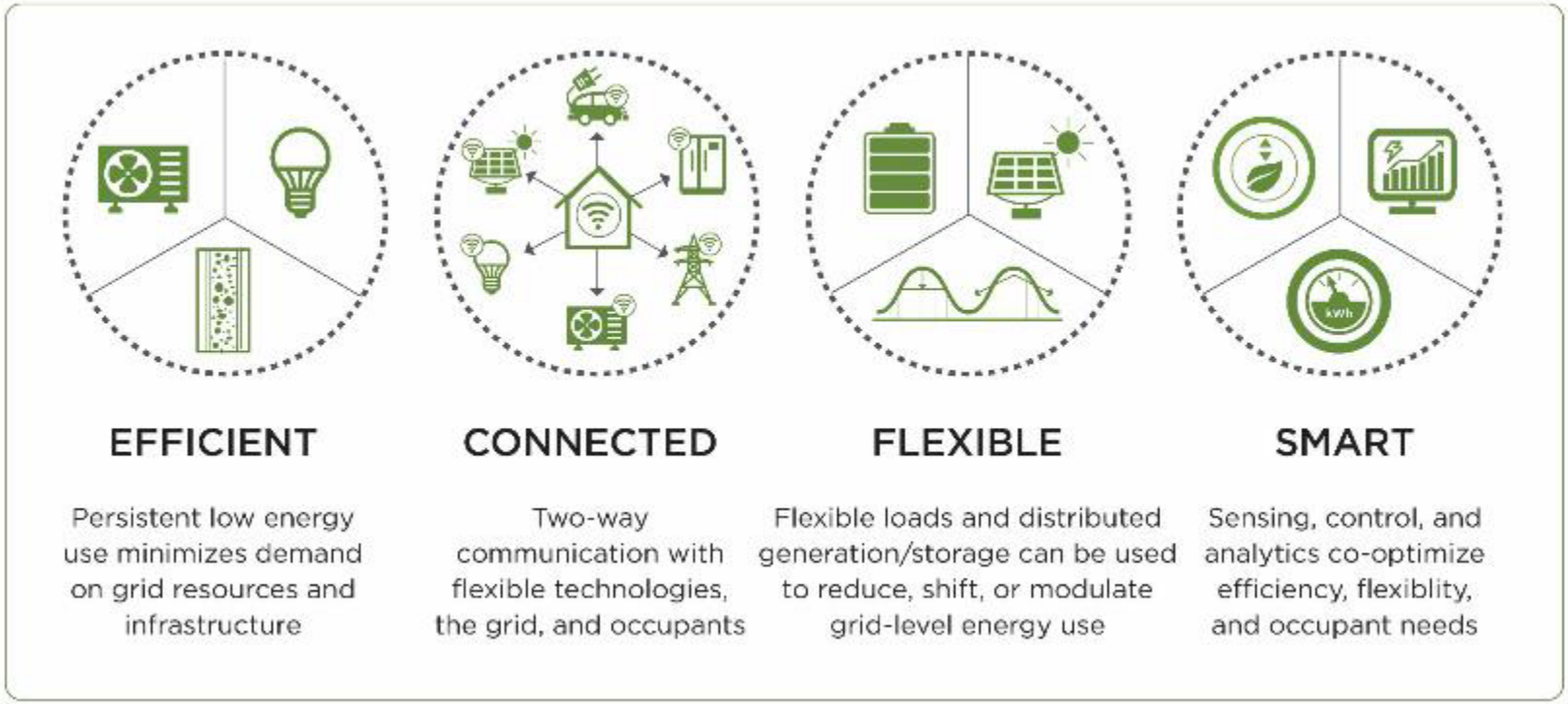
The goal of Better Buildings is to dramatically improve the energy efficiency in the commercial, public, industrial and residential sectors by at least 20% over the next decade.



