# Energy Efficient Data Centres

Liam Newcombe
BCS Data Centre Specialist Group Secretary

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# Energy Use in the Data Centre

# EU Code of Conduct for Data Centre Operators

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# Asking the Wrong Questions

# Per Service Energy Use

# The DCSG Model

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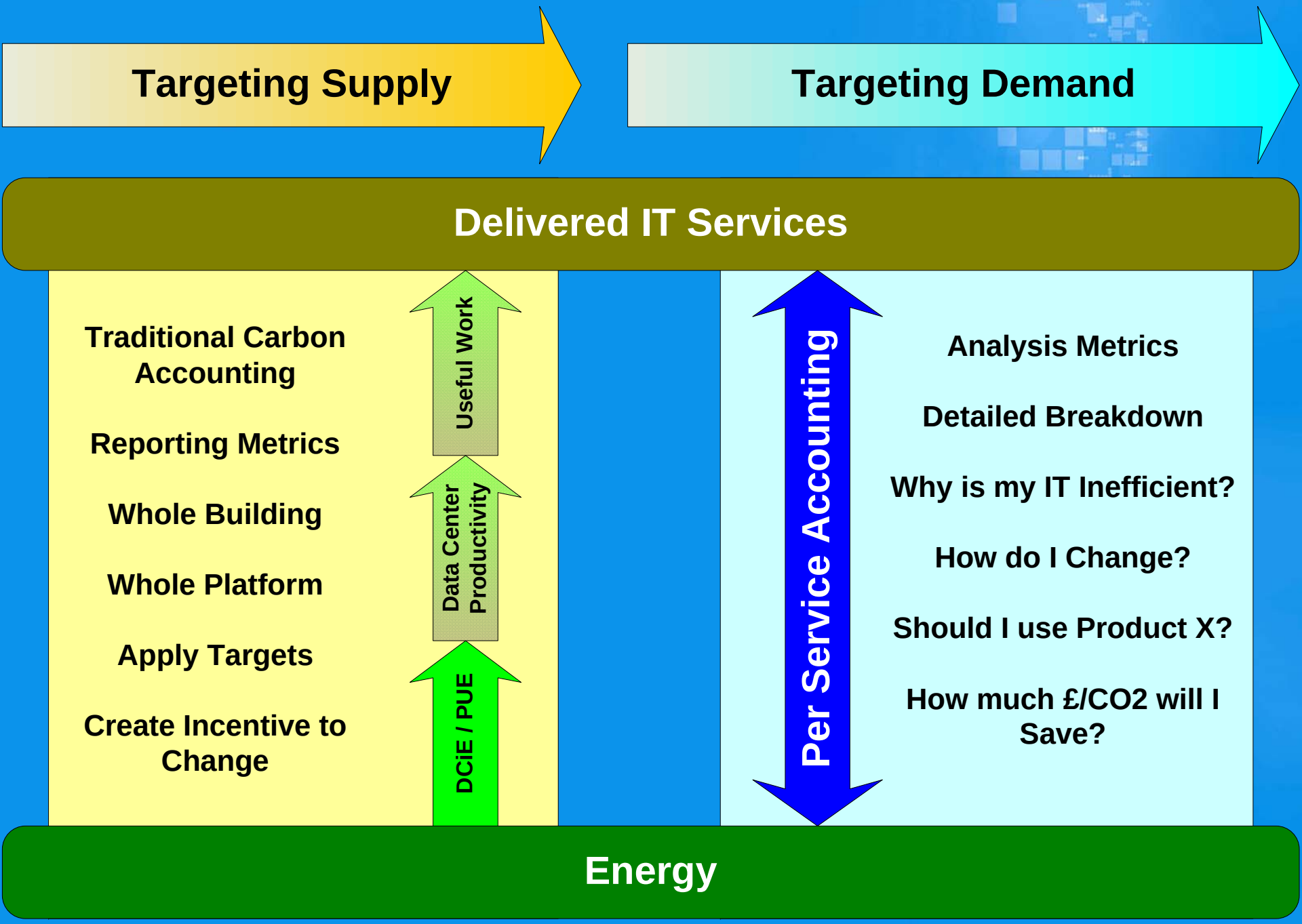
# Asking the Wrong Questions

# “For each Watt my Data Centre consumes what output do I get?”

vs.

# “For each Service I deliver how much energy do I use?”


Targeting Supply
Targeting Demand
Delivered IT Services
Traditional Carbon Accounting
Reporting Metrics
Whole Building
Whole Platform
Apply Targets
Create Incentive to Change
Useful Work
Data Center Productivity
DCiE / PUE
Per Service Accounting
Analysis Metrics
Detailed Breakdown
Why is my IT Inefficient?
How do I Change?
Should I use Product X?
How much £/CO2 will I Save?
Energy

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**What is the marginal economic or environmental benefit of operating this IT service?**

