



Power in the network

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Why would you power a device via IT network?

*Technical Capabilities
Management
Motivation*

Agenda

1. Power
 - Power over Ethernet
 - Energy Management
 - Cisco EnergyWise
2. Internet of Everything
3. Light as a Service
 - Proof of concept
 - Project setup
4. Extending Light as a Service
 - Sensor networks
5. Question time

Technology

*Power over Ethernet
Cisco EnergyWise*

Power over Ethernet– fewer cables

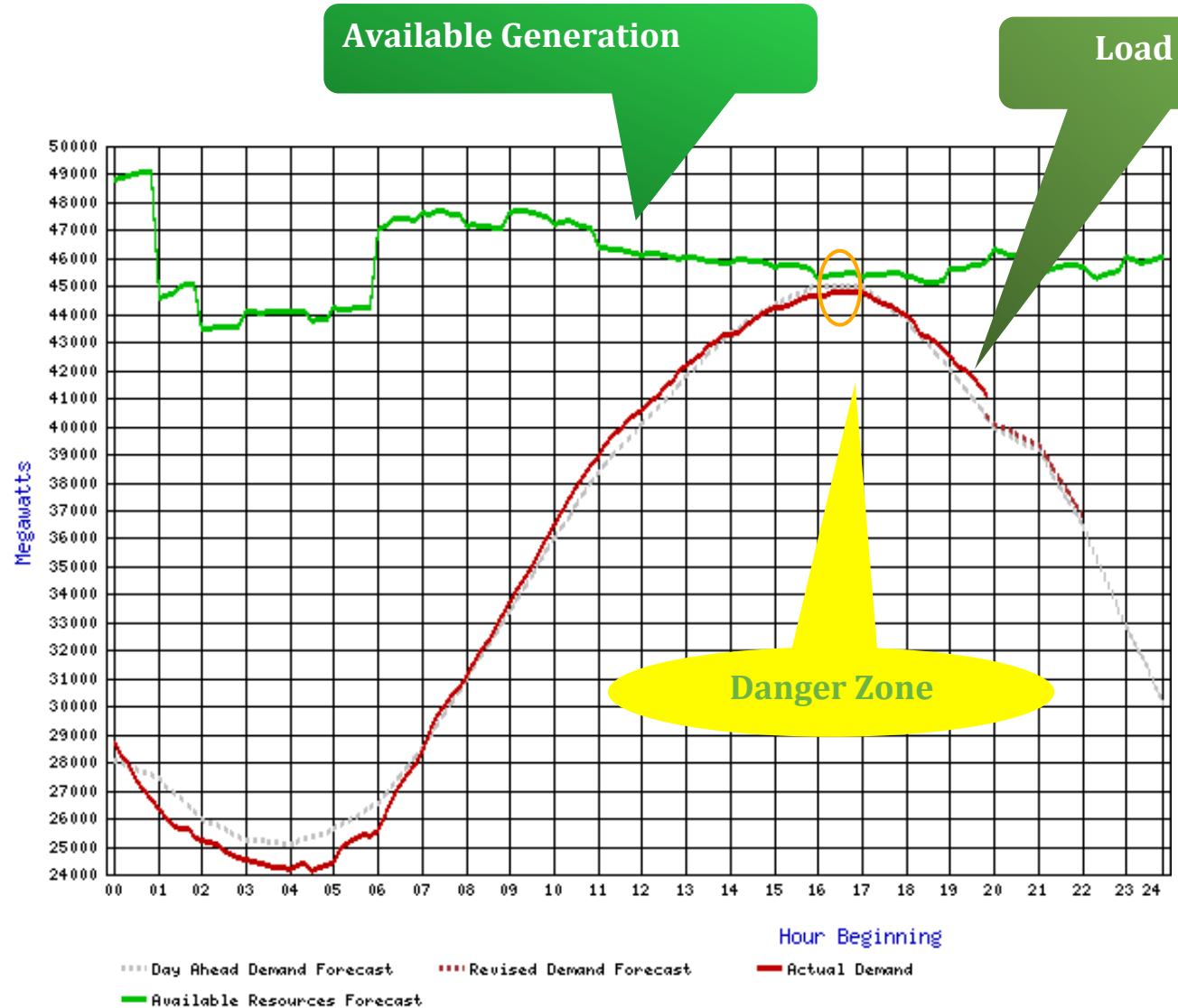
- Power
 - 15W - 802.3af PoE
 - 30W - 802.3at PoE+
 - 60W - Cisco UPoE
- Over
 - Standard Cat5e cable
- Ethernet
 - LLDP needed for higher power levels
- Supported by switches, phones, cameras, APs, lights, sensors...



