GEB Component Technology: Lighting

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DOE GEB Component Technology Panel

Grid services: The case for Lighting

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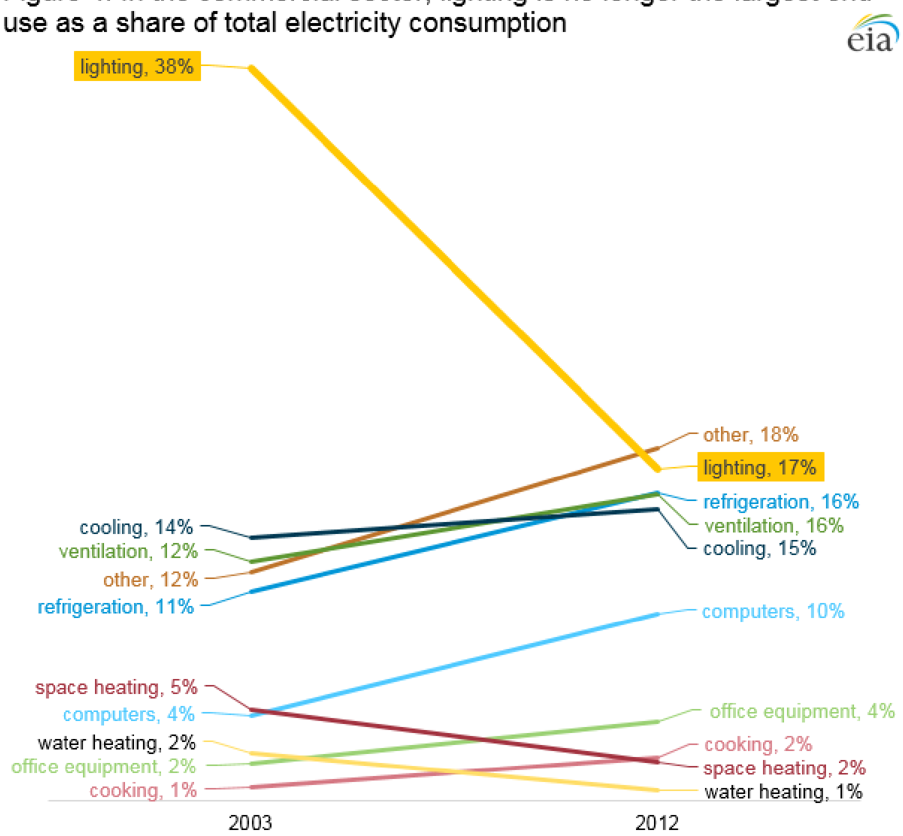
Figure 4: In the commercial sector, lighting is no longer the largest end use as a share of total electricity consumption



- In 2017, about 143 billion kWh were consumed for commercial lighting, which includes commercial and institutional buildings, and public street and highway lighting, which was equal to about 11% of total commercial sector electricity consumption
- In 2014, about 55 billion kWh were consumed for facility lighting in manufacturing facilities, which was equal to about 1.4% of total electricity consumption.

Lighting is (still) a significant electrical energy consumer in all building types.

