

# Studying the “Other” Energy in Buildings: B90 Plug-in Device Study

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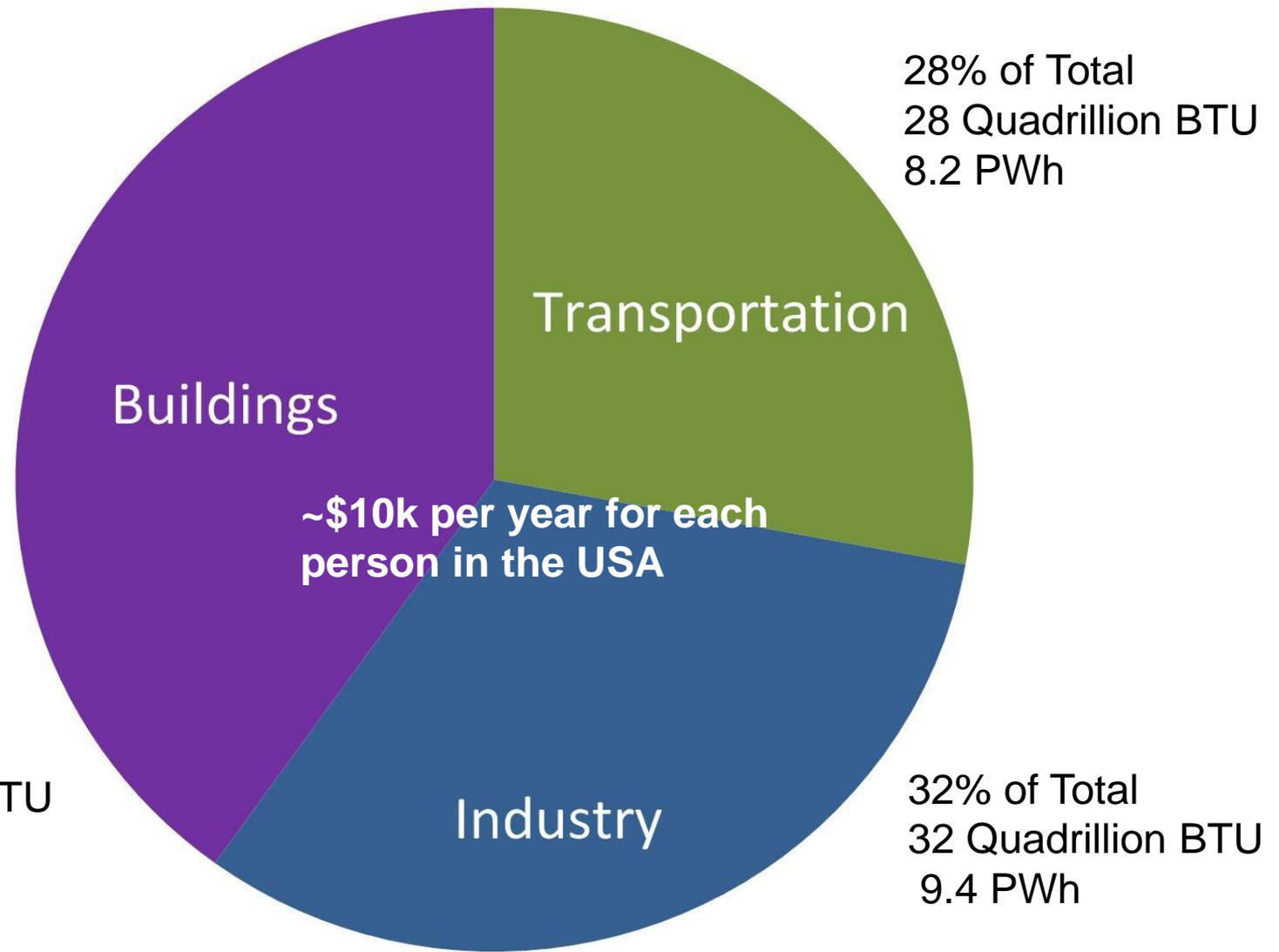
12 October 2010



