Literature Review…Topics Studied

- Electricity usage in by various sectors in this country & NEC

- Geographic regions in US – Census divisions, ASHRAE, and DOE

- Commercial buildings: types and demographics, energy and electricity consumption, major and minor end use loads

- MELs (Miscellaneous Electric Loads), including transformers and plug-loads

- Models for energy usage in buildings: DOE commercial building reference model and EIA (U.S. Energy Information Administration) NEMS (national energy modeling system) CDM (commercial demand module)

Literature Review…Work In Progress

- Lighting – communication with IES and PNNL, ASHRAE specifications
  - Needed: Review material provided by Eric Richman (PNNL) – technical documents on conversion of IES illuminance requirements to electric power density, contact IEEE (Steven Townsend)

- Energy Codes – ASHRAE and IECC, adoption, interior & exterior lighting
  - Needed: To more carefully study and understand relationship with electrical equipment selection and electrical stipulations contained

- Transformers – Review of Cadmus study (loading) and treatment as MEL
  - Needed: Impact of manufacturer date, type and loading level on efficiency, calculating losses, relationship of capacity to % impedance (available fault current)
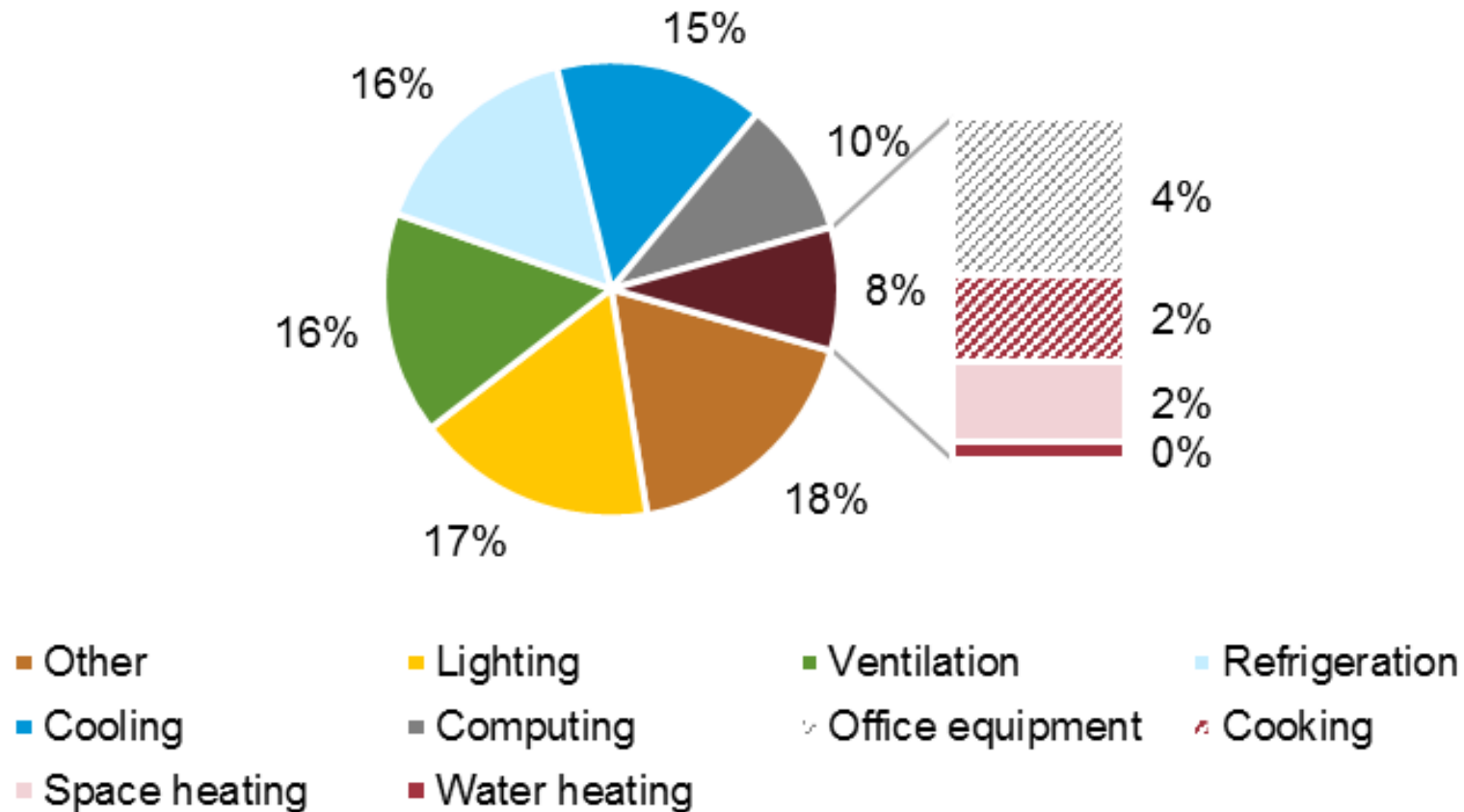
Literature Review…Work Remaining