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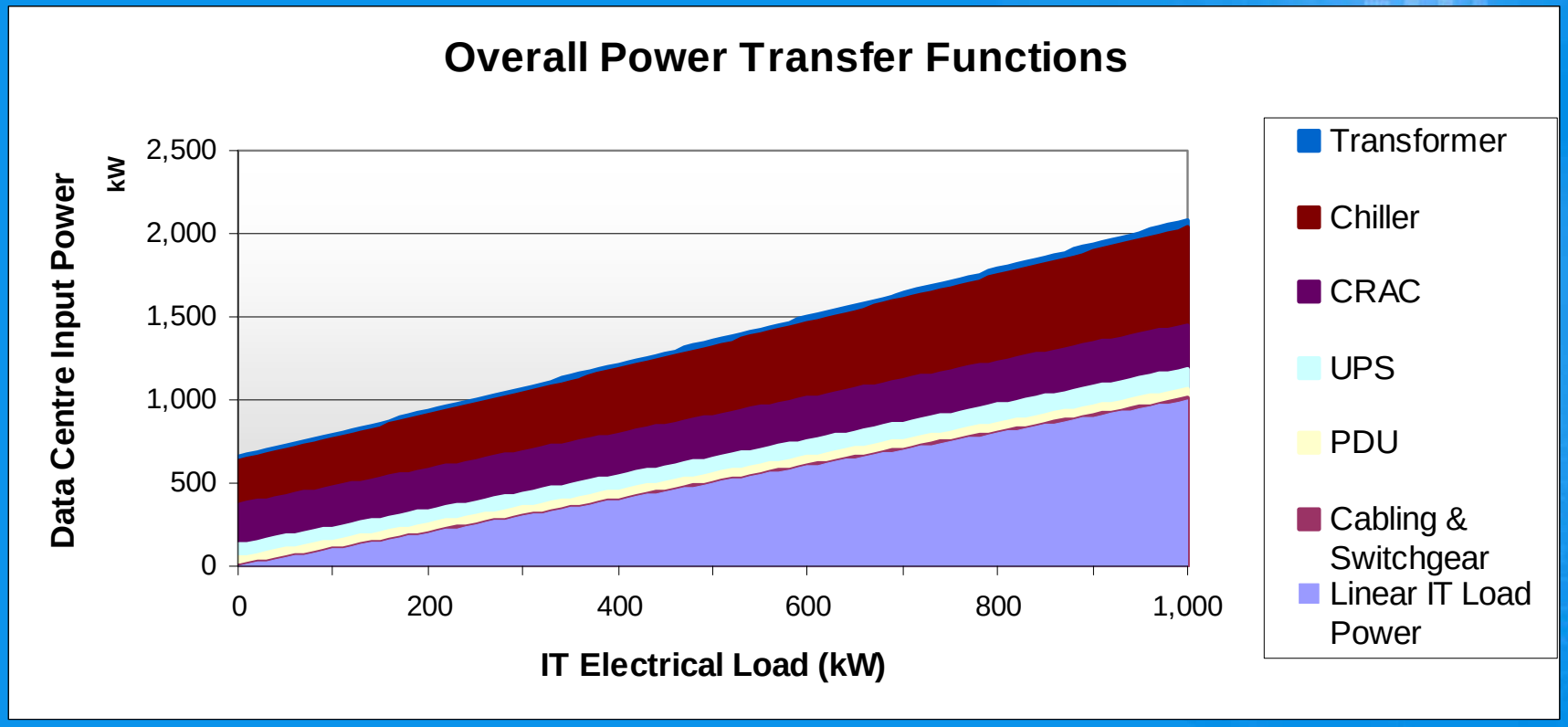
# Per Service Energy Use

