

U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

Grid-Interactive Efficient Buildings

Energy Efficiency & Grid Optimization

David Nemtzow

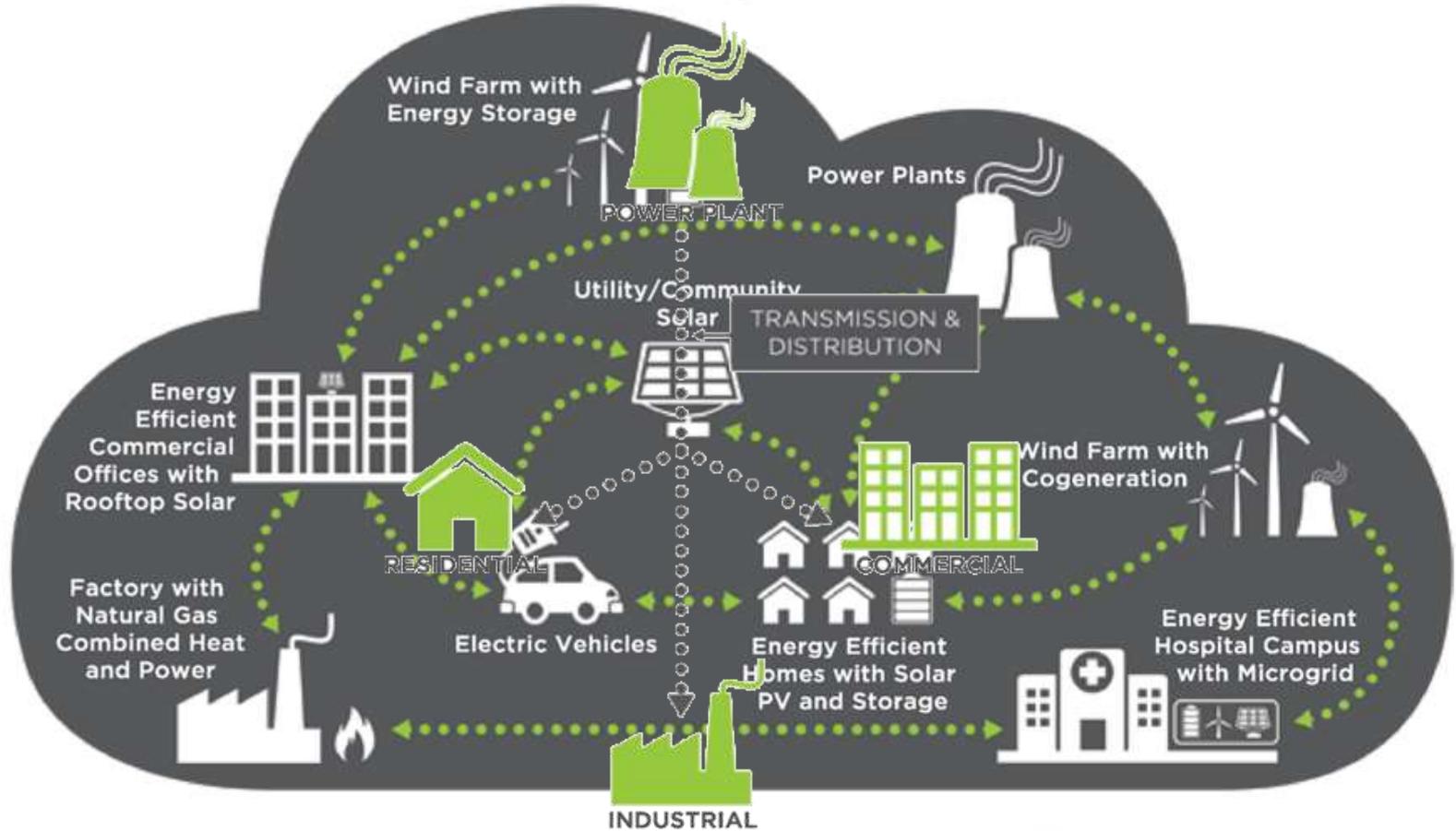
Director, Building Technologies Office

NASEO 2018 Annual Meeting, Detroit



Moving Towards the Grid of the Future

TODAY: ONE-WAY POWER SYSTEM
Central, One-Way Power System Flows



Source: Navigant

DOE/EERE/BTO
Buildings



Our Homes and Buildings

The U.S. building stock is comprised of more than 123 million commercial buildings and housing units totaling 324 billion square feet.