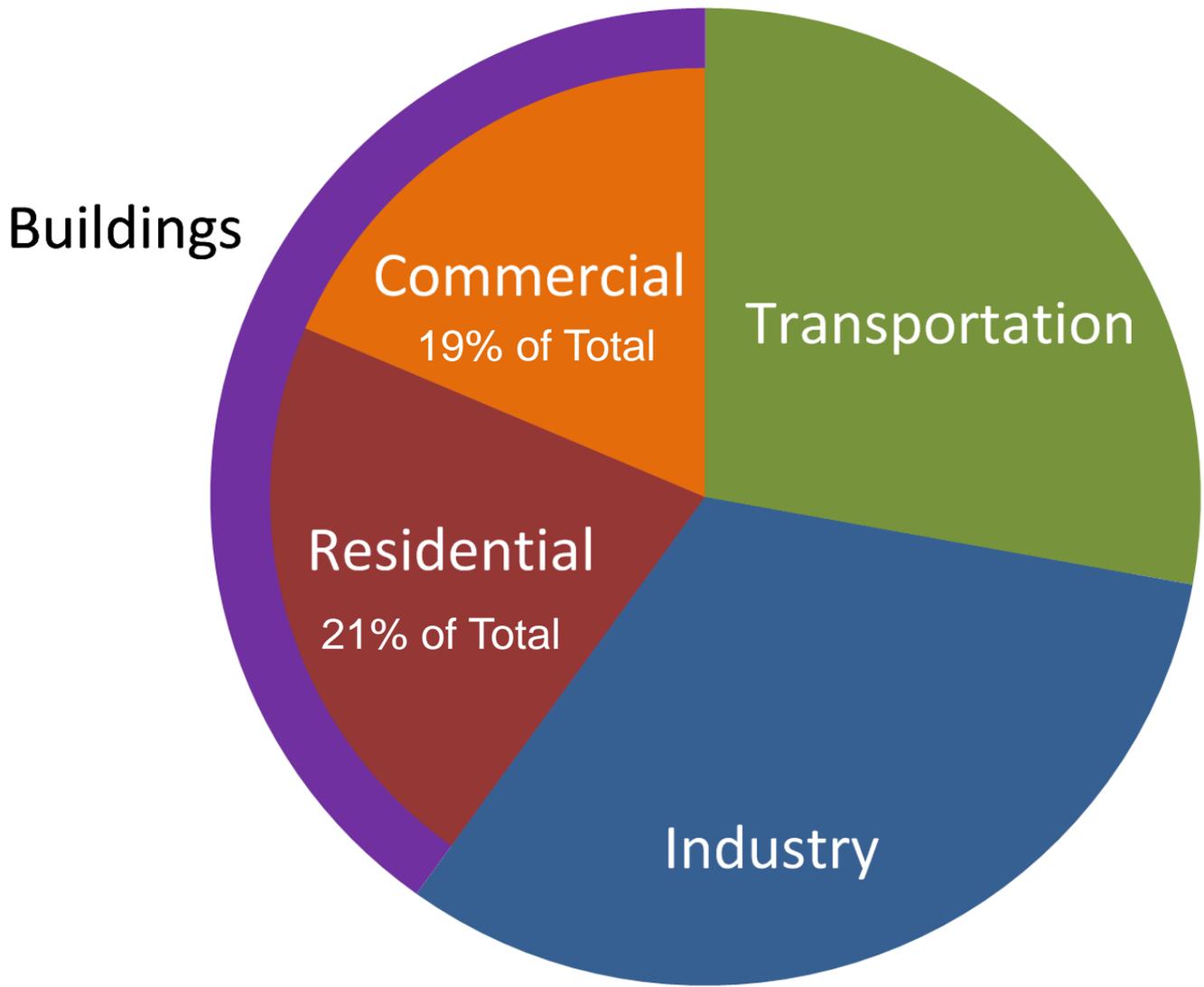
- Motivation & Background
- Status
- Preliminary Findings
- Research Plans

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# US Energy Consumption



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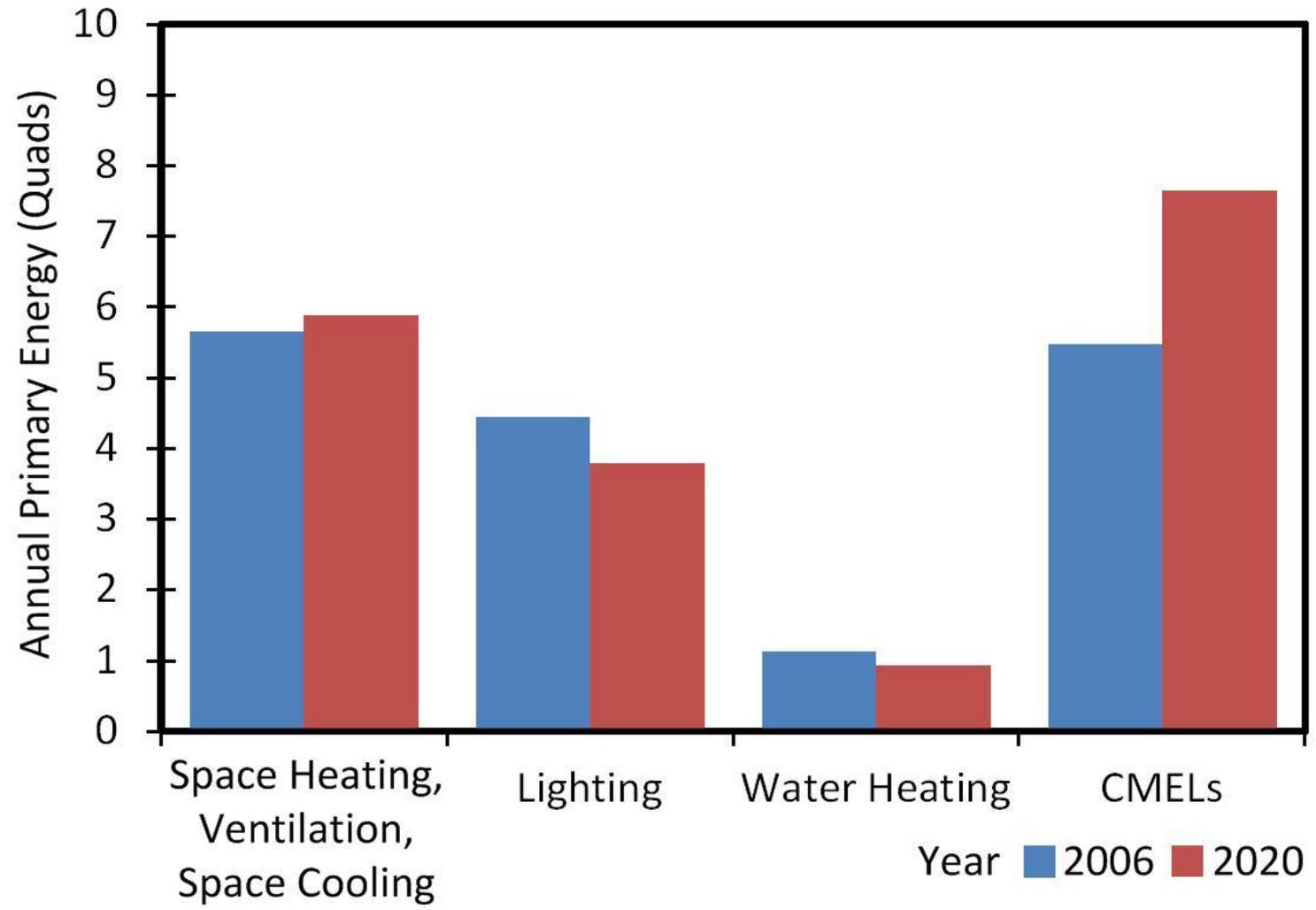