Energy Usage Today

- How much power consumed by a switch is used for switching? 40-150W
- What percentage of a switch's power is used to power attached devices? 70%
- What's the average aggregate power consumption of devices connected to a switch (PoE and non-PoE)?
48 port switch = 3392W
- What's the average per port power usage? ~70W

Energy Management – Original problem



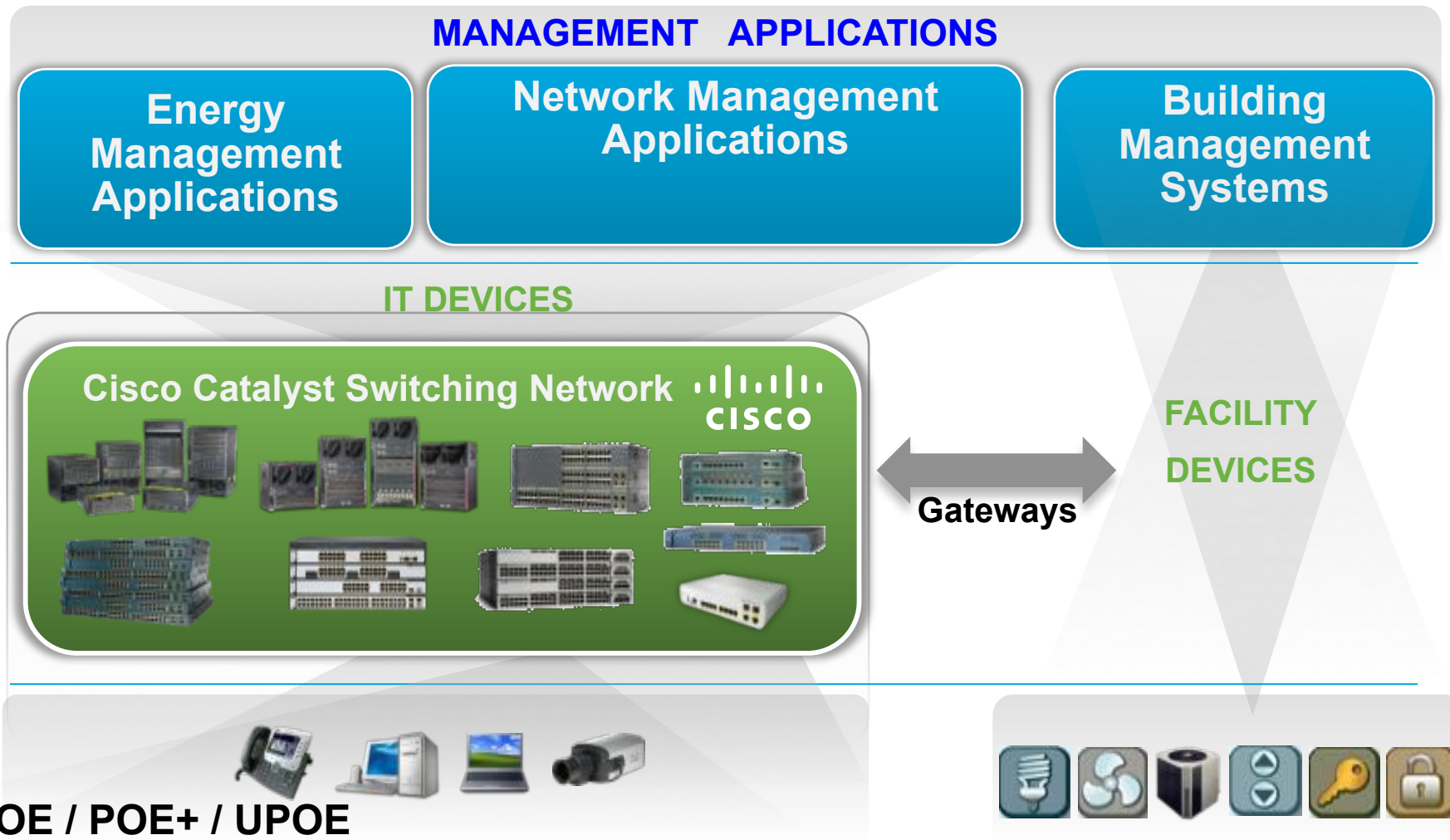
- Passive strategies reduce the curve
- Active strategies shape the curve
- Networked systems will drive efficiency