More than 80% of structures are at least 20 years old.



5.5 million commercial buildings totaling 87 billion square feet



118.2 million housing units totaling 237.4 billion square feet



37% of homes & buildings produce rental income for their owners



80 million Americans are invested in real estate through retirement and investment funds

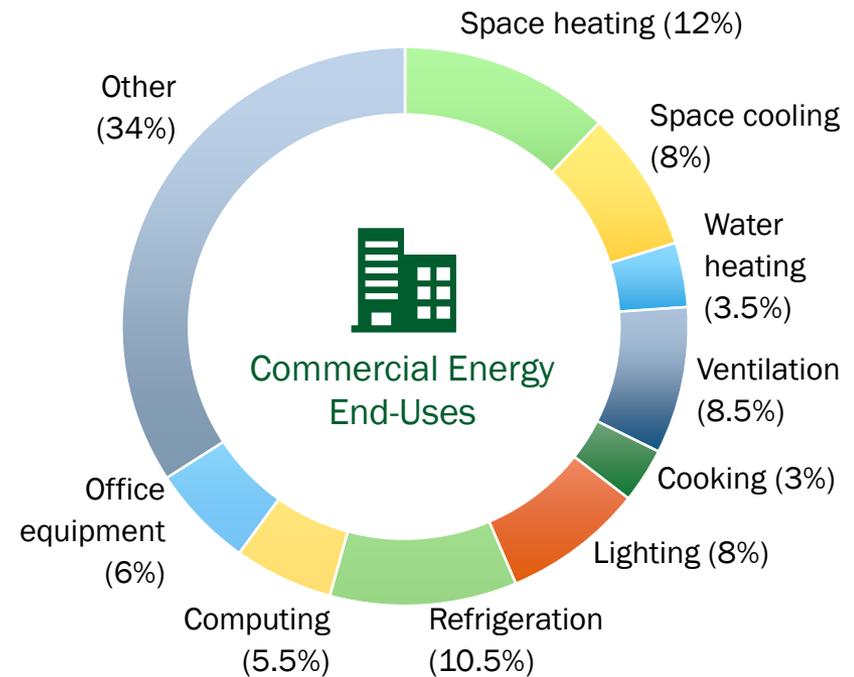
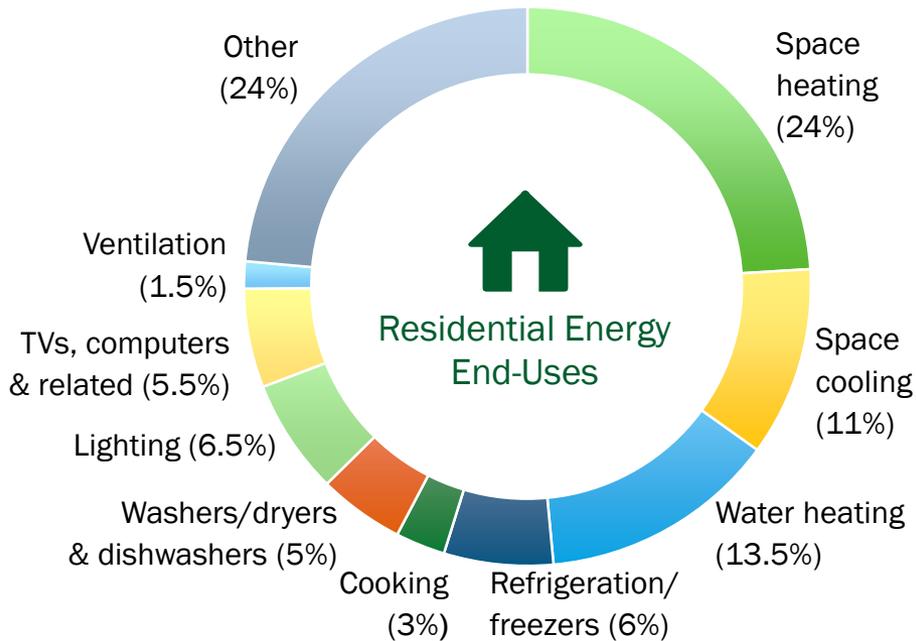


Buildings's energy bill is ~\$380 billion annually, much of which is wasted

Source: 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.