## Data Centres

Servers

Server in a Data Centre

# Data Centre Power - Where does it go?



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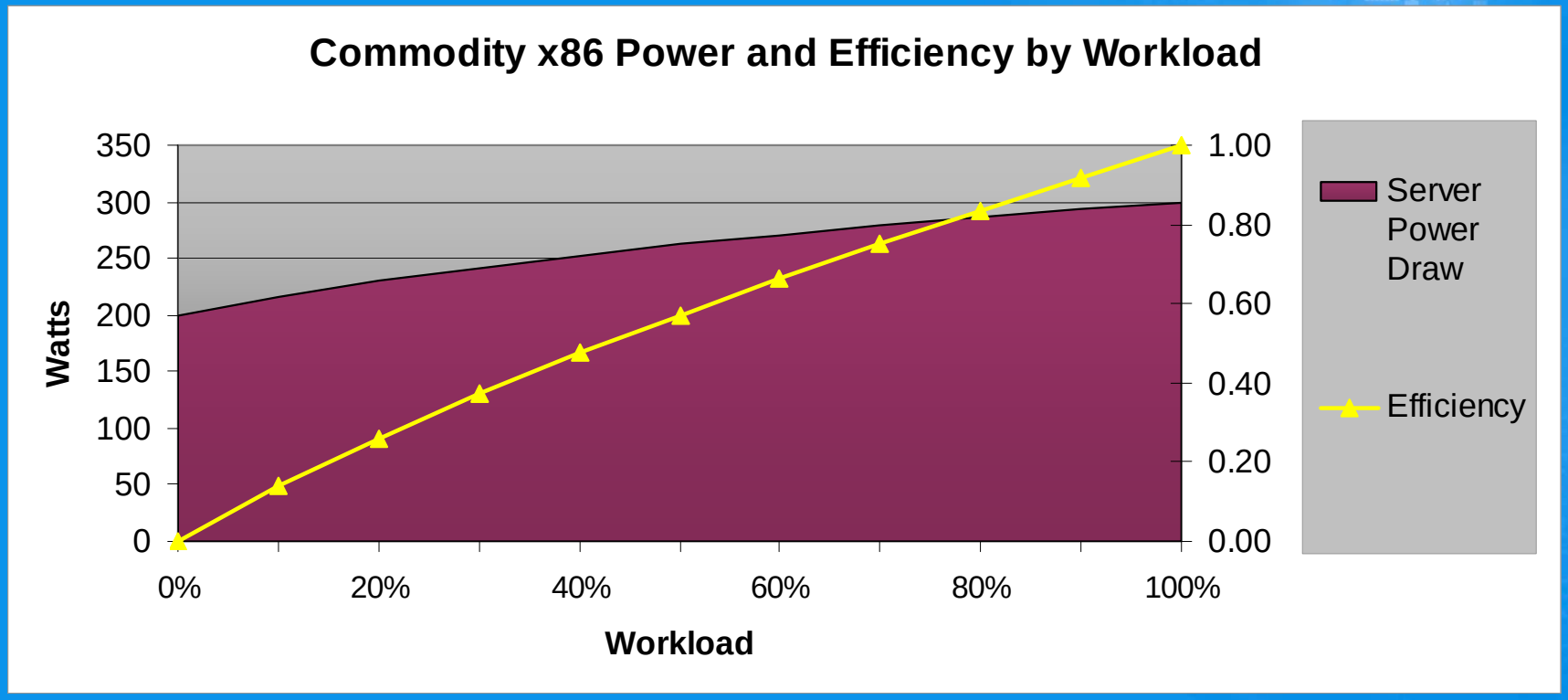
# Per Service Energy Use

Data Centres

**Servers**

Server in a Data Centre

# Server Power and Efficiency vs. Workload



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# Per Service Energy Use

Data Centres

Servers

**Server in a Data Centre**

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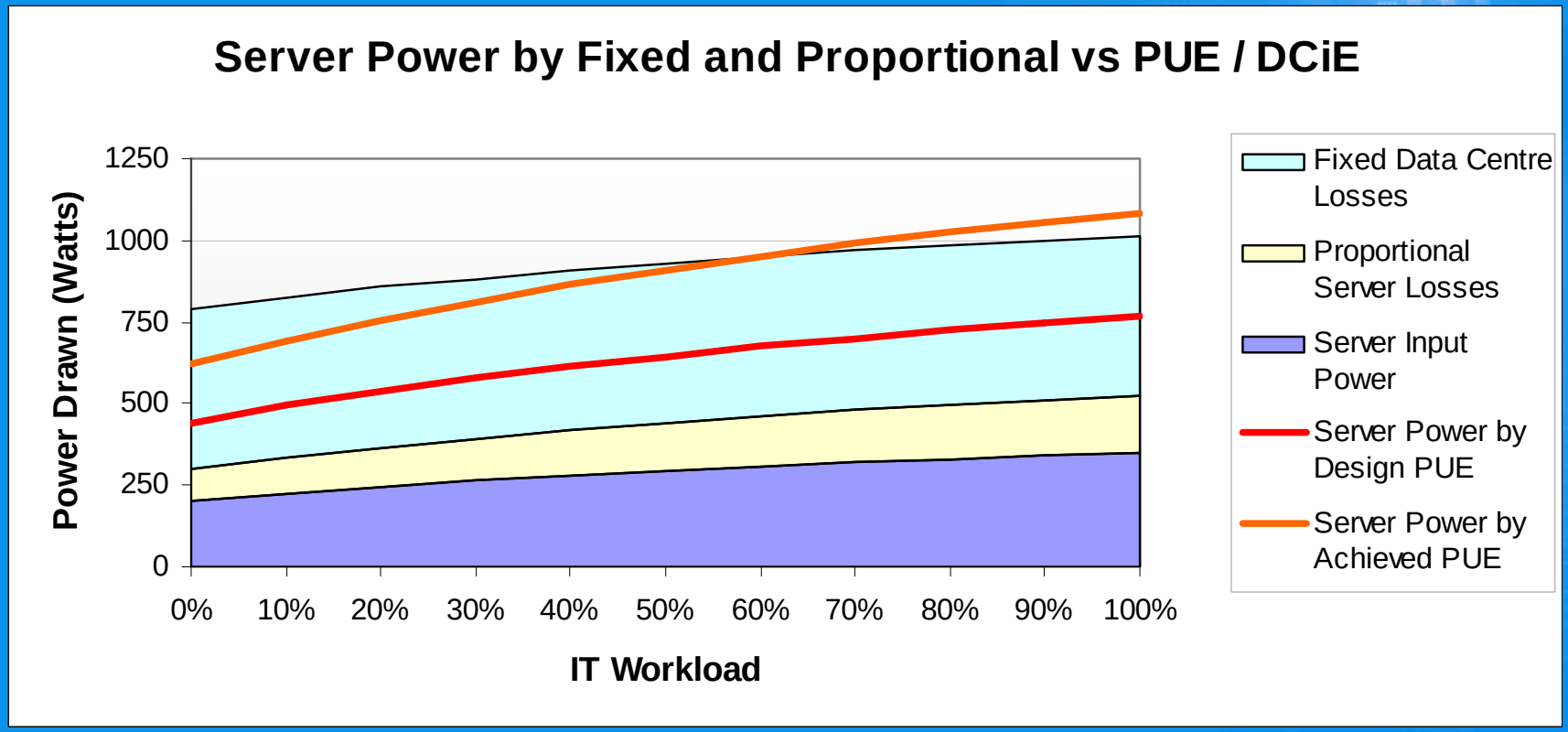
# Put the Server in a Data Centre