California Heat Wave 7/6/07

Cisco EnergyWise - Solution

- Energy management protocol
 - Allows to set and measure energy consumption
 - Provides context for network endpoints
 - Easily extendable to support more functionality
- Runs on Cisco Catalyst switches
 - Flooding algorithm
 - Talks to client software on EnergyWise enabled devices
 - Talks to switch ports to control PoE devices
- SDK available
 - Libraries for endpoints and management interface

Cisco EnergyWise Framework



Questions



Part 2 [LaaS]

Proof of Concept

Internet of Everything (IoE)

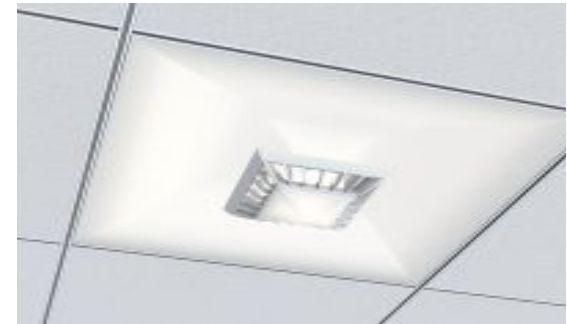
1 object -> 1 IP address

Intelligent objects talk to . other objects
. the network

Then **Light** becomes part of the IoE:

1 LED light -> 1 IP address

Managed light = Light-as-a-Service (LaaS)



LaaS: Enabling Technologies

Power over Ethernet:
Power and control lights over same cable

PoE (15 Watts)
PoE+ (30 Watts)
uPoE (60 Watts)