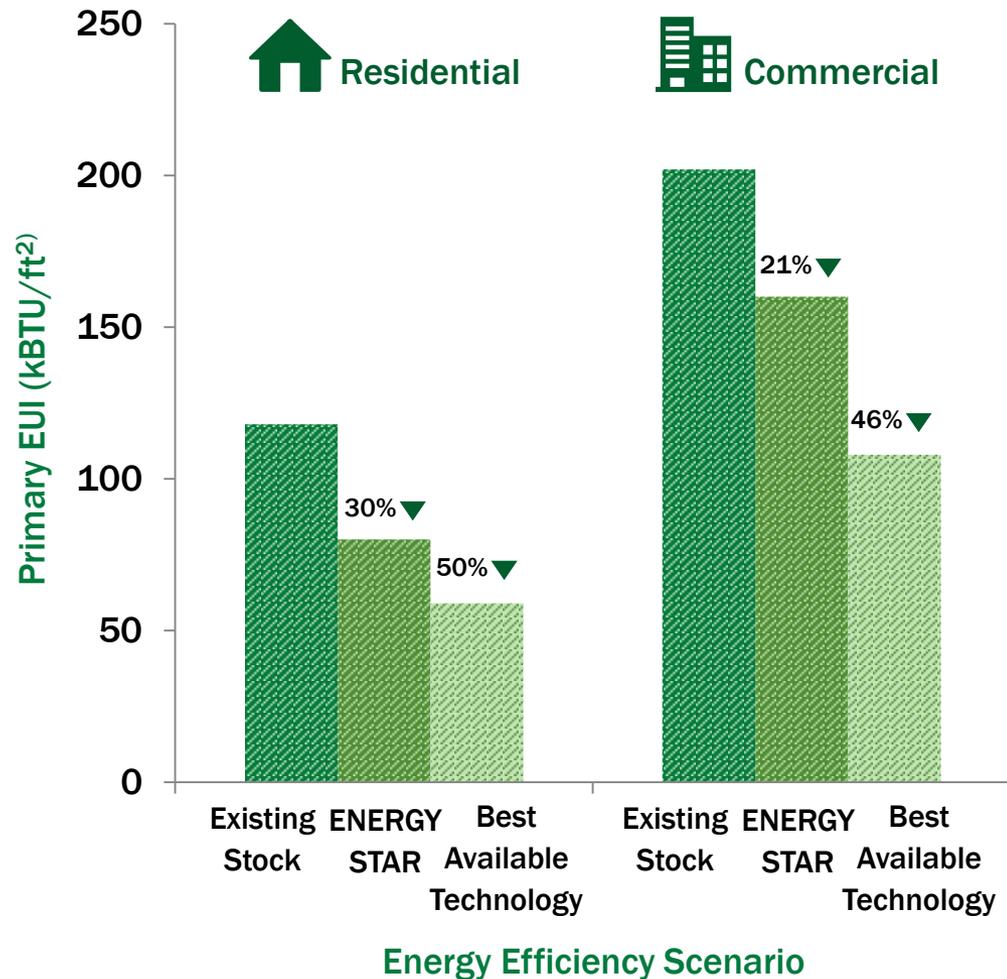


Source: U.S. Energy Information Administration AEO 2018

Energy Efficiency Opportunities

Using cost-effective ENERGY STAR technologies across our building stock could reduce energy consumption by 30% in homes and 21% in commercial buildings.

Using existing “best available technologies” could cut building energy usage in half.