# Commercial Buildings



Plus office, warehouse, storage, public safety, public assembly, religious worship...

# Energy in Commercial Buildings

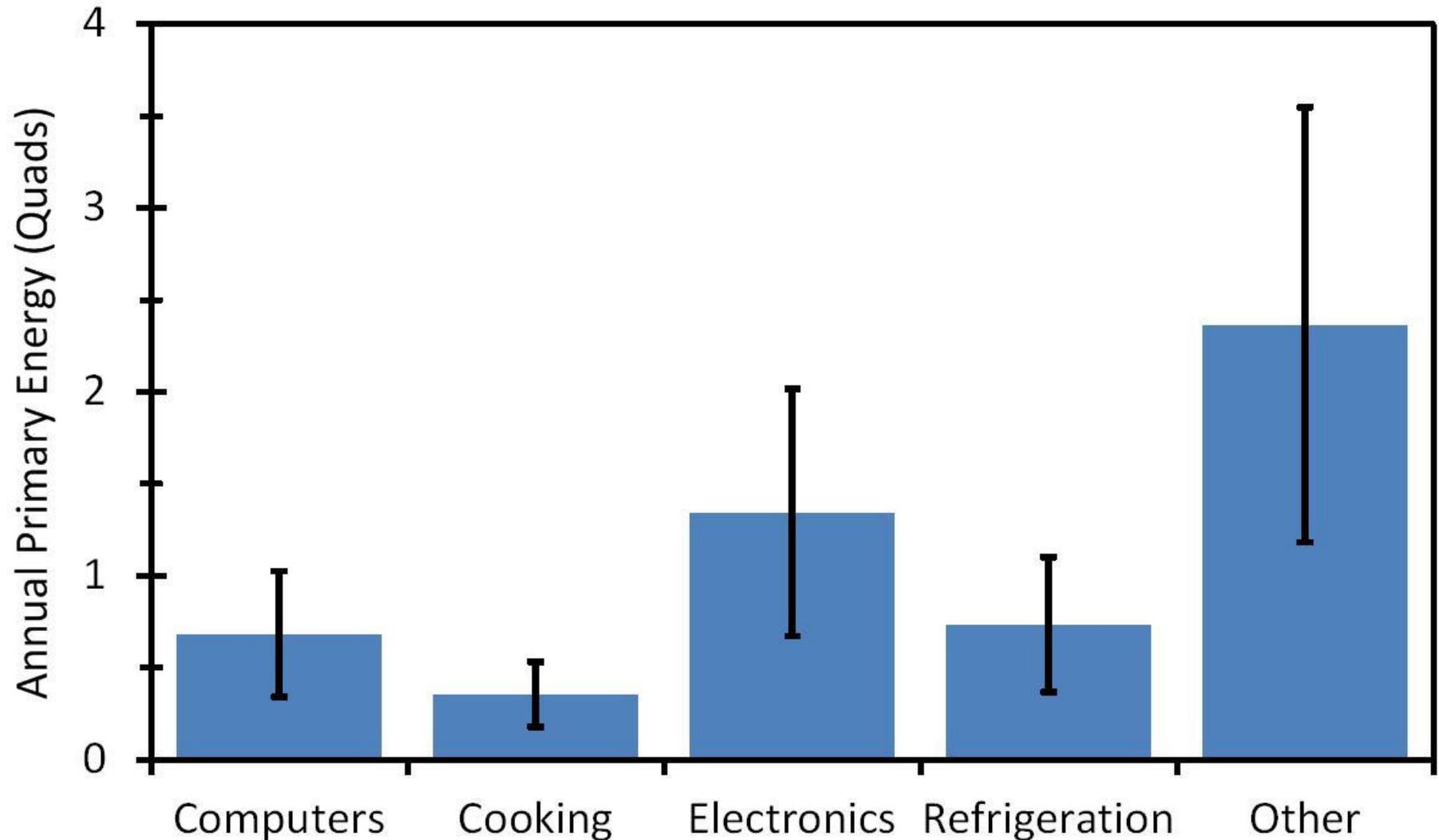


Source: EIA Commercial Building Energy Consumption Survey (CBECS) 2008

# Miscellaneous and Electronic Loads



# State of Knowledge



Source: EIA Commercial Building Energy Consumption Survey (CBECS) 2008, Uncertainty estimated

# DOE Commercial Building Partnerships

- Work with builders, owners, retrofitters to create highly efficient example buildings
- DOE labs provide technical guidance
- Move advanced tech into private design firms
- Buildings from across the sector
- Pilot studies carried out to build expertise

# Motivation Summary

- The MELs end-use is the fastest growing
- It's the least understood
- Requires new solutions