Following PoE,
uPoE is currently going through IEEE standardisation

Cisco EnergyWise

Software to control the light



Software to measure energy use

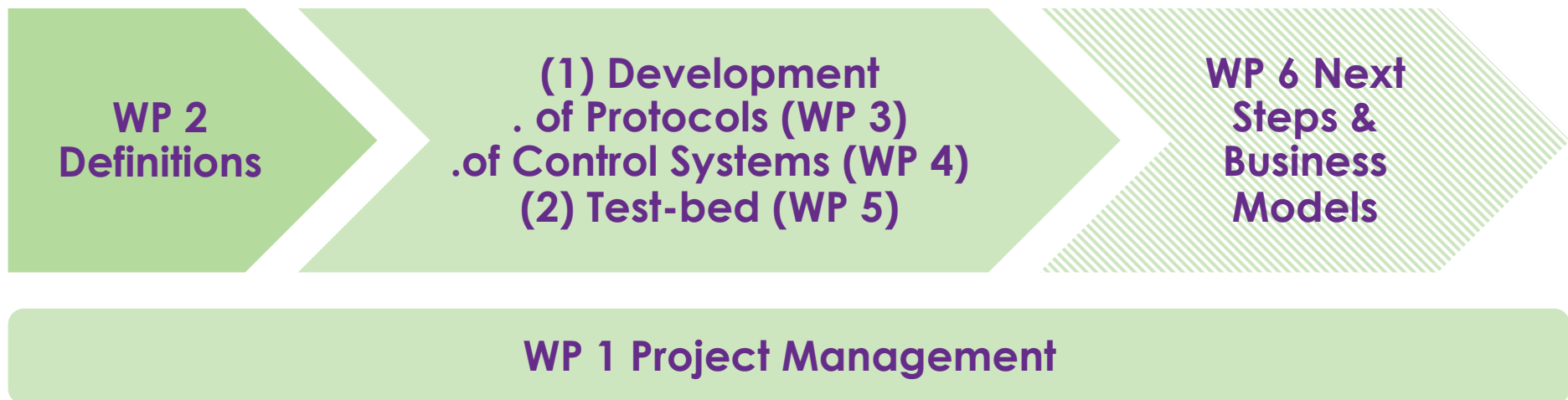
Other partners

Software for Individual Control

Project summary

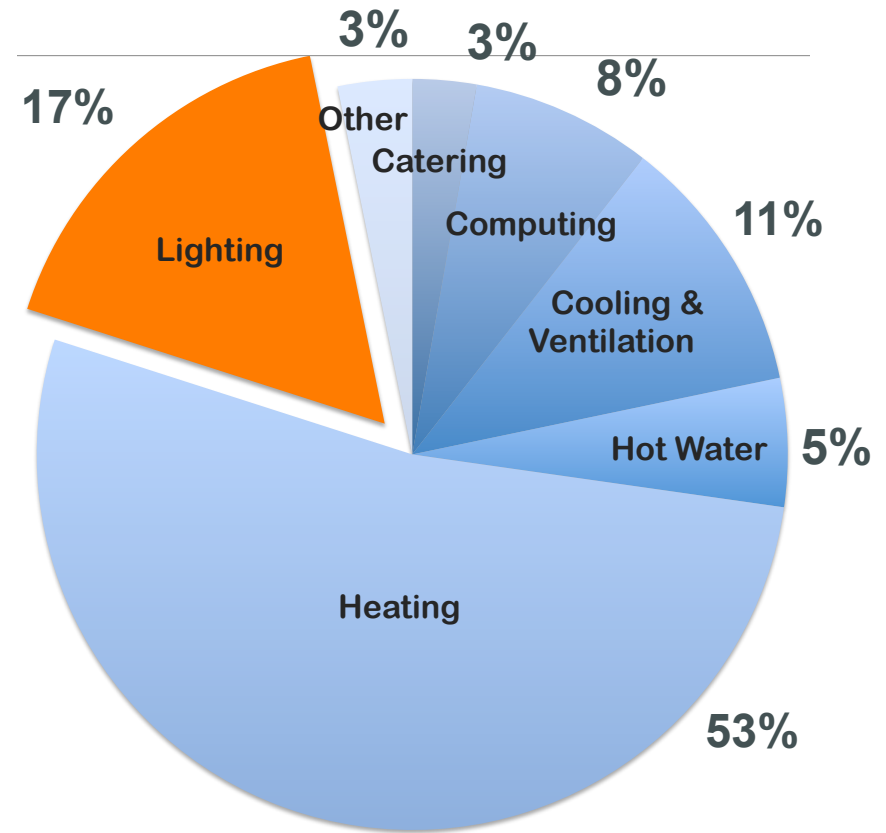
- Funding: UK Technology Strategy Board (TSB)
- Focus: Industrial research
- Consortium Partners

- Timeframe: 24 month [starting 1st October 2013]



LaaS: Benefits

- Easy installation:
one cable, one network
- Cost savings on Capex and Opex.
- Reducing energy demand: more energy-efficient, accurately measured, less heat production.
- Web-based systems, ease of data gathering (smart (sub)-meters) and control.
- Standalone management systems (assets, control, workflow) will merge into integrated solutions.



Commercial Offices Final energy consumption 2012

(from DECC (2013) Energy Consumption in the UK Service sector data tables, Table 5.09)

