

# **Data Centre Electricity Use**

## **Practical Steps**

### **for Energy Efficiency and Low Carbon in Stand Alone and Shared Data Centres**

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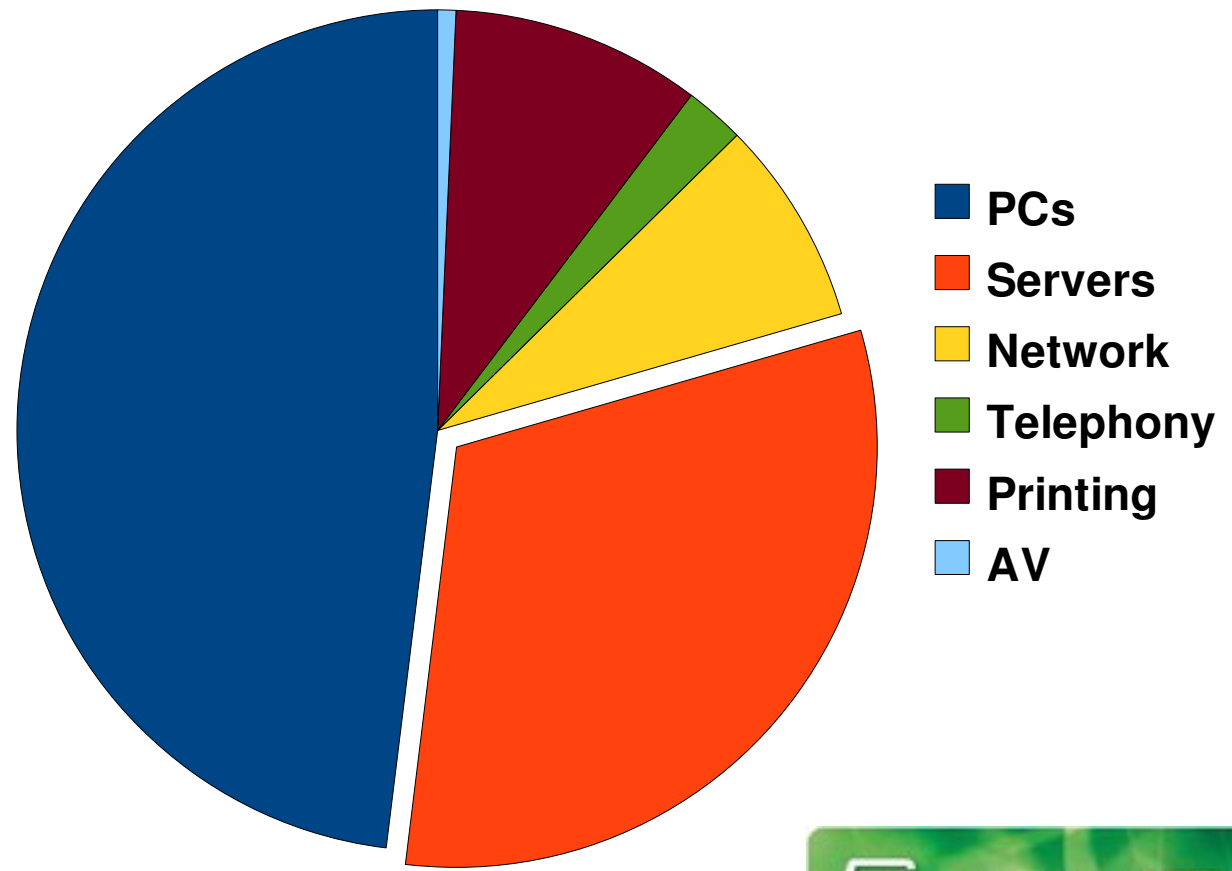
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# Summary

- ICT Electricity Use Footprint
- Data Centre Electricity Use
- The Electricity Bill
- ASHRAE 2008
- IT equipment, Measuring and Costing
- European Code of Conduct
- Sharing Data Centres

# University of Sheffield ICT Electricity Use

- More than £1M/year
- About 20% Institution use
- PCs dominate
- Servers: 31% (including HPC & departmental)