  - Data collection & monitoring
  - Energy mitigations

- Motivation & Background
- **Status**
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# Project Overview

- B90 is 90,000 square feet
- 450 regular occupants
- Project:
  - Catalog every CMEL in the building
  - Monitor a fraction of them



# LBNL – UCB Collaboration

- Energy monitoring via the ACme platform
- Hardware and networking work done on campus
  - LBNL supports where possible
- LBNL leads building level efforts
  - Inventory
  - Meter installation
  - Data analysis

# Inventory Protocol

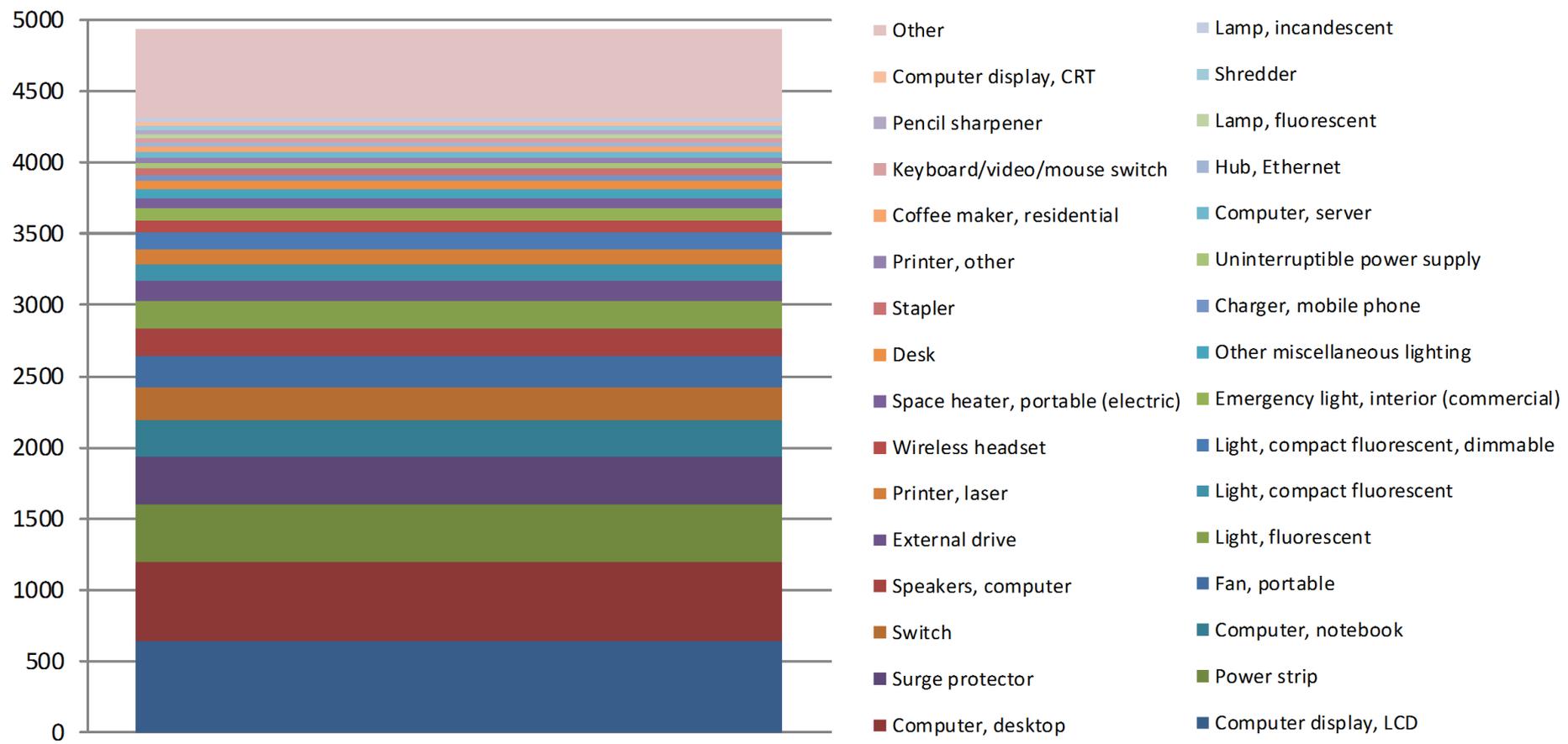
- Catalog every MEL in Building 90
  - About 5000 devices
  - 56 hours of effort for a two person team
- Taxonomy of CMELs
- Direct data entry via keyboard
- Tried: voice recognition, transcription of hand writing, video/audio with transcription