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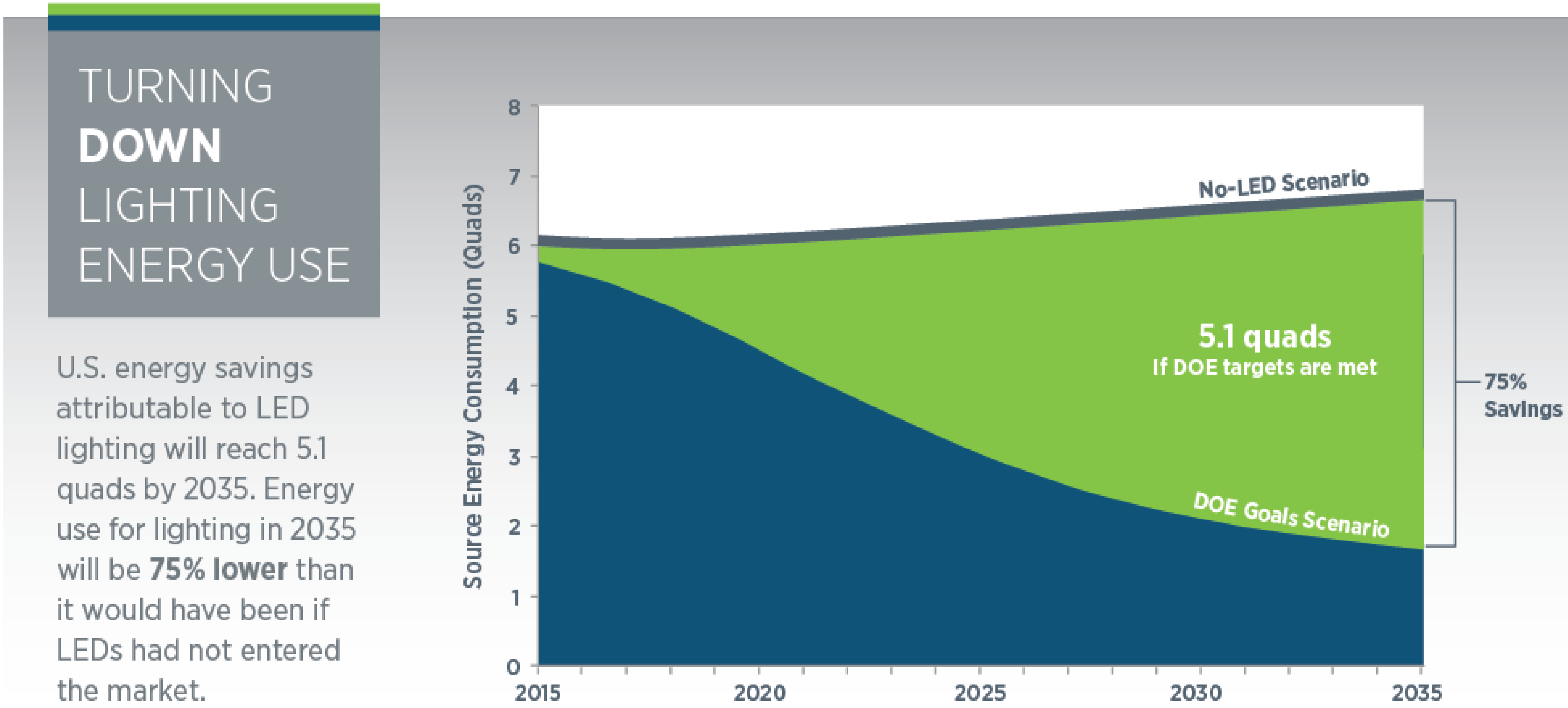

The built environment is on a clear path to LED for most if not all space types/applications…

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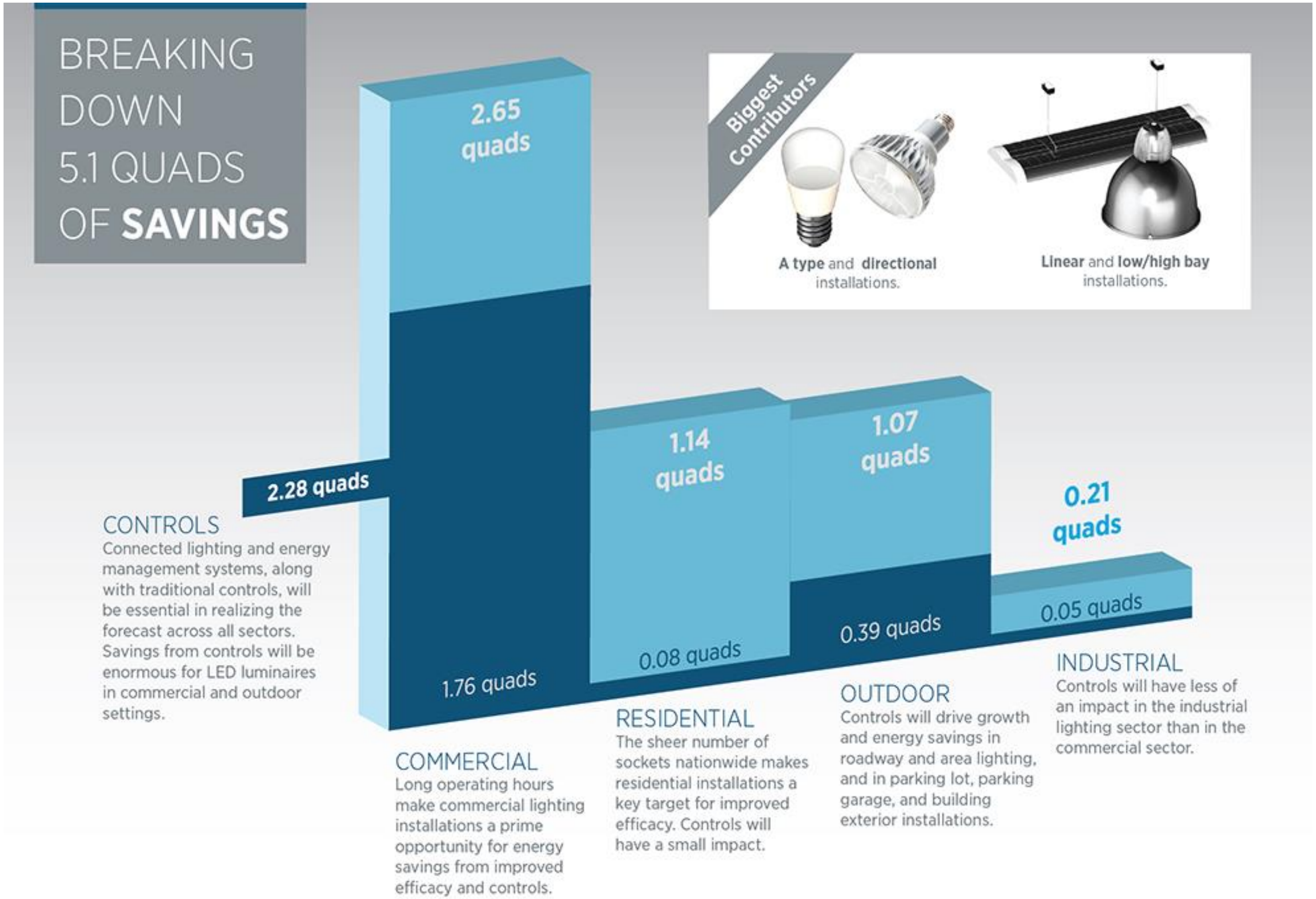