- There are more than **900 organizations** that make up the Better Buildings Initiative, including **17 Federal Agencies** and **8 National Laboratories**
- Key Program Results:
  - Partners 900+
  - Square Feet 12.5 billion;
  - Industrial Facilities 3,200;
  - Energy Saved (QBtu) 1.38;
  - Dollars Saved $8.4 billion
- More than 360 partners have joined the Better Buildings Challenge. Reported 470 trillion Btus in energy savings and $3.8 billion in cost savings.

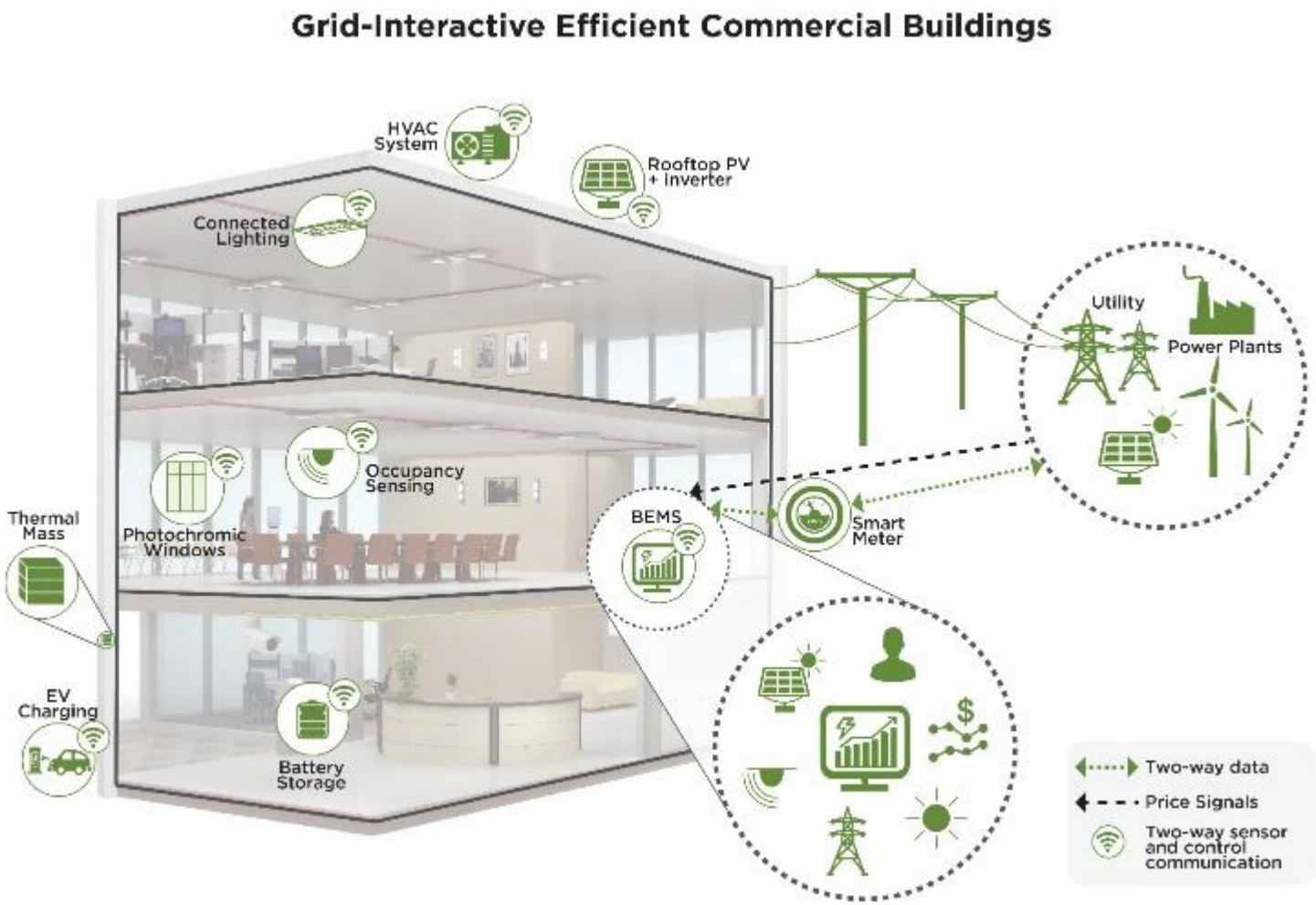
Grid-interactive Efficient Buildings (GEB)