Source: U.S. DOE Quadrennial Technology Review 2015

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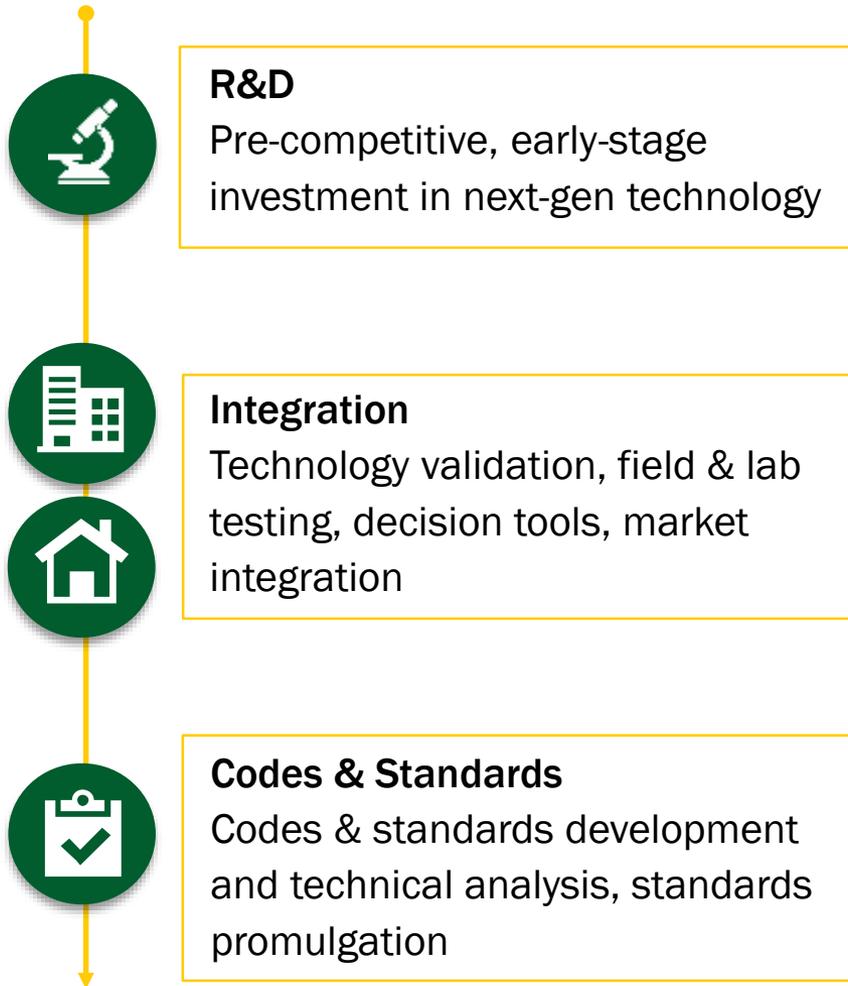
Energy Efficiency &
Renewable Energy

BTO is one of 11 program and technology offices within the Office of Energy Efficiency and Renewable Energy (EERE).

Our FY 2018 budget is \$220.7 million, or about 10% of EERE's \$2.3 billion budget. DOE's total spending is about \$34.5 billion.

ENERGY EFFICIENCY	RENEWABLE POWER	SUSTAINABLE TRANSPORTATION
Advanced Manufacturing	Geothermal Technologies	Bioenergy Technologies
Building Technologies	Solar Energy Technologies	Fuel Cell Technologies
Federal Energy Management	Wind Energy Technologies	Vehicle Technologies
Weatherization & Intergovernmental	Water Power Technologies	

Our Approach



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.

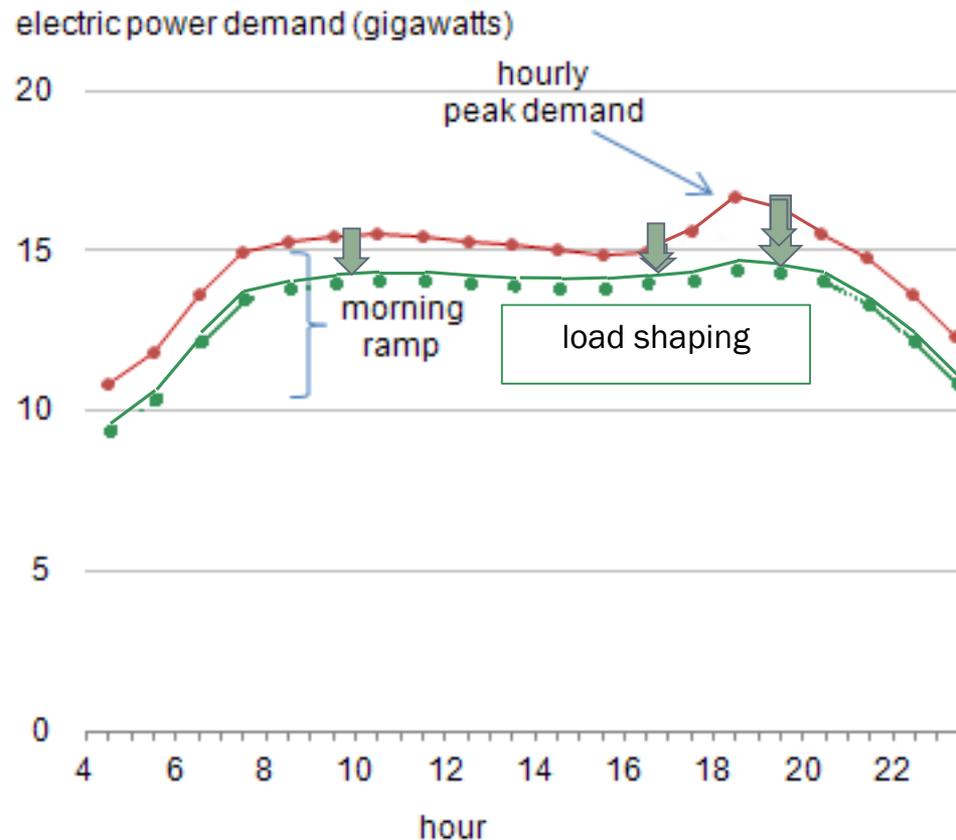
Source: AEE Advanced Energy Now 2017 Market Report