… and possibly Connected LED for many applications.

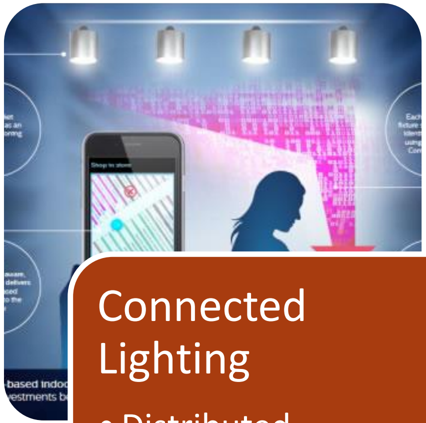
Lighting technology evolution

Traditional Lighting

- Gas-Discharge
- High-Voltage
- Fixed color temperature/color point

LED Lighting

- Solid-State
- Low-Voltage
- White-tunable
- Color-tunable



Connected Lighting

- Distributed Intelligence & memory
- Network communication
- Sensors

Grid services:
The case for Connected Lighting

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Significant and unique features:

- Power draw can be modulated by dimming deeply (<1%) and varying light spectrum and distribution
- Potentially very fast response time, likely limited by network communication, enables the ability to provide grid services at time frames of hours (e.g., for energy services) to seconds or less (e.g., for frequency regulation)
- Tight integration with renewable and storage technology can yield enhanced service (e.g. longer duration, increased power draw)
- Can self-monitor and report energy use and space conditions that affect occupant satisfaction, and share historical and projected data for coordination and optimization with other building equipment
- Self-monitoring can both quantitatively characterize service potential, and confirm delivery of service

Lighting energy self-reporting

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Dashboard | Map | Configuration | Calendar | Manual Control | Analysis | Reporting | Administration

Energy Usage Map

Average Daily Energy Usage (30 day average)

Rooms Status

- Room 1
- Room 10
- Room 11
- Room 12
- Room 13
- Room 2
- Room 3
- Room 4
- Room 5
- Room 6
- Room 7
- Room 8
- Room 9