## What does DCiE / PUE tell us?



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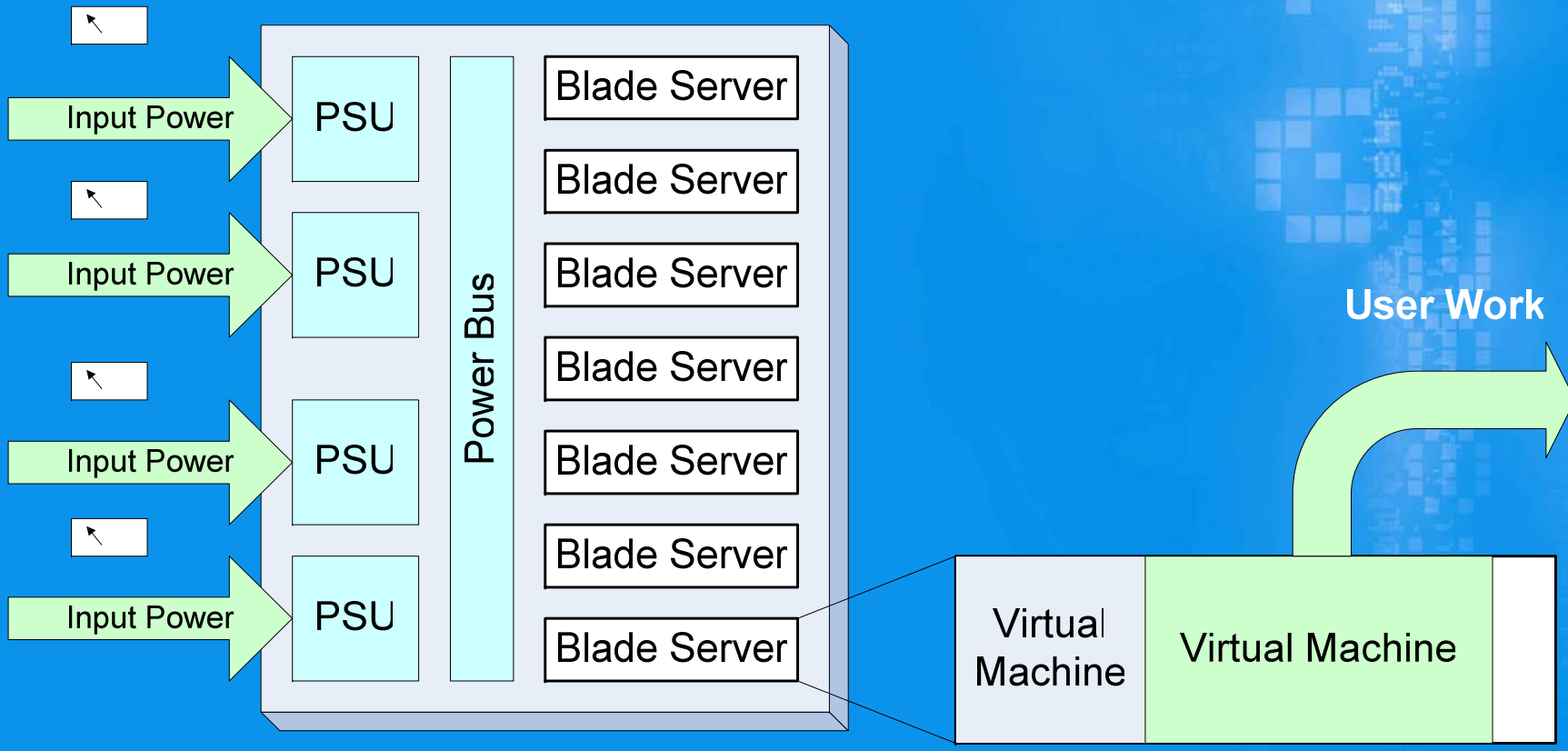
# Metering