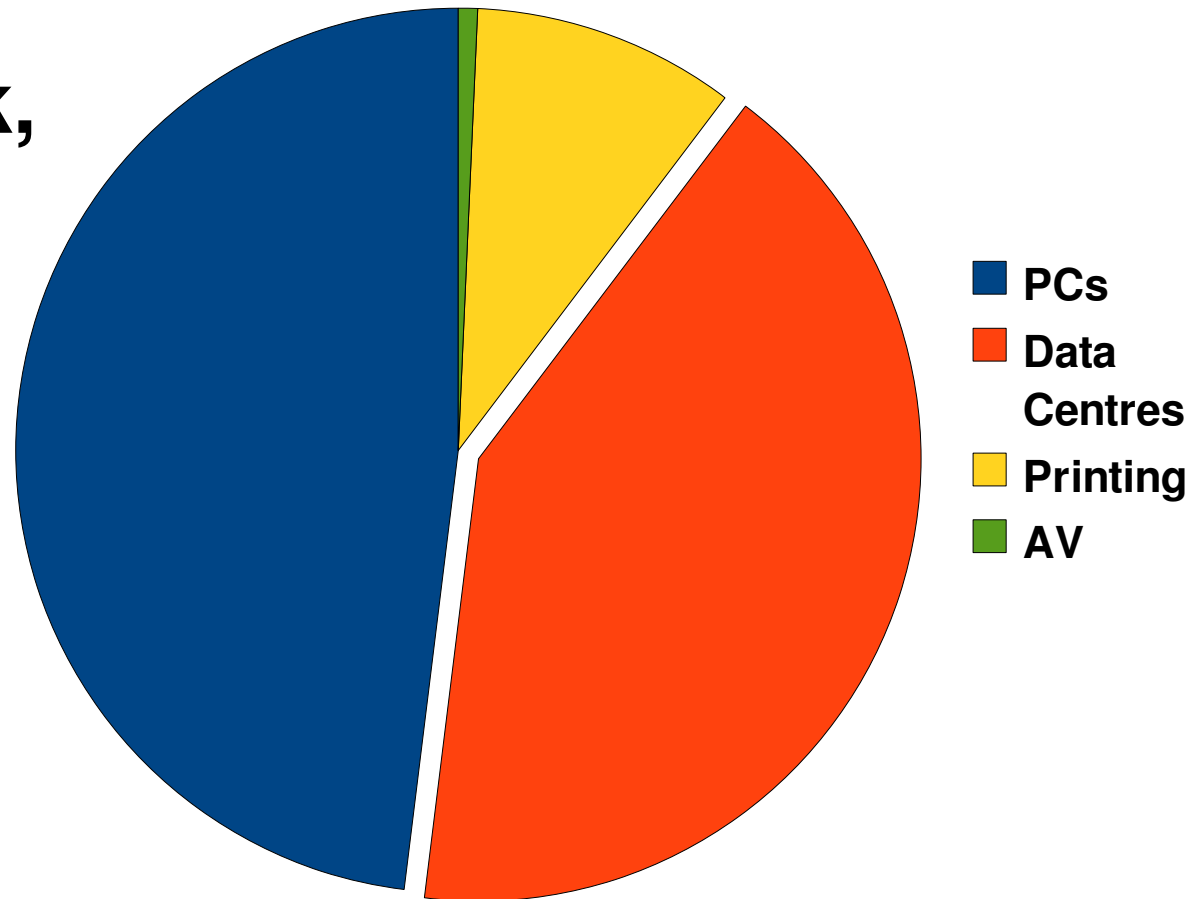
# University of Sheffield Data Centres Electricity

- **Servers, Network,  
PABX**

Over

40% of ICT use  
£400,000 p/a

- Including  
departmental &  
remote cabinets



# Data Centre Study

- Half a dozen Universities in North of England
- Late 2008 to early 2009
- Typical: 22,000 students
  - 4,000 staff
  - Including Russell and post 92 institutions
- Each with two main data centres
  - Largely full...