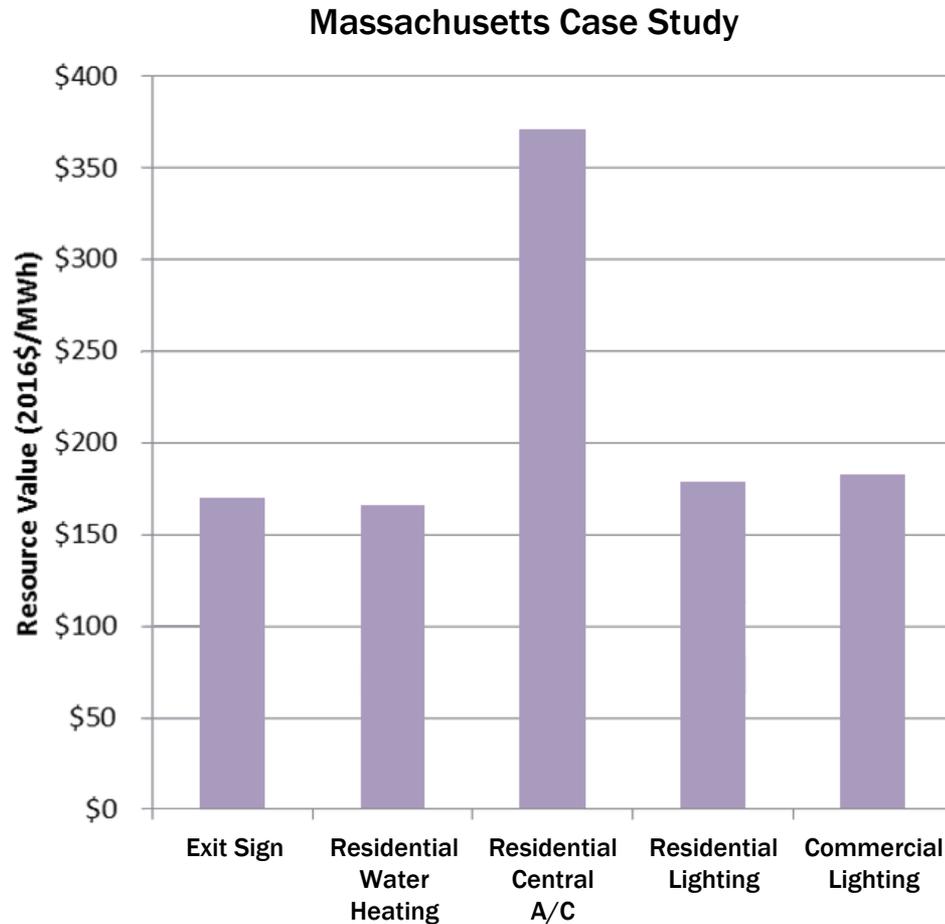
Energy Efficiency can be a Key Responsive Grid Resource

Energy efficiency projects remove energy loads from the grid, reducing the energy supply required.

- Defers or eliminates investments in new electric generation capacity or the T&D system; and
- Reduces peak demand and the strain placed on existing T&D infrastructure.



