U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Low-Cost Identification and Monitoring of Diverse MELs in Residential and Commercial Buildings with PowerBlade

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PowerBlade: MEL Monitoring and Identification

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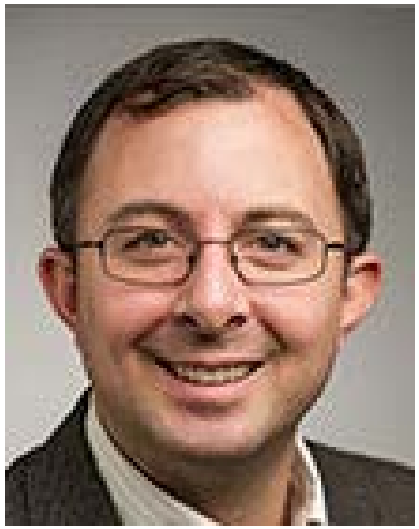

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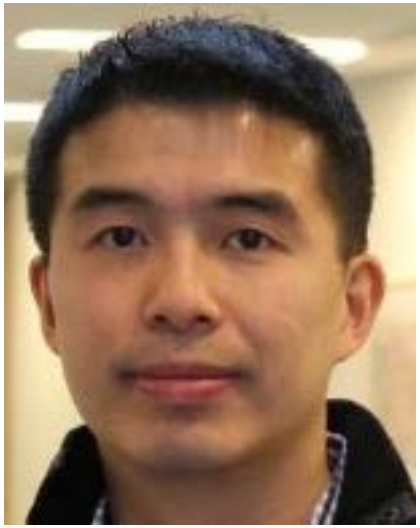
NREL



ZhiYoong Foo
CubeWorks

Why this team?

- Dutta is a leader in dense, large-scale, low-power sensor systems and networks.
- Brown is a leader in characterizing and addressing MEL energy use in buildings.
- Christensen is a leader in residential energy management systems and solutions.
- Foo is a leader in nano-power “smart dust” sensor technologies and components.

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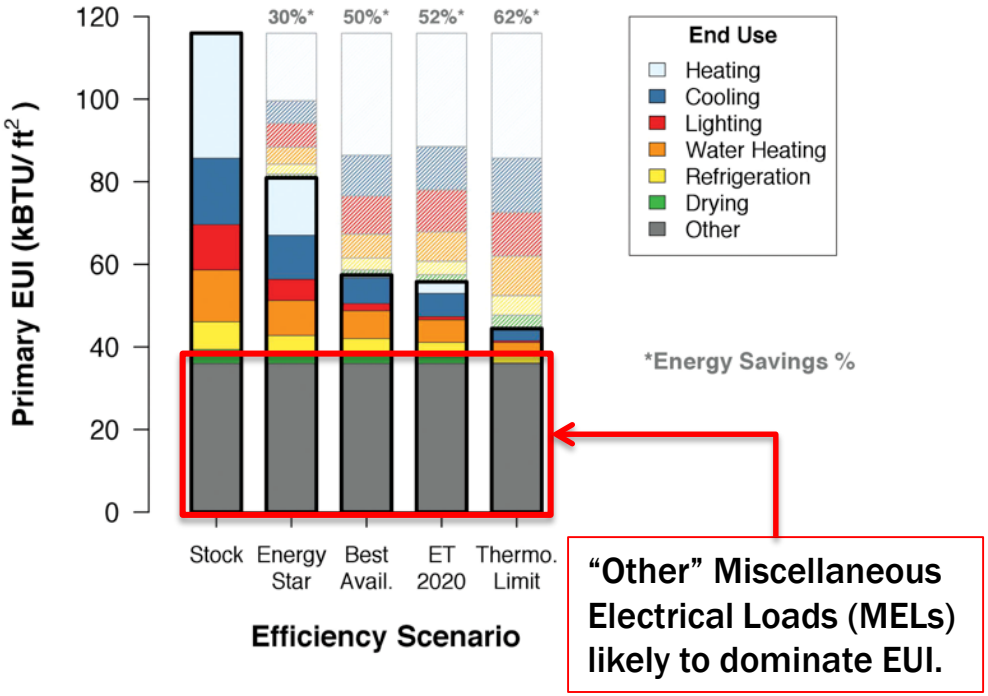


Source: U.S. Department of Energy, Quadrennial Technology Review (QTR): An Assessment of Energy Technologies and Research Opportunities, Sep. 2015.