LaaS: Vertical Market Applications



Commercial



Healthcare

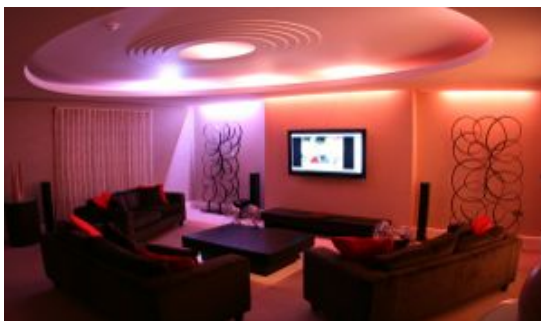


Retail



Light as a Service

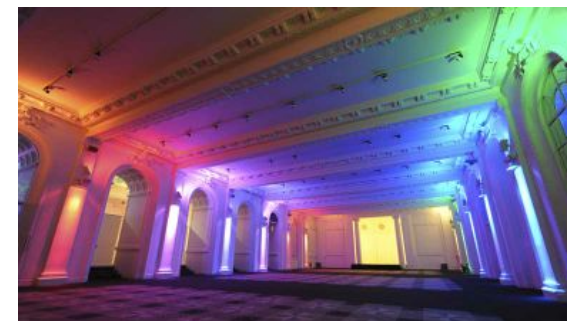
Residential



Education



Hospitality



Questions

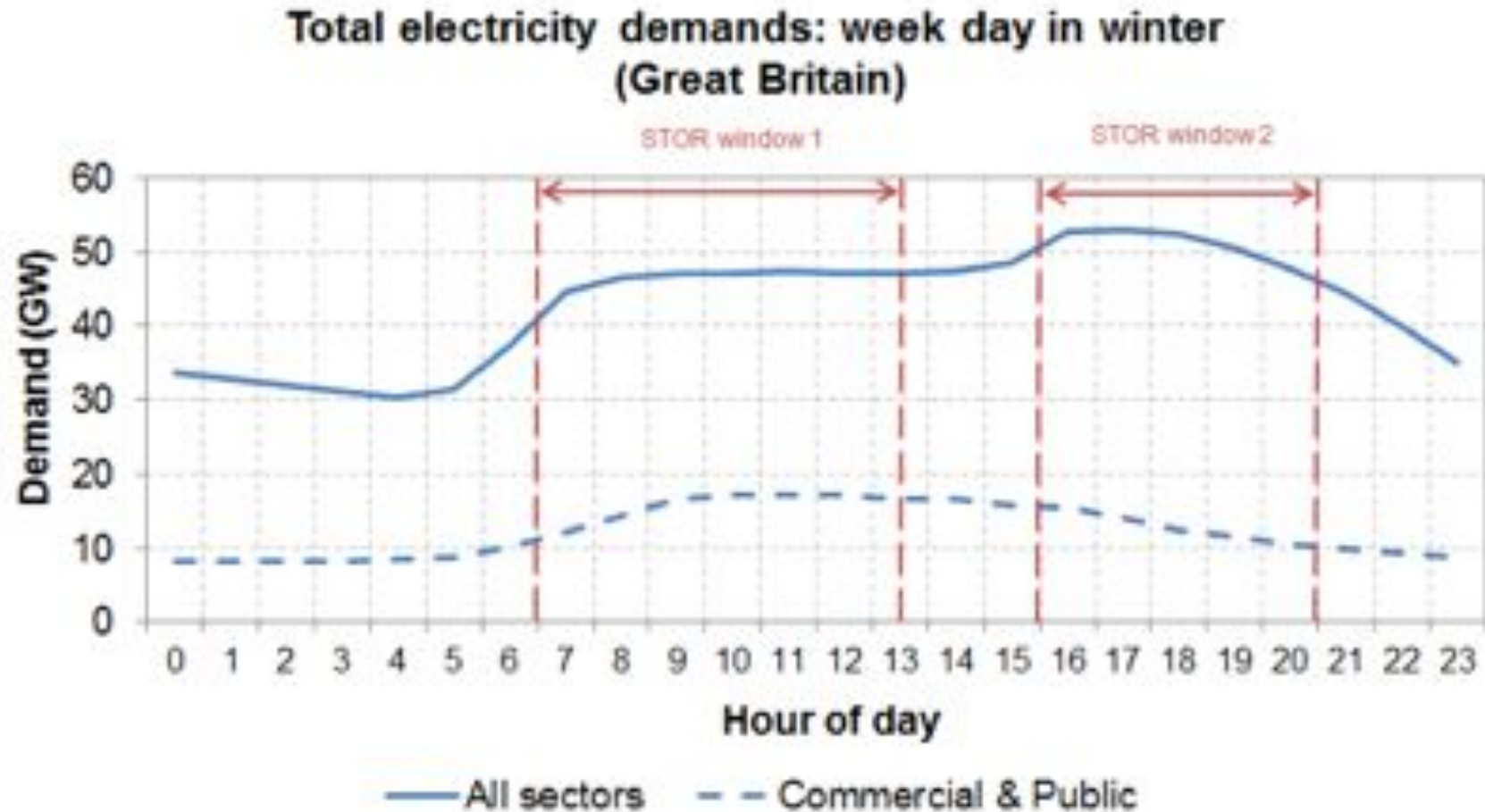


Part 3 [LaaS / UCL]