## What about Blade Servers and Virtualisation?

# Metering Fails for Blades or Virtualisation



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# Metering

## Must be able to link the logical to the physical

## Does not address our problem

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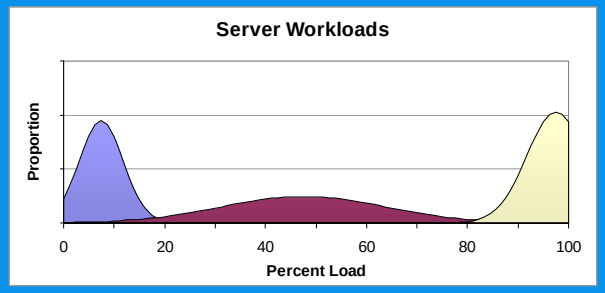
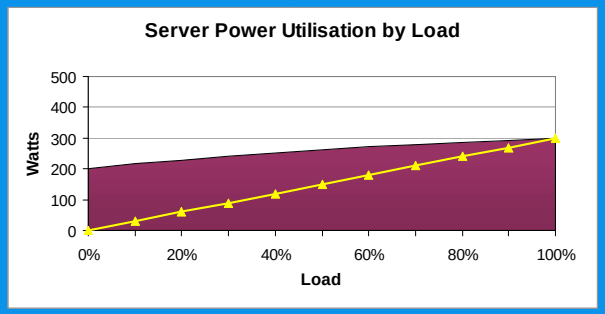
# DCSG Data Centre Model

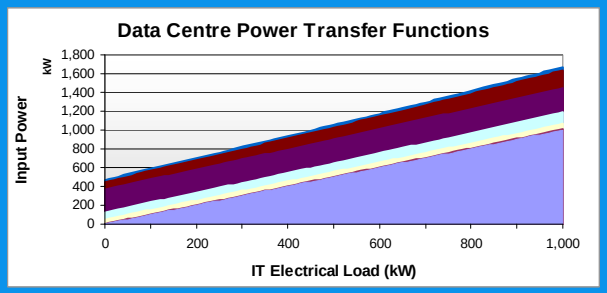
# DCSG Data Centre Model




IT Workload




IT Device Load to Power Function




Data Centre Power Transfer Function

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# EU Code of Conduct for Data Centre Operators

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# Goals and Scope

# Development

# Best Practice

# Release

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# Goals and Scope of the CoC

## Goals

- Led by Paolo Bertoldi, Directorate General
  - *“aim is to inform and stimulate Data Centre operators to reduce energy consumption in a cost effective manner without hampering the critical function ….”*
- A Voluntary Commitment
- Reward best practice with branding and associated EU Green marketing.

## Scope

- The Code of Conduct covers:
  - "Data centres" of all sizes – server rooms to dedicated buildings
  - Both existing and new
  - IT power and Facility power
  - Equipment procurement and system design

# Development

# Working Groups

- **Best Practice**
  - Focused on design best practice, Software, IT Architecture and Facility
- **Metrics & Measurement**
  - Developing a standard method of comparative measurement of energy efficiency
- **Data Collection & Analysis**
  - Performance benchmarking across the industry

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# Best Practice

## Best Practice Intent

- Some Practices are required for Participants
- Practices that apply to;
  - Existing estate
  - New IT equipment
  - New or refitted Data Centres
- It is understood that not all operators will be able to implement all required practices

# Required Practices

- Grid and Virtualisation
  - “Processes should be put in place to require senior business approval for any new service that requires dedicated hardware and will not run on a resource sharing grid or virtualised platform”
- Select efficient software
  - “Make the performance of the software, in terms of the power draw of the hardware required to meet performance and availability targets a primary selection factor ”

# Required Practices

- New IT Equipment
  - “Include the Performance per Watt of the IT device as a high priority decision factor in the tender process ”
- Power Provisioning
  - “Provision power and cooling only to the as-configured power draw capability of the equipment, not the PSU or nameplate rating ”