# Current Deployment

- 100 ACmes installed on 3<sup>rd</sup> floor of B90
- BLIP based network
- Power, apparent power, energy every 10s

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- **Preliminary Findings**
- Research Plans

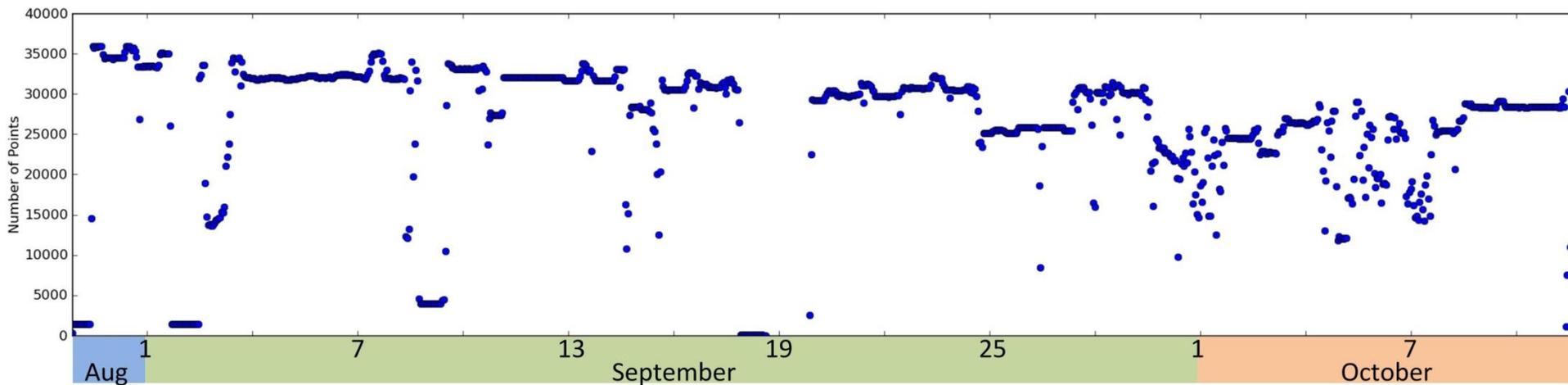
# Inventory



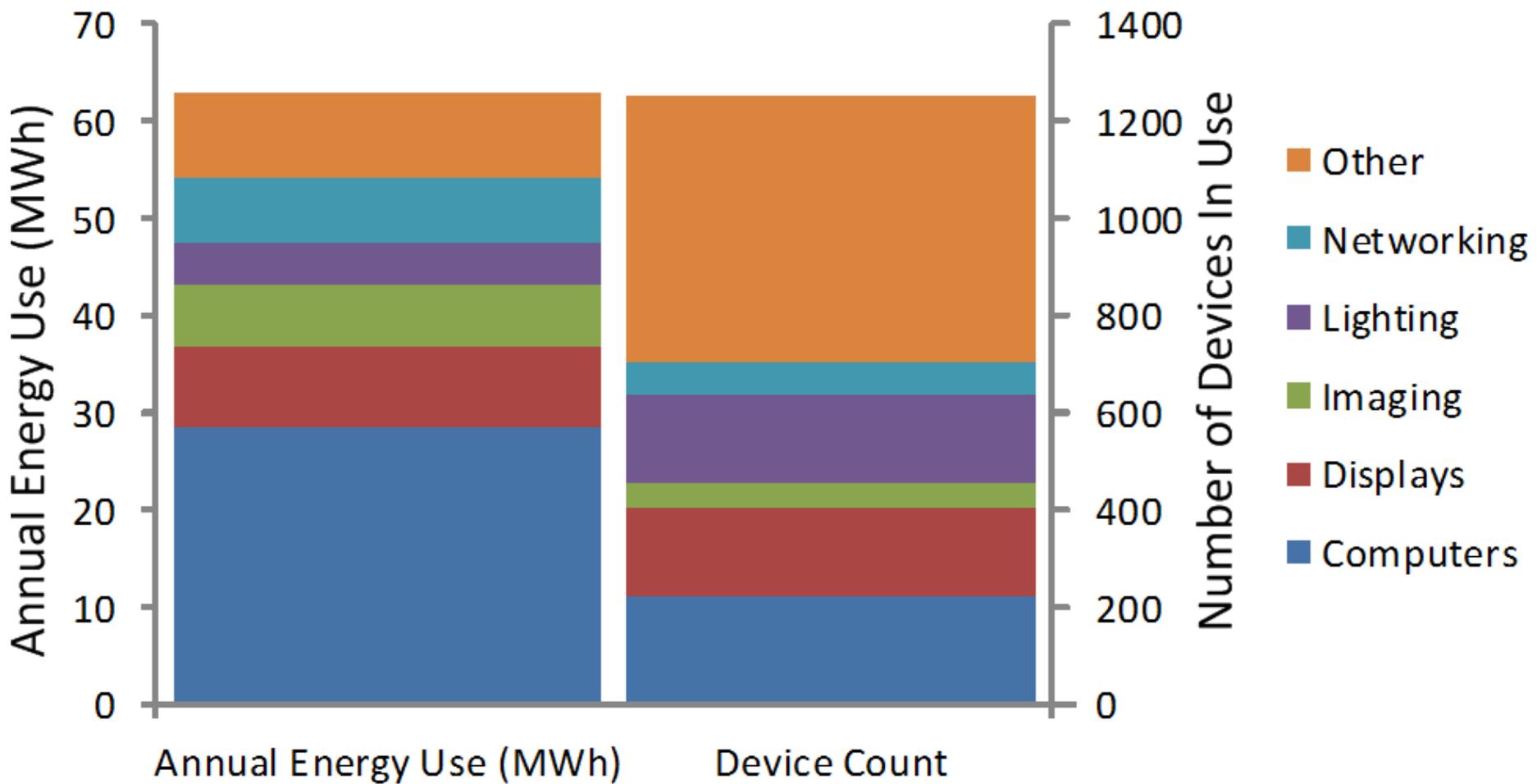
- Smallest category shown is 0.5% of total number of devices.
- 127 device types in “Other”
- Inventoried 98% of building floor area.