Project Set-Up

Cisco Future Cities project

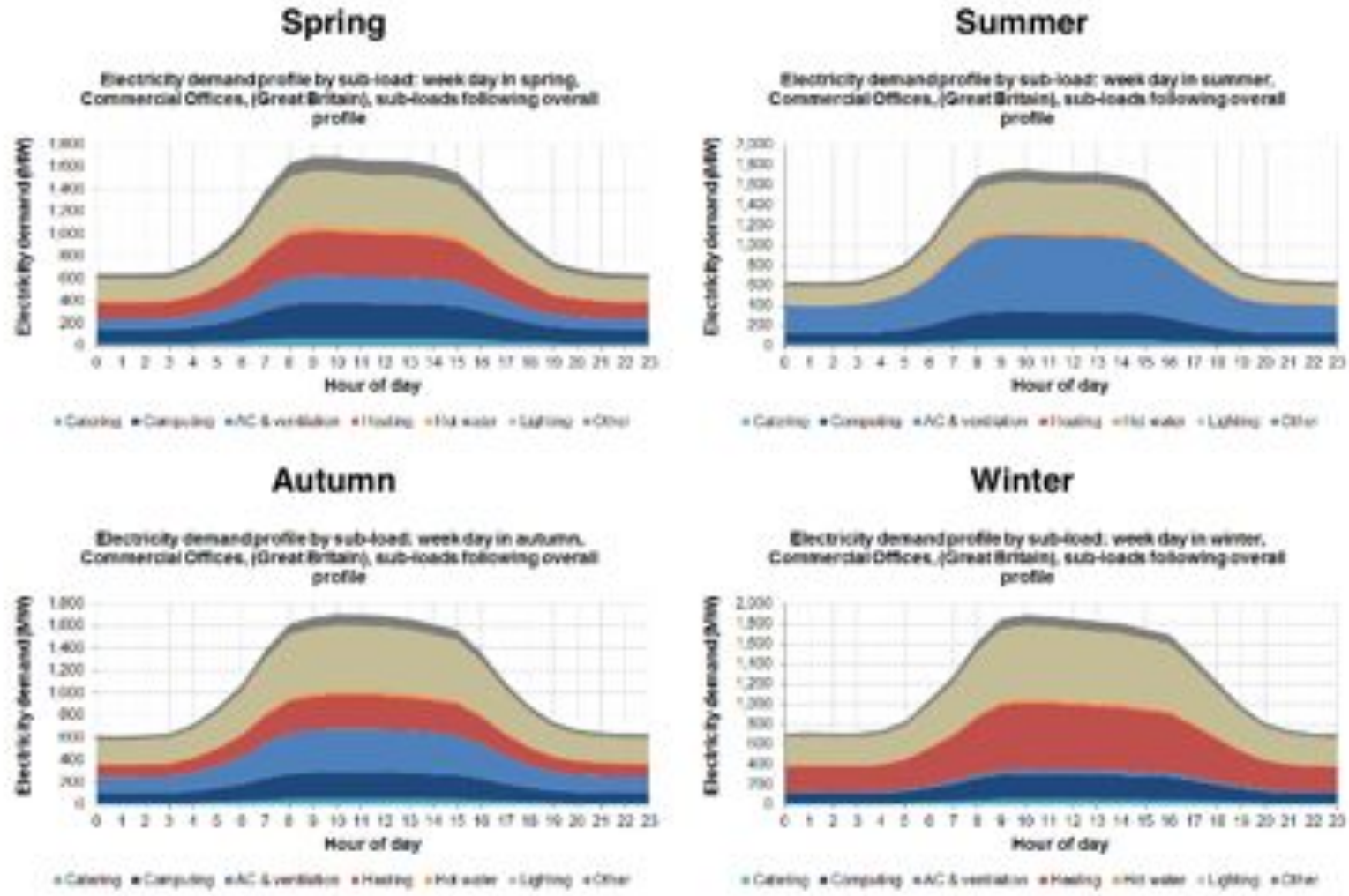
collaboration between UCL, Cisco and other partners



Ref: Element Energy Limited for Ofgem (2012) Demand side response in the non-domestic sector (p 44). Available at: <https://www.ofgem.gov.uk/publications-and-updates/demand-side-response-non-domestic-sector>

Cisco Future Cities project

collaboration between UCL, Cisco and other partners



Ref: Element Energy Limited for Ofgem (2012) Demand side response in the non-domestic sector (p 25). Available at: <https://www.ofgem.gov.uk/publications-and-updates/demand-side-response-non-domestic-sector>