A new, holistic approach that reaches beyond a building's walls and into the grid to maximize the energy efficiency and buildings and the grid simultaneously



www.energy.gov/eere/buildings/geb

A Grid-interactive and Efficient Office



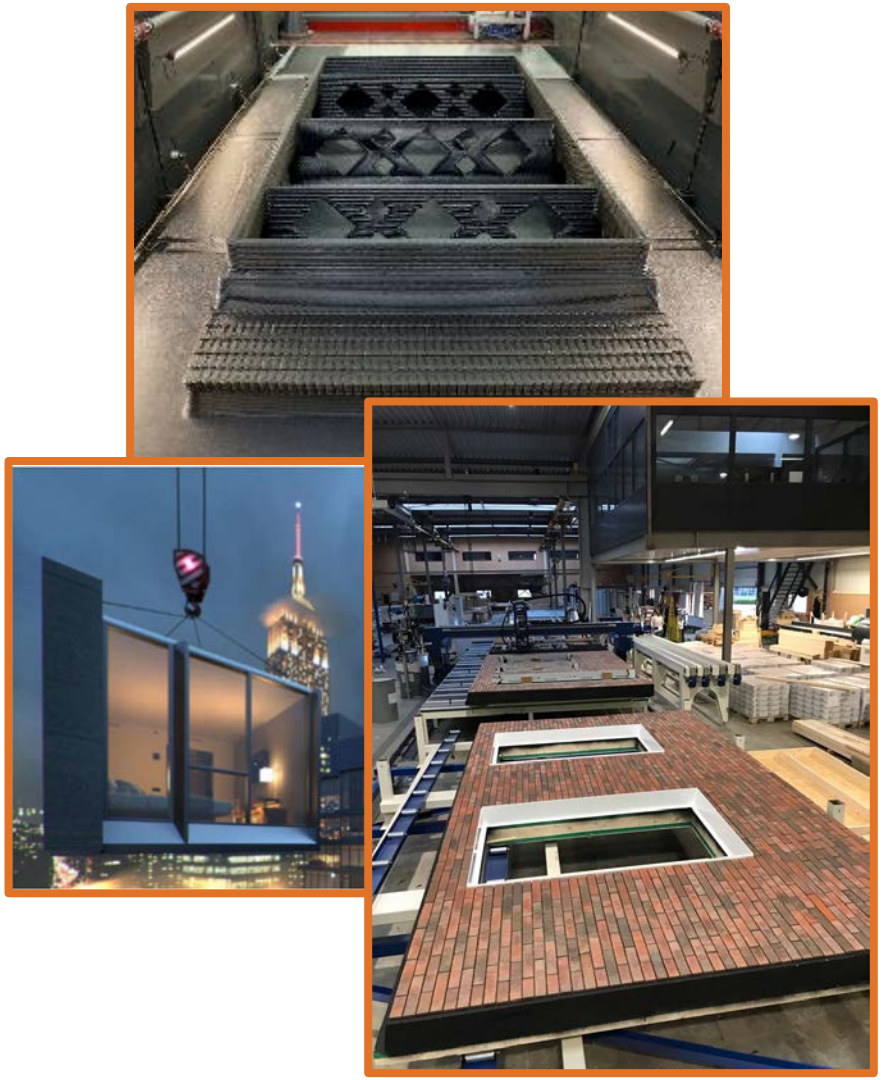
Advanced Building Construction

Next-gen technologies and practices that improve building energy performance without *increasing costs of building construction, including innovations in design, component fabrication, onsite assembly, and construction process integration*