# Data Collection Network

- ACme enables wide spread data collection
- Meter is close to the ideal meter for this study
- Research grade device with some performance issues...

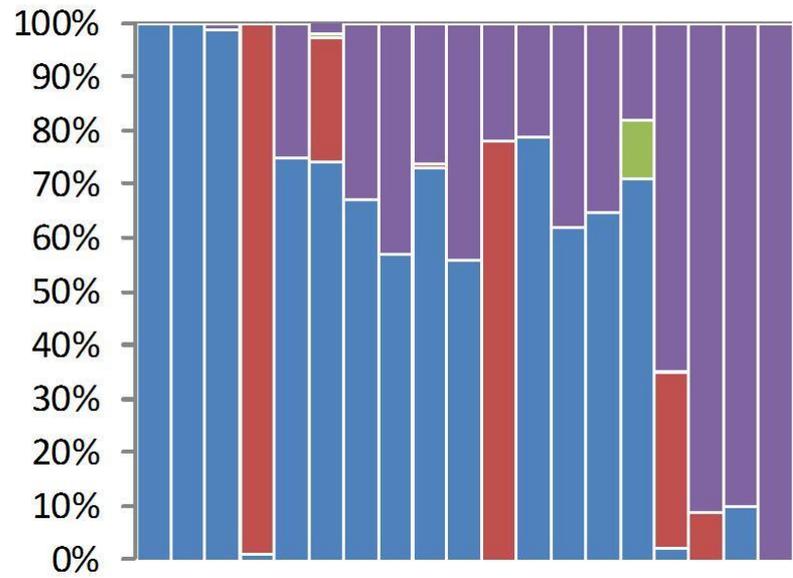


# 3<sup>rd</sup> Floor Inventory vs Energy

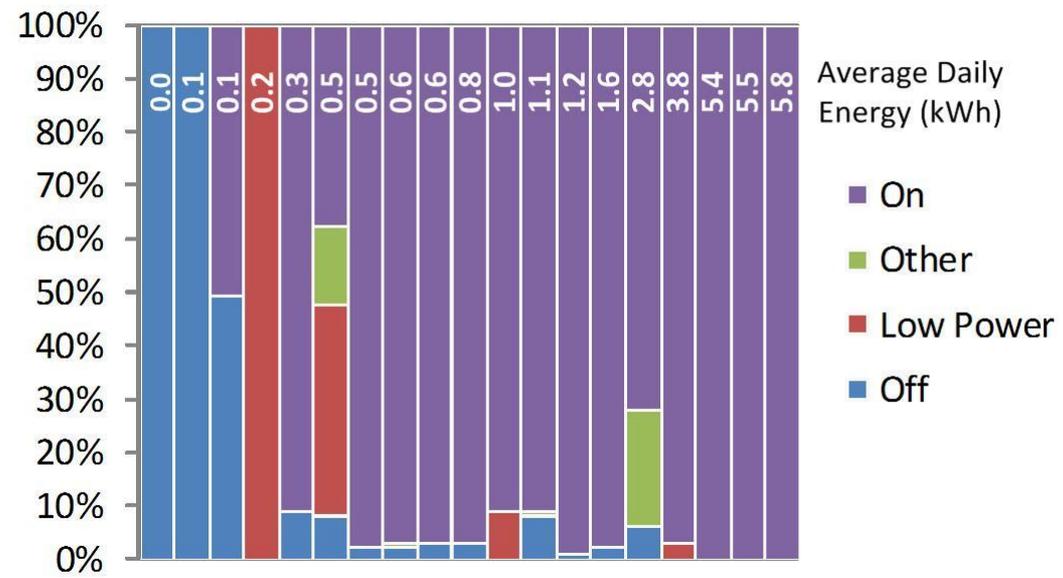


# Time & Energy in Power Mode

Percent time in power mode

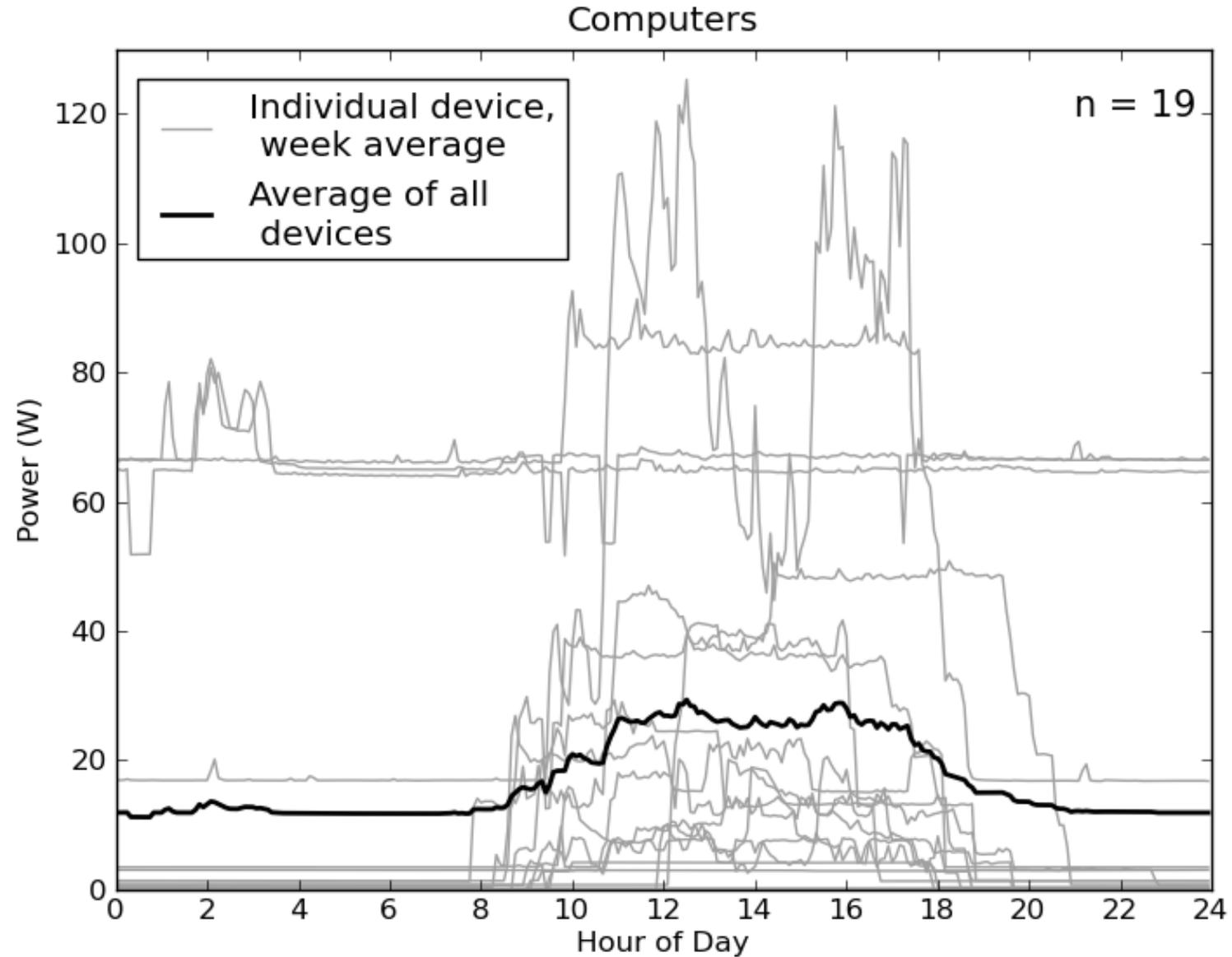


Percent energy in power mode