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# Example Scenario

**Same Computing Workload**

**100 One App Per Server Servers**

**15 Virtualised Servers**

**10 HPC Grid Servers**

**Old N+1 Data Centre, Nameplate Provisioning**

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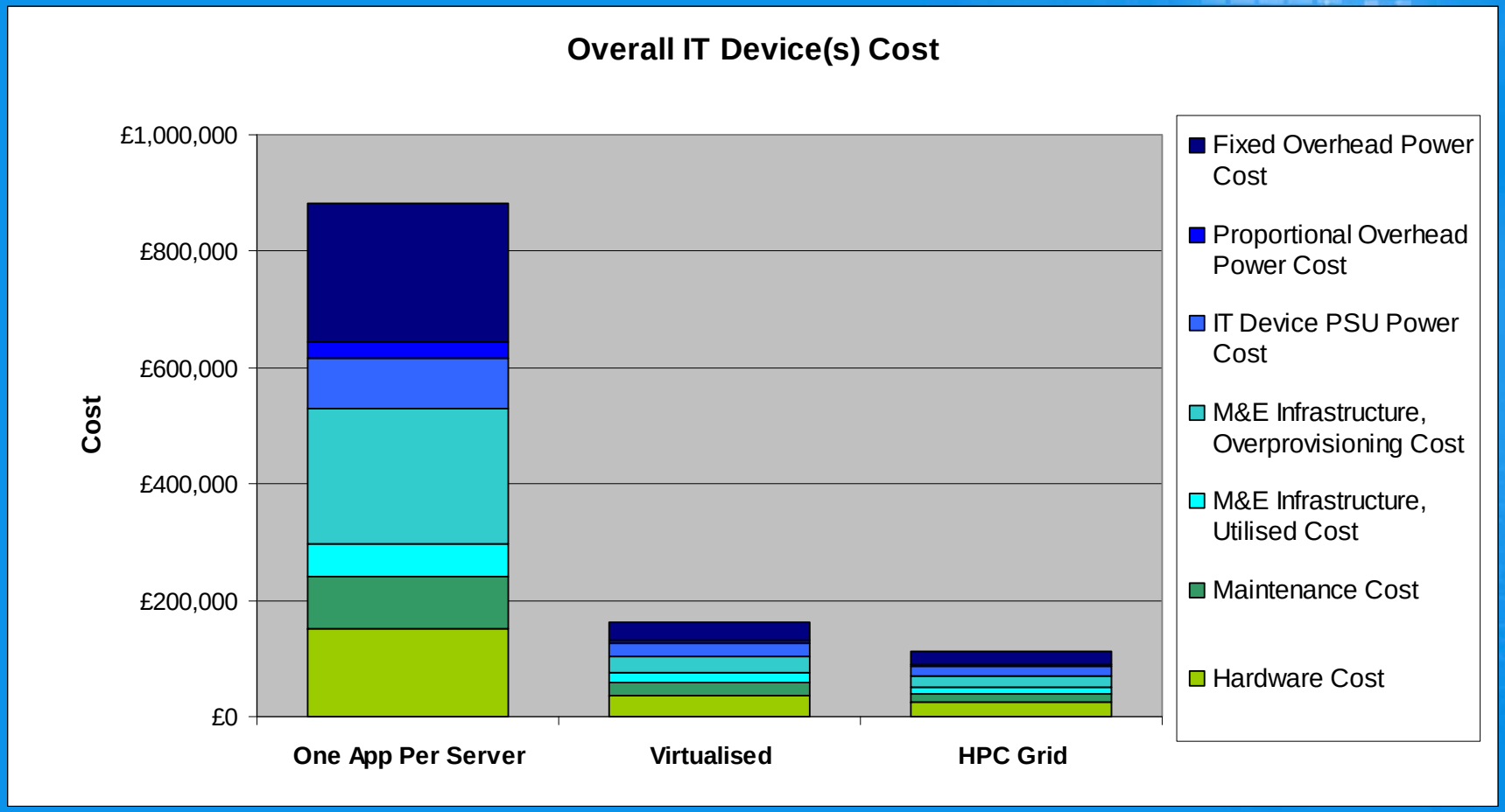
## Old N+1 Data Centre, Nameplate



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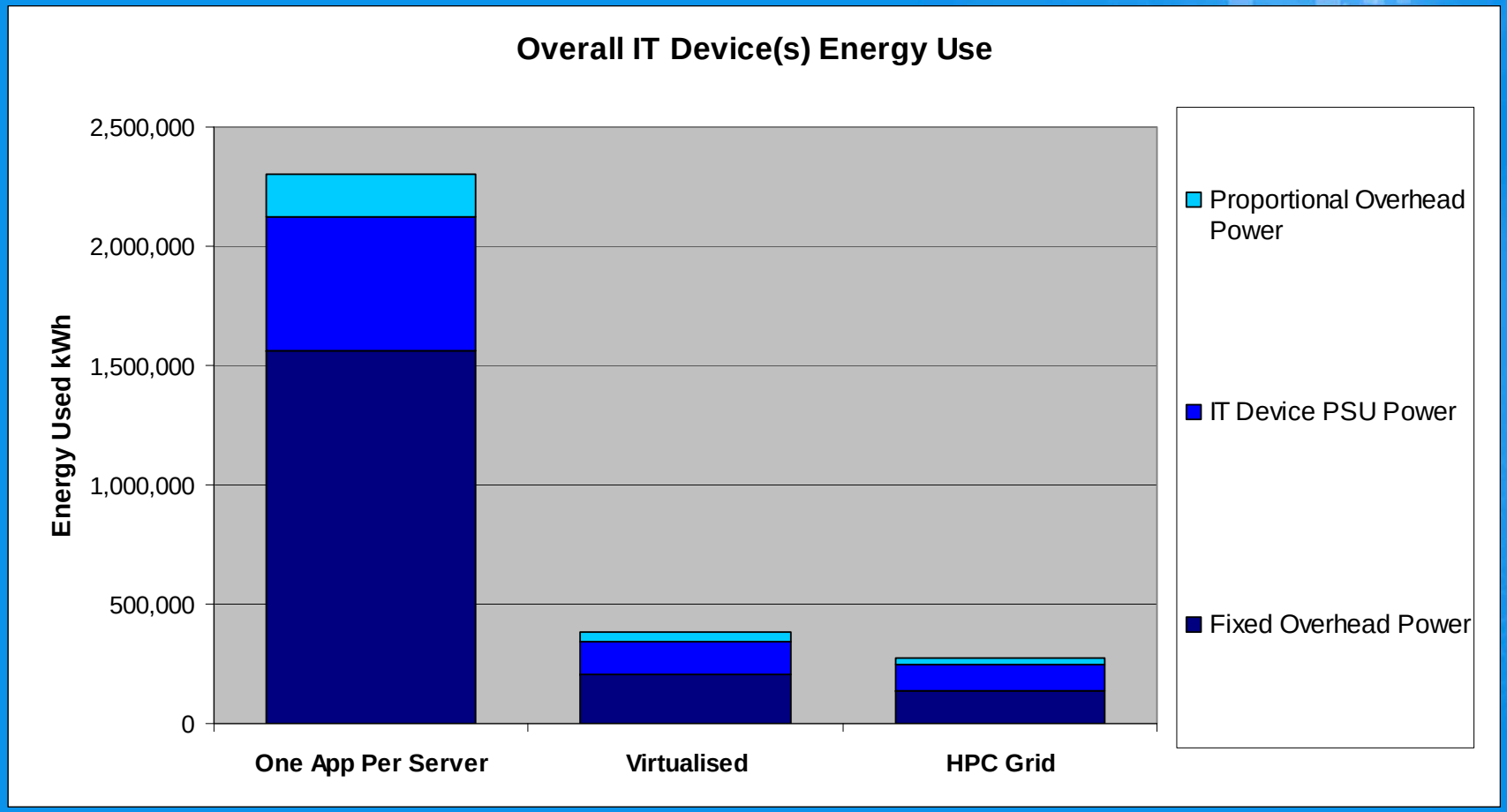
## Old N+1 Data Centre, Nameplate