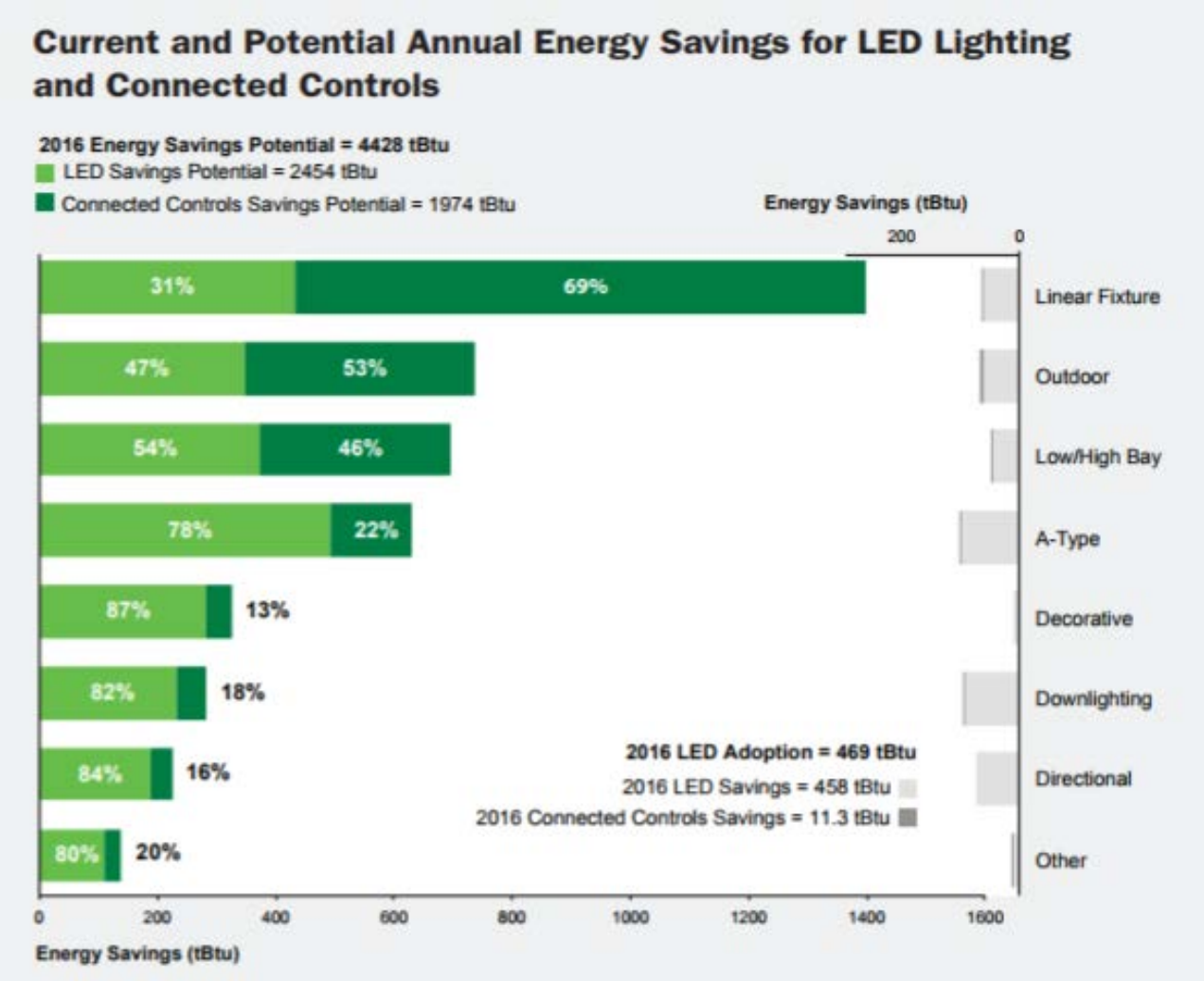
- ✓ **New Construction & Retrofit applications**
- ✓ **Residential & Commercial**
- ✓ **Lean Construction & Remodeling processes:**
  - Shorter construction schedules
  - Less production uncertainty
  - Construction cost savings through component standardization & automation
  - Improved labor productivity
  - Fewer installation errors
- ✓ **Off-site production technologies**