- Current practices in electrical feeder and branch circuit design, including IEEE guidelines and NEC requirements

- Current practices in equipment sizing

- Final task: report of literature review

Literature Highlights…2012 CBECS

All Buildings - End Use Electricity

Pie chart segments: 15%, 10%, 8%, 18%, 17%, 16%, 16%

Breakout from 10% segment: 4%, 2%, 2%, 0%

Legend:
- Other
- Lighting
- Ventilation
- Refrigeration
- Cooling
- Computing
- Office equipment
- Cooking
- Space heating
- Water heating

Literature Highlights…2012 CBECS

Electricity End Uses by Building Type
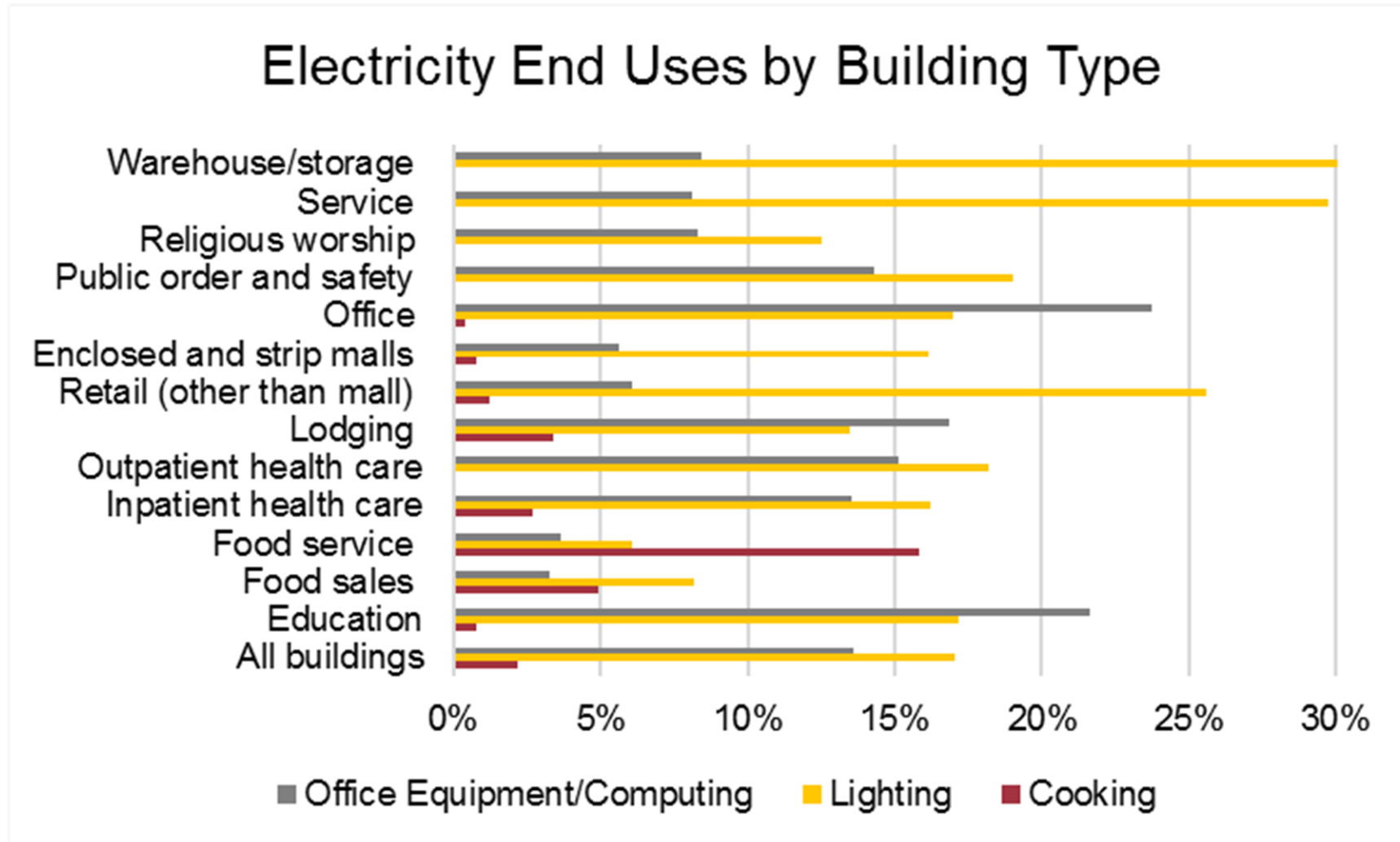
Literature Highlights...2012 CBECS
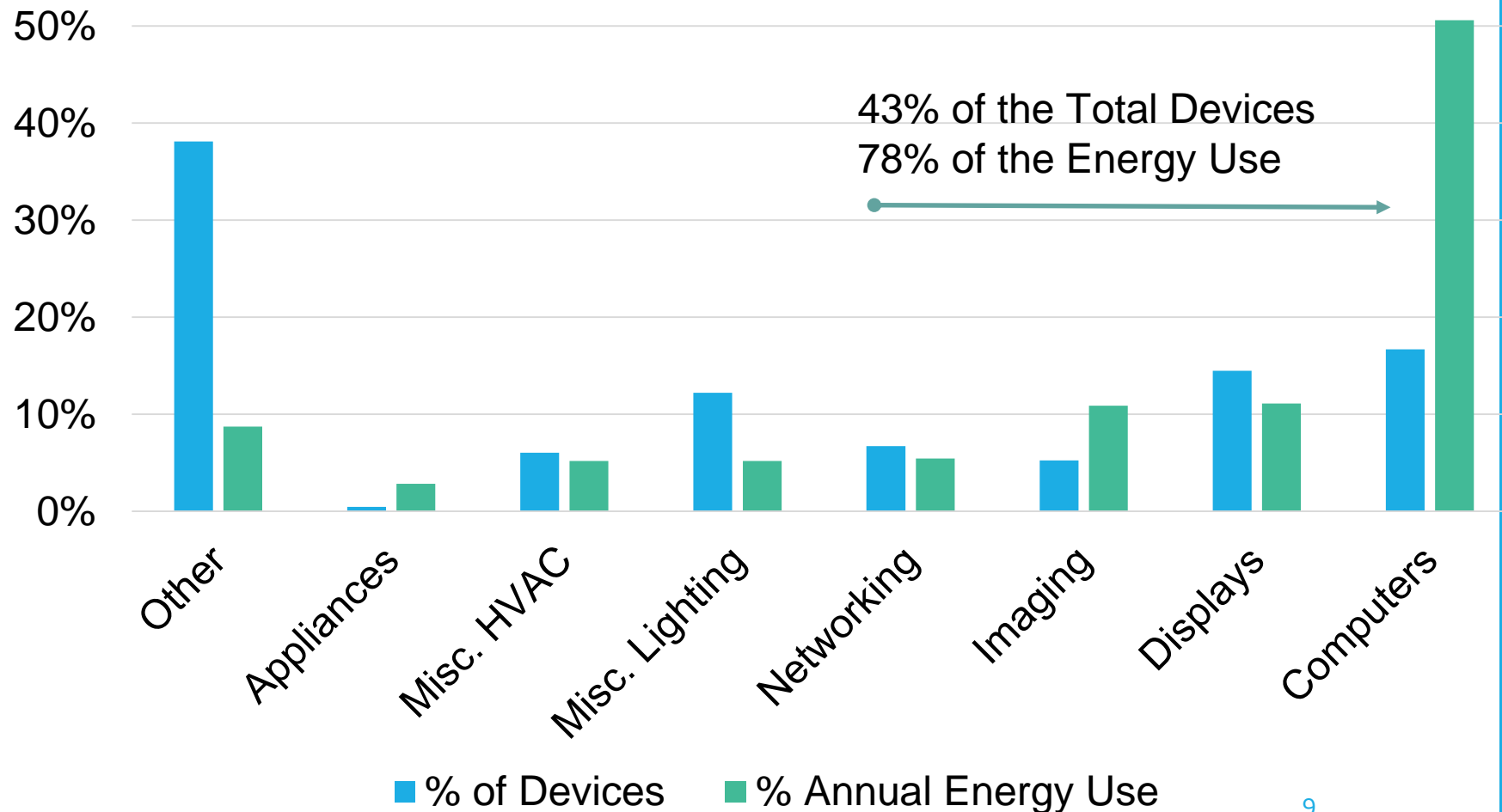
Annual Mean Electric Power Intensity (W / sq. ft.)
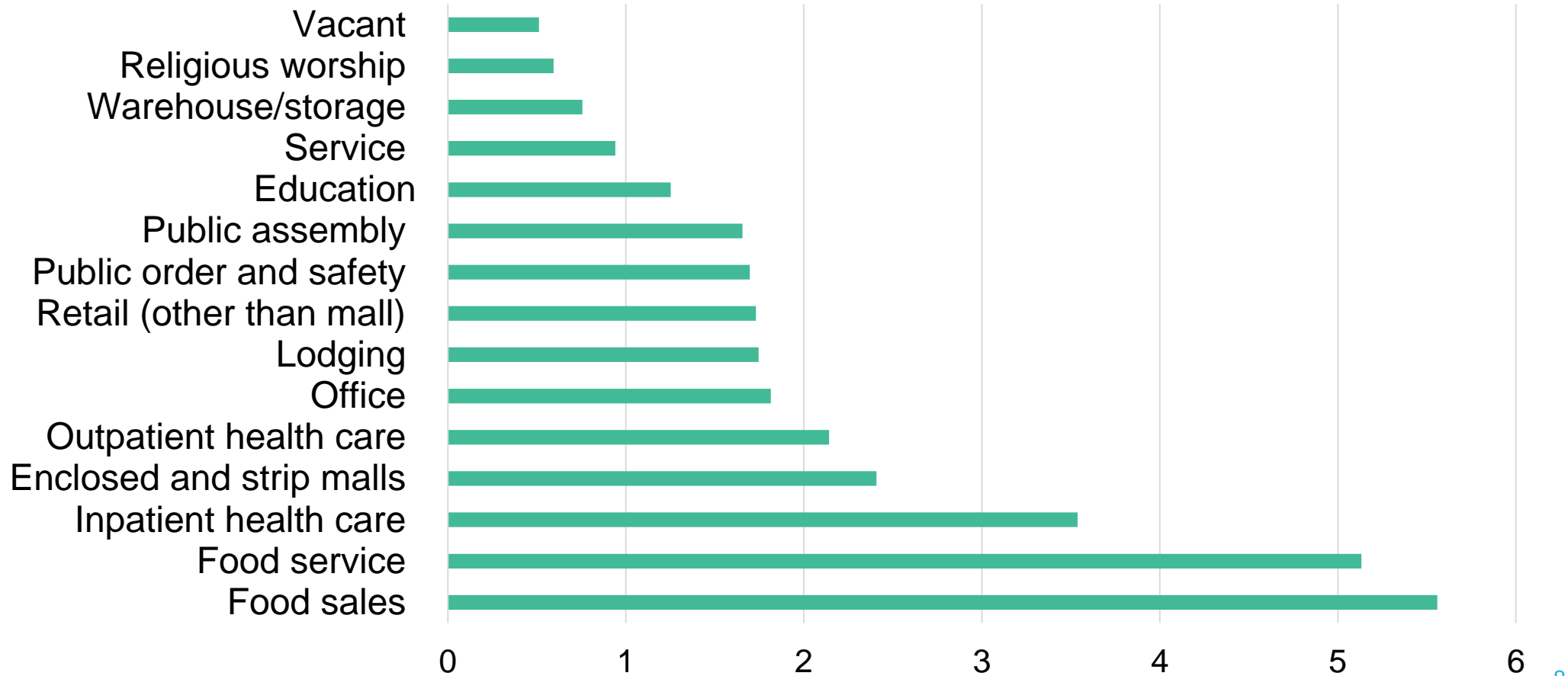
Literature Highlights…Receptacle Study