# Data Centre Study - continued

## Typical provision

- Primary
- 50 cabinets
- 120 KW
- Old, but possibly refurbished
- Was mainframe room
- Secondary
- 25 cabinets
- 75 KW
- Recent, but built to a price, since 2000
- Was a plant room

# Typical Data Centre

- Secure room, false floor, structured cabling
- Room UPS, but no generator
- Conventional aircon
- Dark, usually with the lights off...
- Open plan: no aisle containment
- Low density – typically 3kW/cabinet
  - 1.5kW/m<sup>2</sup>
  - Up to about 10kW/cabinet for HPC
- Often not hot aisle/cold

# Electricity

**Typical bill: £350,000**

- **Estates**

- Building and plant
- Pays electricity bill
- Meter data often limited
- No input on IT spend
- Major projects, CDM, M&E consultants, PABX

- **Computing Services**

- Must deliver IT service
- No knowledge of bill
- Unable to monitor use
- Buys equipment blind
- VMWare, thin client, SAN, PoE, IPT, VoIP

**- Limited communication and understanding -**

# Example - Data Centre Set Point

- Reported average: 21.5°C
  - values from 20°C to 25°C
- ASHRE recommendation now: 18°C to 27°C
  - was 20°C to 25°C up to late 2008
- 4% saving claimed, for 1°C higher
  - Up to 20% aircon saving by raising to 26°C?
  - But equipment fans may work harder
  - And aircon performance not simple
- **Who initiates/manages such a change?**

# ASHRE References

- The American Society of Heating, Refrigerating and Air-Conditioning Engineers
  - advances technology to serve humanity and promote a sustainable world.
  - [http://tc99.ashraetcs.org/documents/ASHRAE\\_Extended\\_Environmental\\_Envelope\\_Final\\_Aug\\_1\\_2008.pdf](http://tc99.ashraetcs.org/documents/ASHRAE_Extended_Environmental_Envelope_Final_Aug_1_2008.pdf)
- Savings reference
  - <http://www.datacenterknowledge.com/archives/2009/01/29/hvac-group-says-data-centers-can-be-warmer/>

# IT Equipment Buying

- Typically, it is blind to electricity consumption
  - The bill is somebody else's responsibility
  - Information not available from server suppliers, now
  - Cost from configuration tool, but not electricity use
  - Lots of other complex issues...
  - Partial information from Sun for X2200 only
    - <http://www.sun.com/servers/x64/x2200/calc/>
- Sheffield includes life cost of electricity in VFM

# Measuring Power Use

- Manufacturer's figures, where they exist
- Measure devices
  - instantaneously
  - or over a period
- Use meter readings
- Remember aircon, UPS overheads