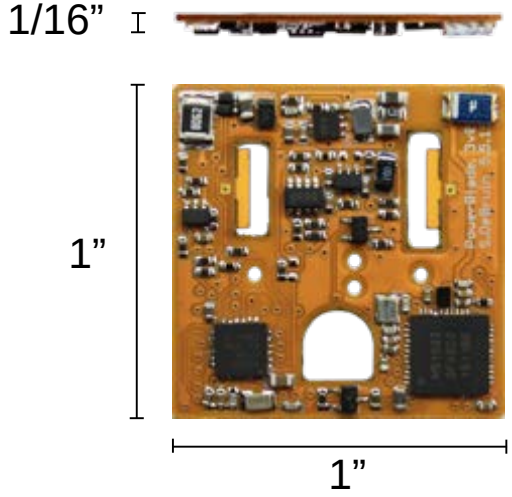
The Problem

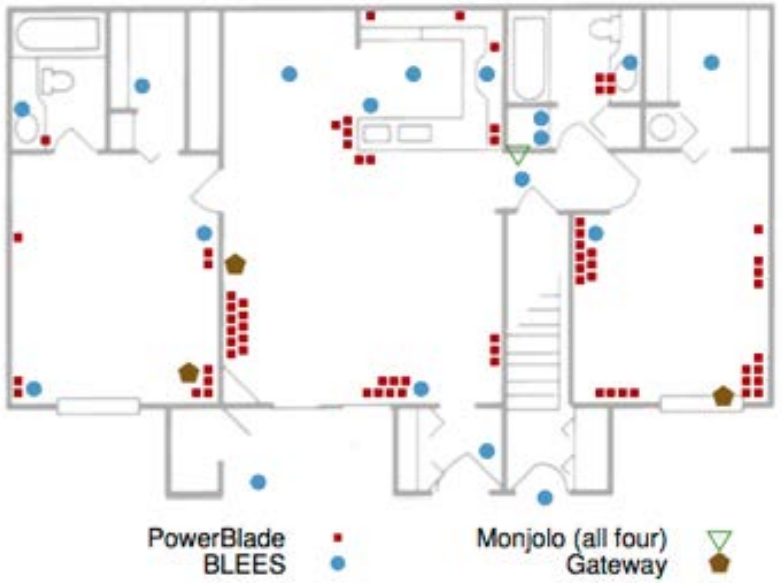
- **MELs are a large and growing fraction of end-load EUI**
- **MELs are fragmented so little visibility into them today**
- **Hard to identify "offenders" given wide mix of MELs**
- **No good solution to identify and characterize MEL energy use and usage patterns**

PowerBlade: MEL Monitoring and Identification

Our Solution

- A small and ubiquitous sensor
- Attaches to every MEL plug-load
- Identifies and monitors every MEL
- Uses advanced data analytics
- Enables unprecedented density



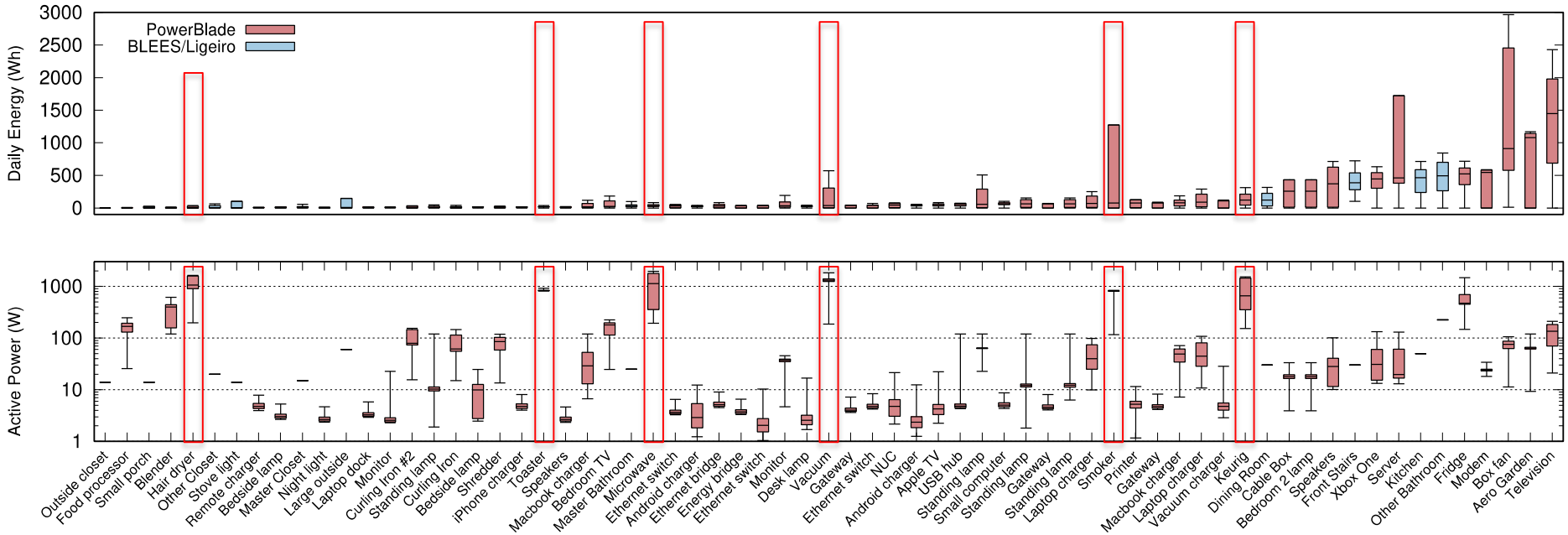


S. DeBruin, B. Ghena, Y.-S. Kuo, and P. Dutta. PowerBlade: A low-profile, true-power, plug-through energy meter, In *Proc. of the 13th ACM Conference on Embedded Networked Sensor Systems (SenSys'15)*, pp 17–29, 2015.

PowerBlade: MEL Monitoring and Identification

Advantage, Differentiation, and Impact

- **Small size and dense deployment enable novel analytics and new insights**
  - The six devices that that draw the most power (> 500 W)
  - Collectively account for a small fraction of total energy use (2.9%)



S. DeBruin, "Enabling Visibility Into Building Energy Consumption Through Novel Metering Designs and Methods," Ph.D. Dissertation, University of Michigan, 2017.

Thank You

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