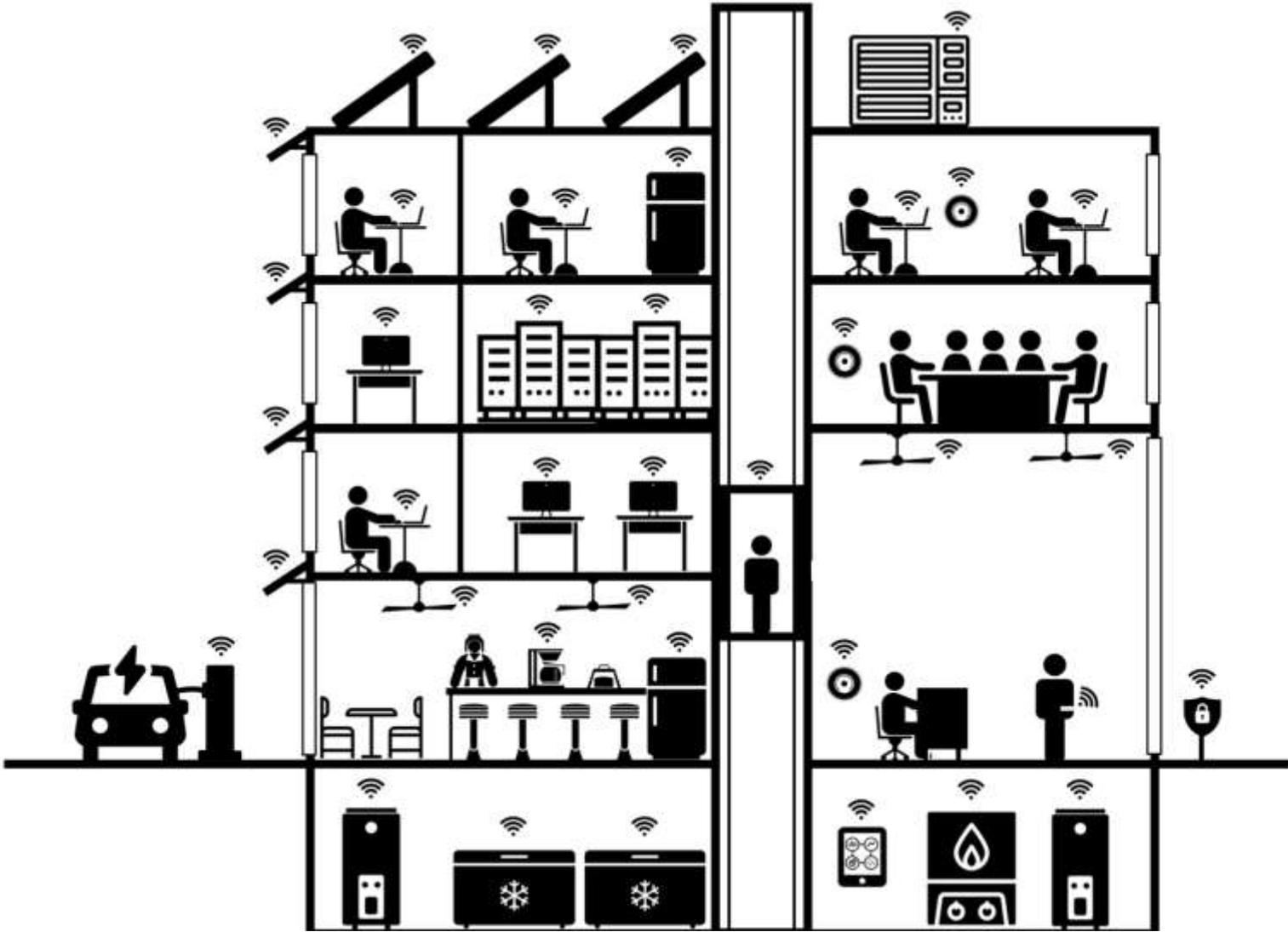
Not All Energy Efficiency is Equally Valuable



Time-varying value of energy efficiency savings by load shape
(reflects publicly available data only)