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# Example Scenario

**Same Computing Workload**

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**Old N+1 Data Centre, Peak Provisioning**

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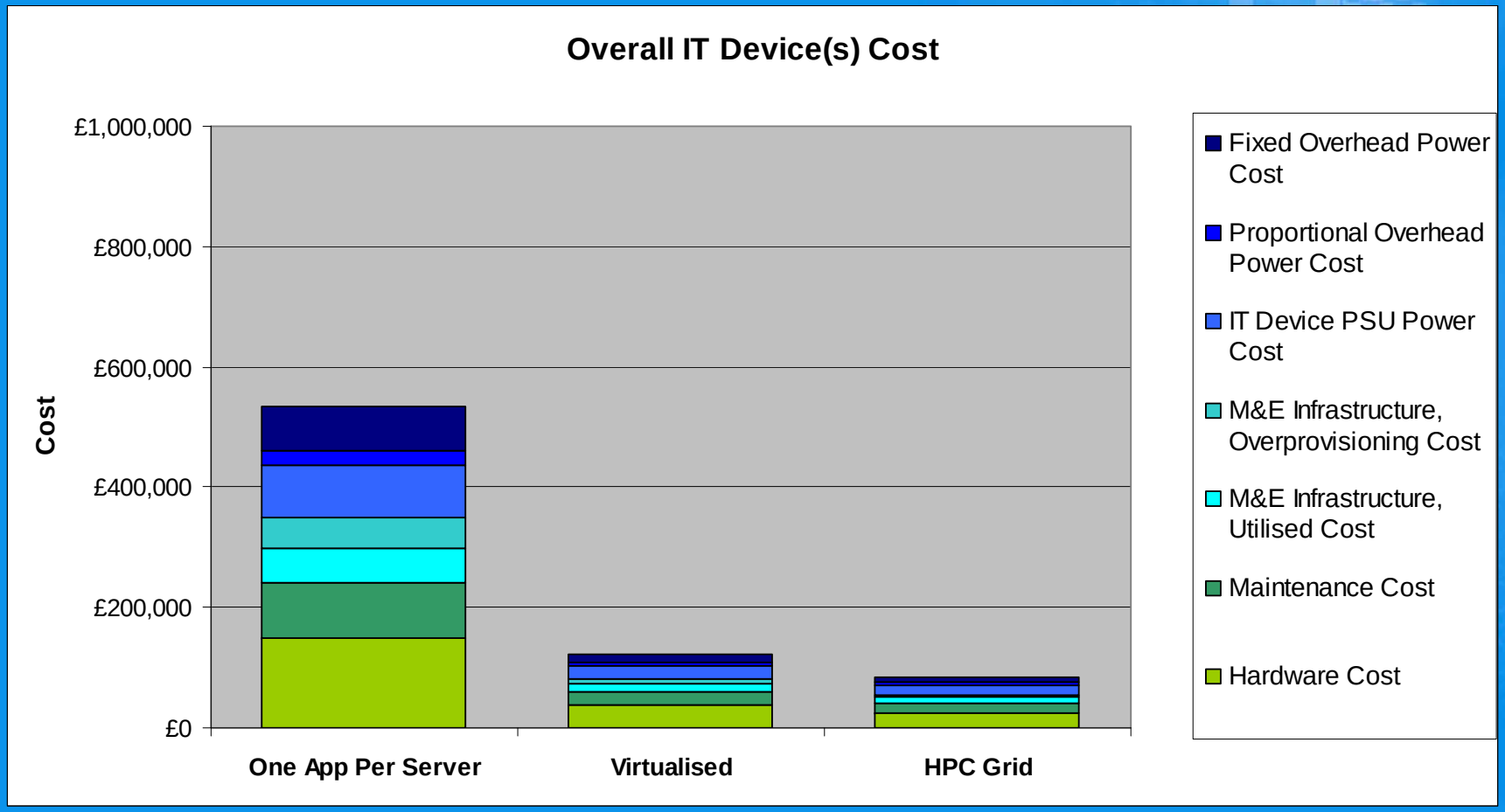
## Old N+1 Data Centre, Peak