ABC Initiative @ BTO

- An integrated strategy across BTO
- Early-stage R&D focused on whole building savings, with requisite advancements in building envelope, HVAC, DHW
- Seeks transformative technology packages, not incremental improvements; and reduce risk and accelerate tech to market
- Seeks regional/local solutions that account for differences in building stock, workforce, and other factors
- “Not a project, but an approach”



LEDs Make Progress, Great Opportunity Remains



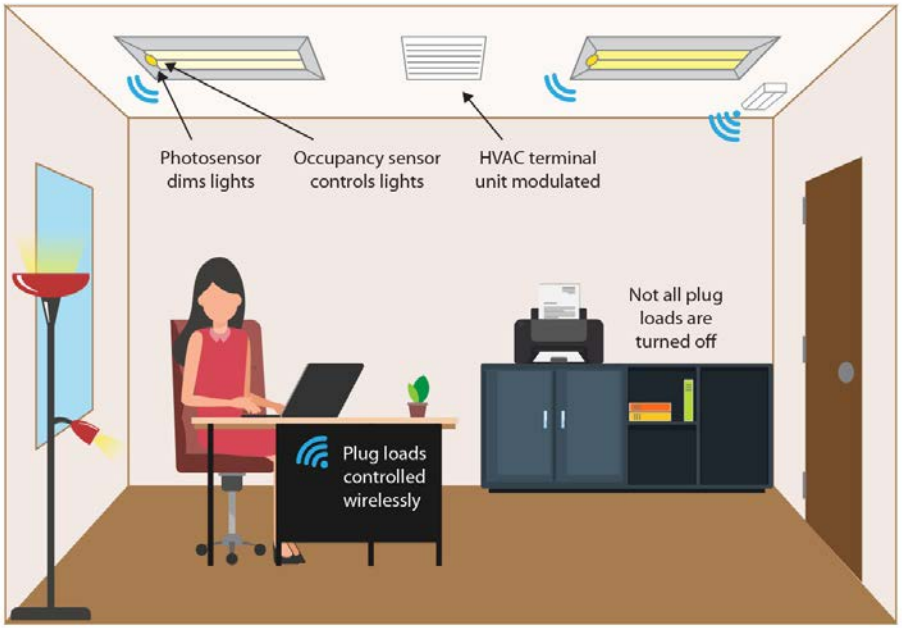
In 2016, LED products delivered 469 trillion Btus in source energy savings, or about **$4.7 billion** in reduced energy bills. Realizing the benefit of connected lighting controls will drive further savings.

Source: Adoption of Light-Emitting Diodes in Common Lighting Applications 2017
https://energy.gov/sites/prod/files/2017/08/f35/led-adoption-jul2017_0.pdf

High Impact Technologies – Commercial Building Integration

Integrated Controls Package for High Performance Interior Retrofit

- Improve total building energy savings from 5-10% for lighting to 25-40%
- In line with DOE Beyond Widgets initiative: this program concept is a significant step toward moving to more holistic program offerings
  - program concept will be fully developed and tested with this pilot
- Nationwide impact could be roughly 760 TBtu energy savings
- Numerous non-energy benefits
  - Occupant satisfaction with retrofits
  - Indoor environmental quality, health
  - Better space utilization



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QUESTIONS? COMMENTS? LET'S WORK TOGETHER!

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