Radius

Lighting energy self-reporting

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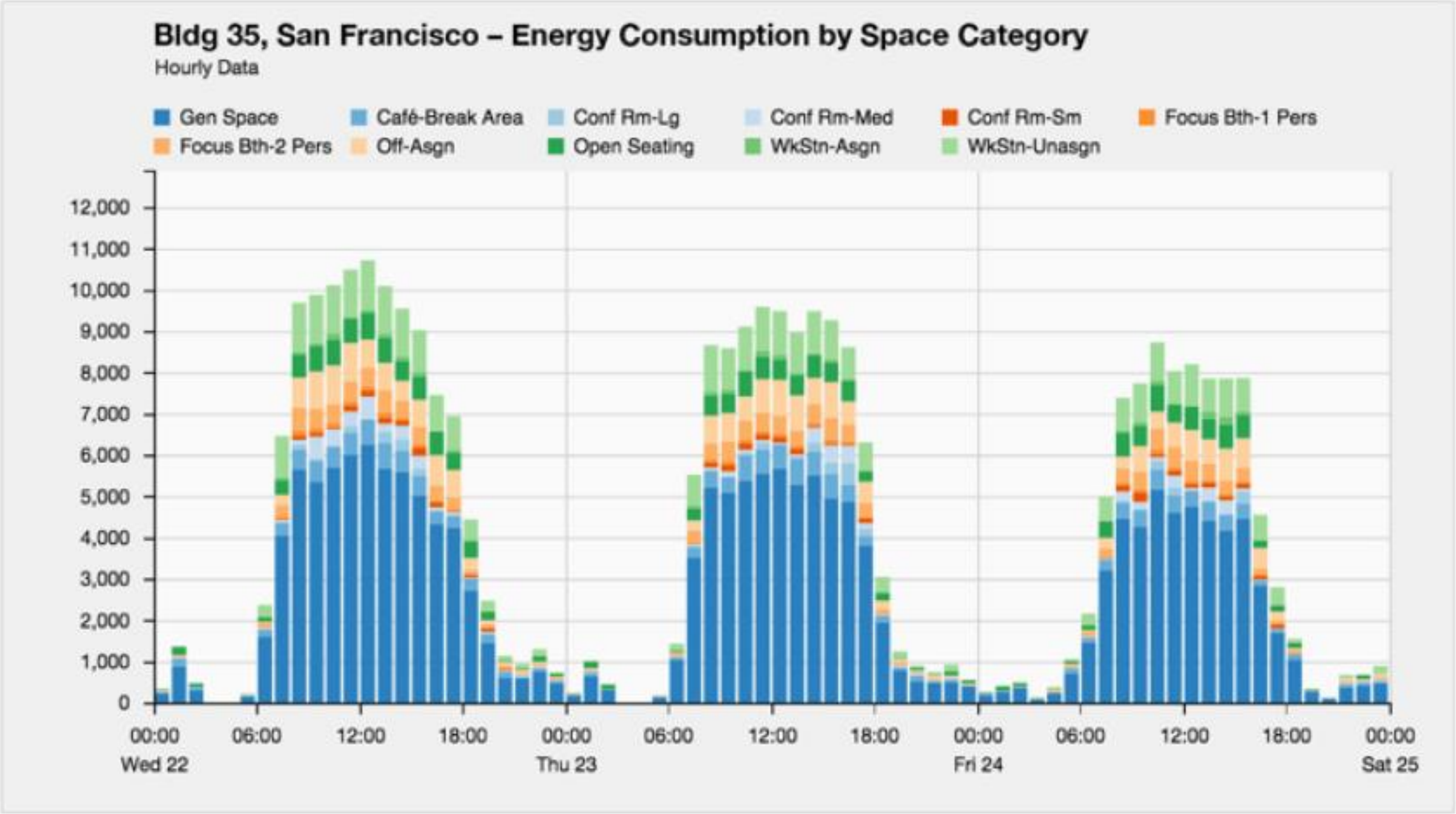

Lighting grid services: Needs and Risks

- Grid services have historically not been a target for the lighting industry, and lighting has not historically been a target for grid services
- Why? Delivering potential grid services while simultaneously delivering sufficient lighting service and occupant satisfaction is challenging, and has not yet been proven or quantified

- Key needs:
  - What grid service metrics (e.g., speed, duration, energy reporting accuracy) are necessary for delivering (specific) grid services, and what is the value of those services?
  - What level of interoperability is needed to realize (specific) grid services, and what technologies can deliver those needs?
- Key risks:
  - What lighting service characteristics might be compromised in the delivery of grid services?
  - How can such compromises be mitigated or managed?

Lighting grid services: Impact

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Preliminary[1] analysis: peak shaving only[2]

- Forecasted efficacy improvements from SSL alone reduce commercial peak lighting demand 64% (39.4 GW) by 2035
- Including the effect of grid services enabled by Connected Lighting Systems reduces commercial peak lighting demand 77% (47.4 GW) by 2035

Commercial Peak Lighting Demand	2015	2020	2025	2030	2035
Base Case	50.4	52.9	55.6	58.4	61.3
With efficacy improvements only	50.4	37.7	27.6	23.4	21.9
With efficacy improvements and grid services	50.4	36.9	24.8	17.6	13.9

[1]Final analysis available in August from SSL Program (Navigant)
[2]Assumptions: CLS enter commercial sector according to adoption curve developed by SSL Program (Navigant); 100% of CLS in the commercial sector participate and are occasionally dimmed to 50 percent power.

Questions?

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