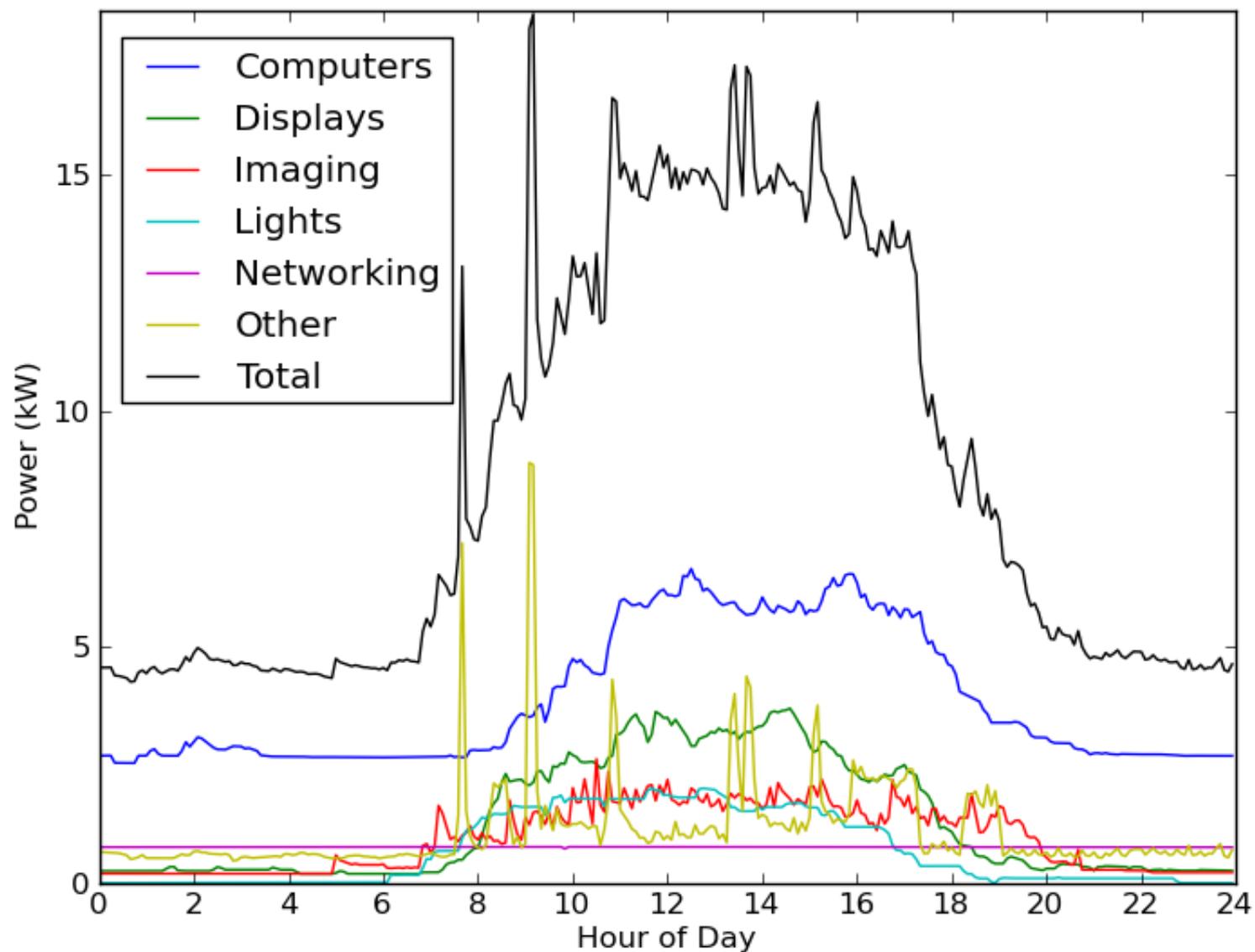


19 computers sorted by energy consumption

# Load Shapes



# Projected Load Shapes

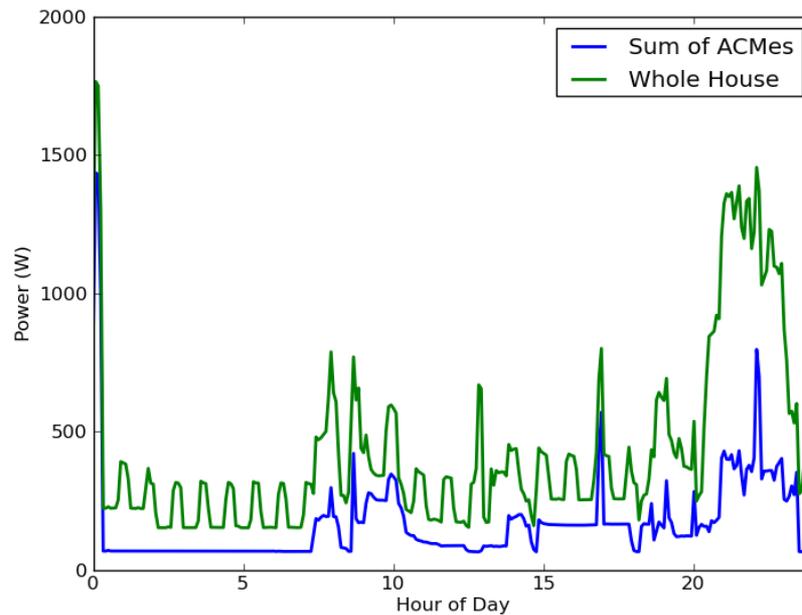


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- Deploy 500 ACmes across building (400 more)
  - Collect data for > 6 months
- Shake out network issues
  - Lots of progress made thus far
  - Still some way to go
- Improve automated data analysis

# Residential Study

- Meter all the MELs in 3 houses
- 6 months of data collection
- Installs between now and early Nov.



# ACme Next Steps

- Find interested people to take ACme to the next level
- New form factors
  - Non-intrusive metering
  - Plug strip
  - Two outlet
- Occupancy sensing

- Collaborations like this enable a new kind of research on energy in buildings
- Deployment is largely successful
- Much work to be done moving forward