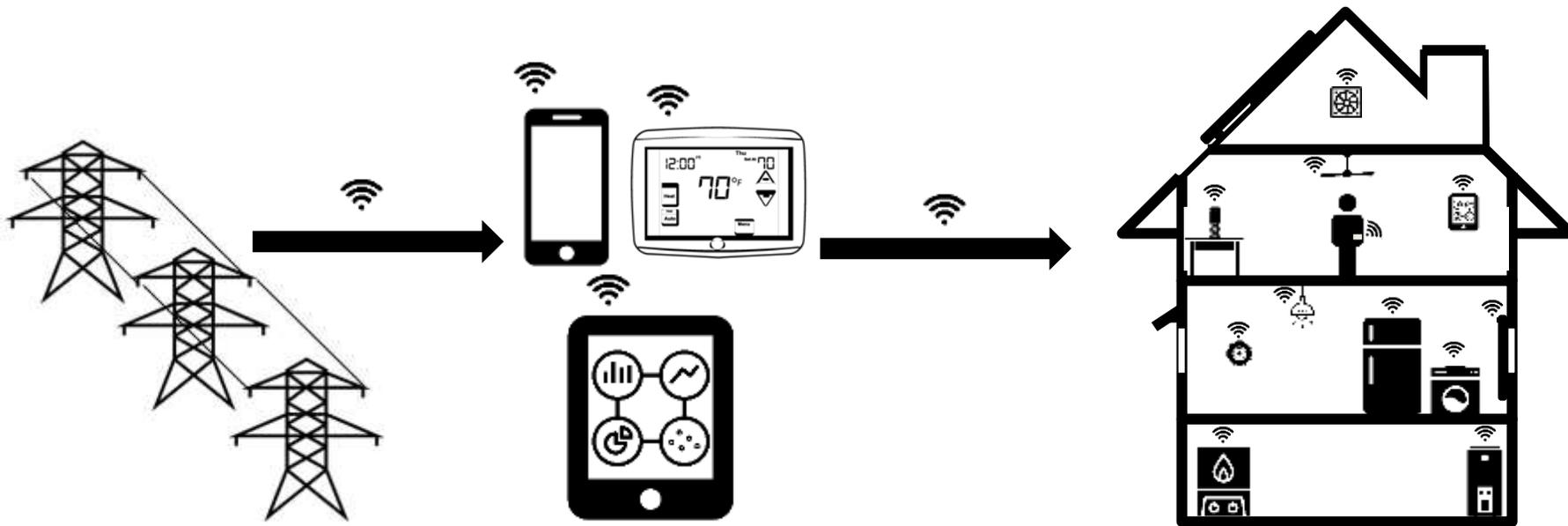
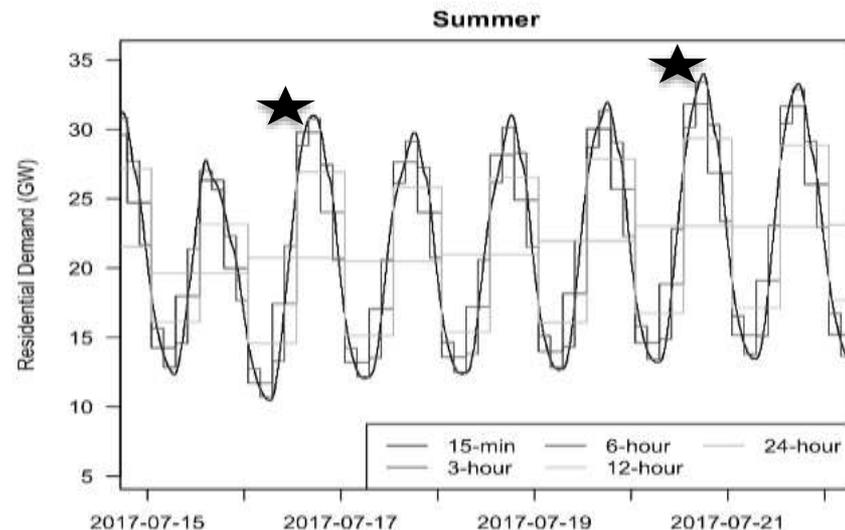
Source: *Time-Varying Value of Electric Energy Efficiency June 2017* N.Mims, T.Eckman & C.Goldman, LBNL, for BTO

The Modern – and thus Connected – Building



Grid-interactive Efficient Building Concept

1. Lowers total electricity demand
2. Flattens peak demand
3. Flexibly aligns with variable renewables (considers load net of renewables)



Questions & Challenges

- ❑ How do grid-interactive efficient buildings fit into larger grid modernization?
- ❑ What are the top priority benefits buildings provide the grid?
- ❑ How critical are better
 - Technologies? Analytics? Policies & programs?
- ❑ What are key barriers to adoption of advanced controls, technologies, practices?
 - Making the case? Complexity? Cybersecurity?
- ❑ Will efficiency get its “fair share”?
- ❑ How is this issue faring among State governments?
- ❑ Is this a “bridge too far” (at least today) for buildings, utilities, governments?

Come to the 3:45pm concurrent session!

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Questions? Comments? Let's work together!

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