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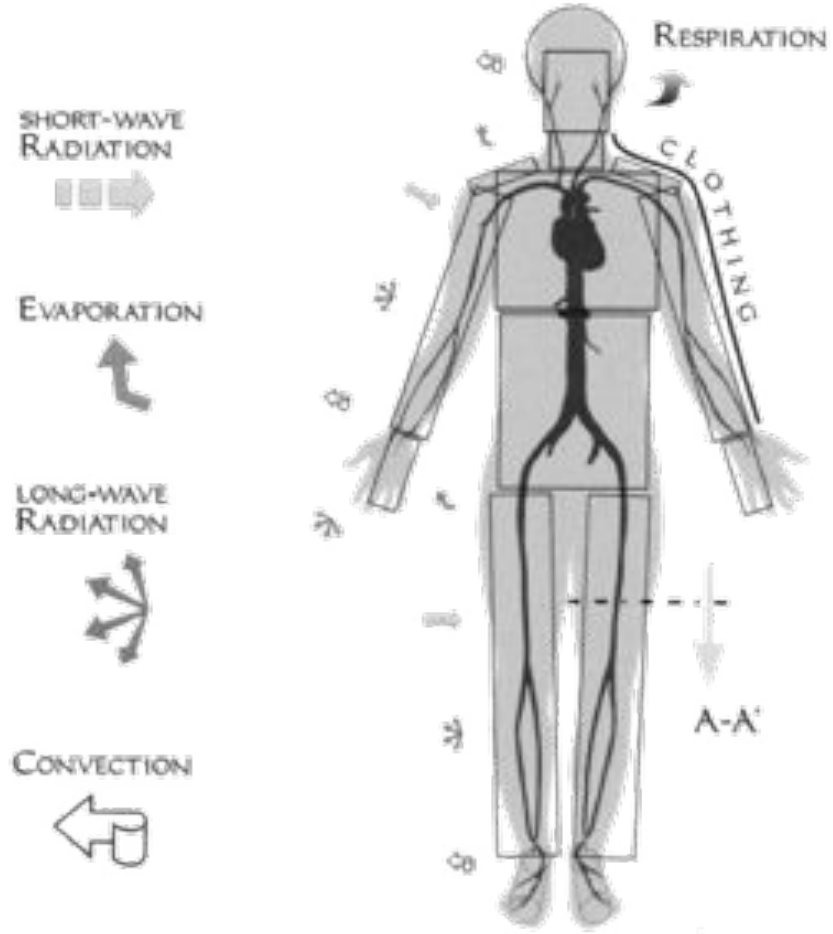


How can Cisco's **EnergyWise** Protocol be implemented in ways that **support Demand Side Response** in commercial buildings while simultaneously supporting **occupant comfort**?

Cisco Future Cities project

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Physics



Psychology

Physiology

Ref: Schematic diagram of the passive system - D. Fiala, K.J. Lomas, M. Stohrer (1999) A computer model of human thermoregulation for a wide range of environmental conditions: the passive system. J Appl Physiol Vol. 87, Issue 5, 1957-1972.



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Occupants Thermal Comfort (*var 1, ... ,var n*)



***Develop + Test
pervasive sensor systems***



***Real time operational control
For individual occupants to
manage their local environment***

Cisco Future Cities project

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*To use the inherent capacity of EnergyWise to **deliver progressive power-down management services** in response to signals from local distribution networks whilst minimising impact on occupants.*

Questions



Extending LaaS

Sensors

Internet Of Everything has potential

- Big Data helps
- LaaS is focused on providing power and control
- But intelligence requires data input

Sensor networks

- Feeding the data back to the network
Wired and Wireless
- Sharing and aggregation becomes a problem
- So does transport and storage
- Cisco is likely to connect them

Sensor networks

- Knowledge Transfer Partnership
- Cisco, University of Strathclyde, TSB
- 2 year research on sensors, data provenance, trust
- Application in LaaS and IoE

Call to action

- Buy Cisco!!!
- Buy more Cisco!!!
- Enable EnergyWise (3 commands)
- See our demo labs and build your own
- Control and manage your lighting network

- Visit developer.cisco.com to see more information about Cisco EnergyWise and Cisco EnergyWise partner program



Questions?