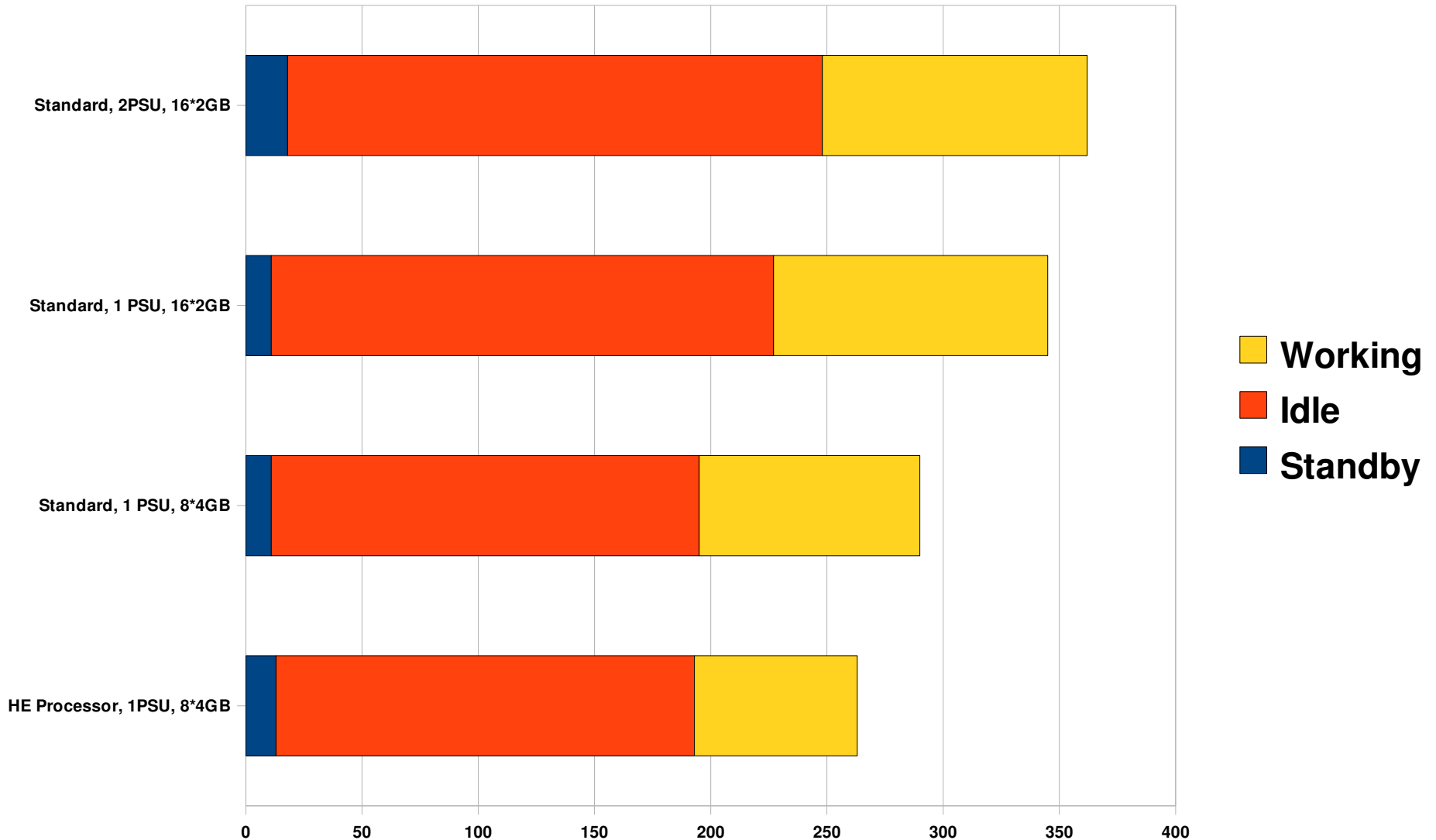


# Electricity Cost

- 10p per unit (per kilowatt hour)
  - Perhaps plus VAT (5%) and climate change levy?
  - Increasing, so say 12p per unit
- Air and power conditioning overhead
  - in a cooled space 18p per unit to 24p per unit
- Over a year of  $365 \times 24 = 8760$  hours
  - £1.60 to £2.10 per watt per year
- Say **£1.80 per watt per year**

# Example - Sun X2200 HPC Server

## 25% Power Saving: £140 p/a



# European Code of Conduct

- **European Code of Conduct on Data Centres Energy Efficiency** adopted in 2008
  - [http://re.jrc.ec.europa.eu/energyefficiency/html/standby\\_initiative\\_data%20centers.htm](http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative_data%20centers.htm)
- **Best Practice Guidelines** to enable change
  - About 120 good practices: over all aspects
- Unlikely to become compulsory
  - HEFCE mindful of University independence
  - But probably unavoidable
  - Organisations can sign up

# Group Involvement

- Establish a cross disciplinary change board
  - Consider impacts, ensure effective solution
  - Definition of standard IT hardware
  - M&E implications of new services
  - Audit existing equipment
    - optimise and consolidate where possible
      - Virtualisation
      - Set point
      - Identify and deal with little used and unused services

# Some Top Rated Practices

- Buy energy efficient IT devices
- Use virtualised servers and storage
- Switch off hardware for unused services
- Virtualise little used services
- Separate cold air from heated return air
- Use free or economised cooling
- Increase temperature set points

# Shared Data Centres

- Universities typically have two Data Centres
  - For BC/DR, but at a short distance
  - Centre two, particularly, limited quality, capacity
  - Little or no tertiary provision
- Opportunity for sharing
  - Common in some other sectors, Health, LAs
  - Agreement for mutual disaster recovery
  - Business model for capacity, with transparent costs
    - Must work for the service
    - For providers
    - For clients
    - Funding available?

# Shared Data Centres, continued...

- Little spare capacity
  - Equipment refresh and consolidation,
  - New build and refurbishment
- Quality: not all Tier II, what is acceptable?
- Some technical issues
  - Dependent on a good network, but FCAL Storage?
- Real human and political issues
  - Trust: extending relationship beyond the network
  - Processes and procedures
    - Racking up, monitoring, PAT, fault handling at a distance
- **Decision still to be taken**

# Conclusion

- There is a lot that can be done to
  - Improve quality of provision
  - Reduce electricity consumption and costs
  - Meet wider agenda
- There are issues
  - Split responsibilities
  - Costs are currently hidden
  - Investment may be needed to make progress