LBNL Plug-in Load Study

- 6-month+ study
- LBNL office building
- Power densities for
- Receptacle load:
- 1.1 W/ft² during day
- 0.47 W/ft² at night

43% of the Total Devices
78% of the Energy Use

Categories (x-axis): Other, Appliances, Misc. HVAC, Misc. Lighting, Networking, Imaging, Displays, Computers

Legend: ■ % of Devices ■ % Annual Energy Use

Literature Highlights...Transformers

- A 2013 Navigant Study of 13 Commercial MELs estimated that distribution transformers consumed 43 TW-hours of electricity in 2011, more that any other MEL in the study.

Measured Transformer RMS Load Factors in 1999 Cadmus Study

RMS Load Factor	15-30 kVA	45 kVA	75 kVA	112.5-150 kVA	225-300 kVA
Average	23.4%	15.6%	14.0%	12.3%	19.9%
Maximum	62.4%	50.0%	40.2%	34.3%	35.6%
Minimum	1.3%	1.1%	0.9%	0.0%	11.0%
Number of Trans-formers (89 Total)	12	28	34	10	5

Data Collection Plan…Work in Progress

- Preliminary draft of data collection plan sent to project technical panel, project sponsors, and others involved in project.

- Data collection plan will be modified and further developed….based on input from you.

TEAM ROLL CALL: WHAT DO YOU THINK?

Project Technical Panel:

Mark Hilbert?   Robert Arno?   Mark Early?

Brian Liebel/Mark Lien?

Project Sponsors:

Michael Berthelsen?   Brett Garrett?   Lou Galante?

Dean Hansen?   Kane Howard?   Michael Hughes?

Jim Jackson?   Paul Kempf?   Brian Meyers?

Bob Wajnryb?   Bob Yanniello?

Anyone else?

Mike Anthony?   Jim Harvey?   Richard Robben?