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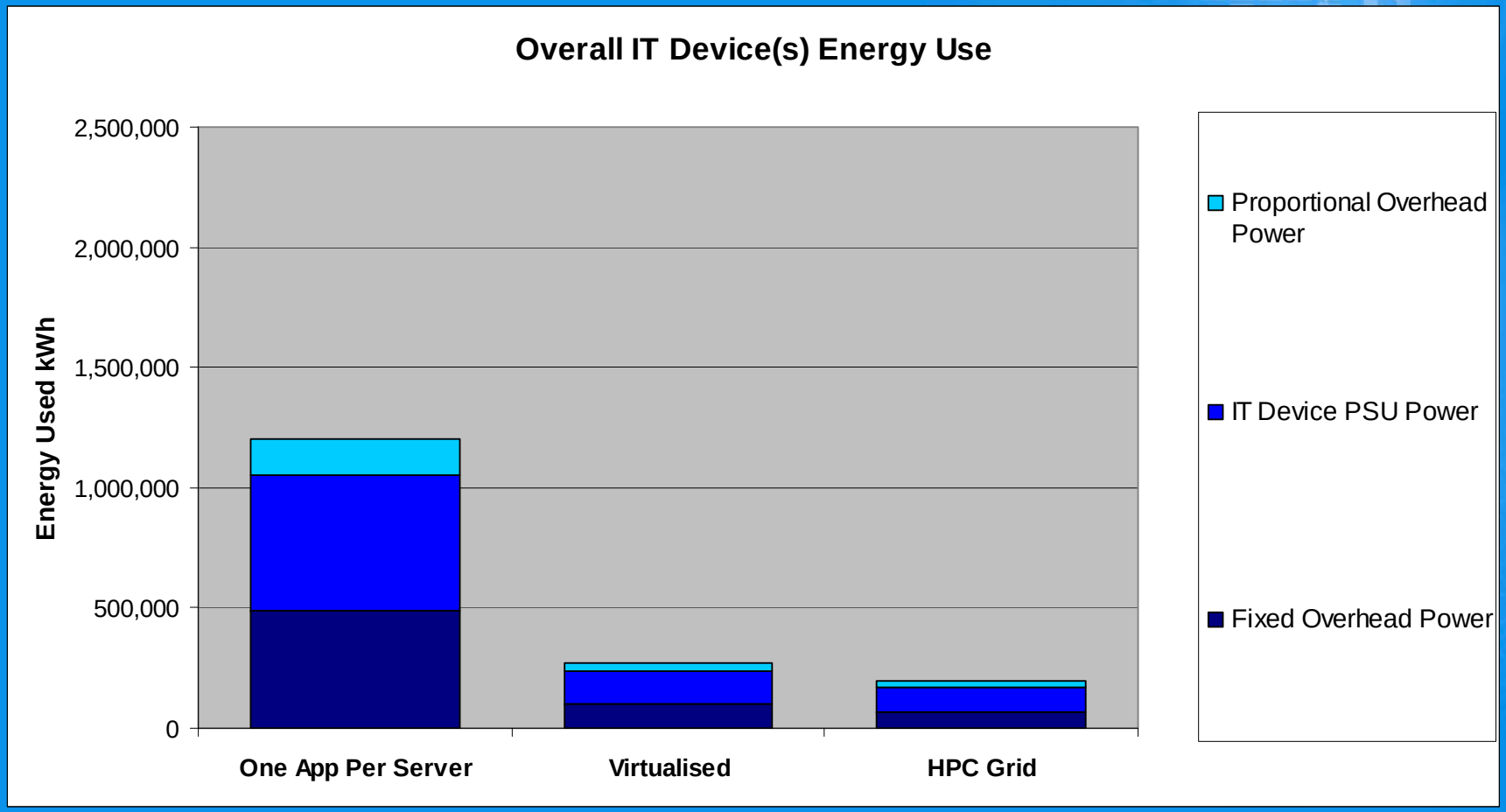
## Old N+1 Data Centre, Peak



# Required Practices

- Cooling
  - "Review and if possible raise target IT equipment intake air temperature"
    - Above the dew point
  - "Review of cooling before IT equipment changes"
  - "Rack air flow management"

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# Example Scenario

**Same Computing Workload**

**100 One App Per Server Servers**

**15 Virtualised Servers**

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**New N+1 Data Centre, Free Cooling**

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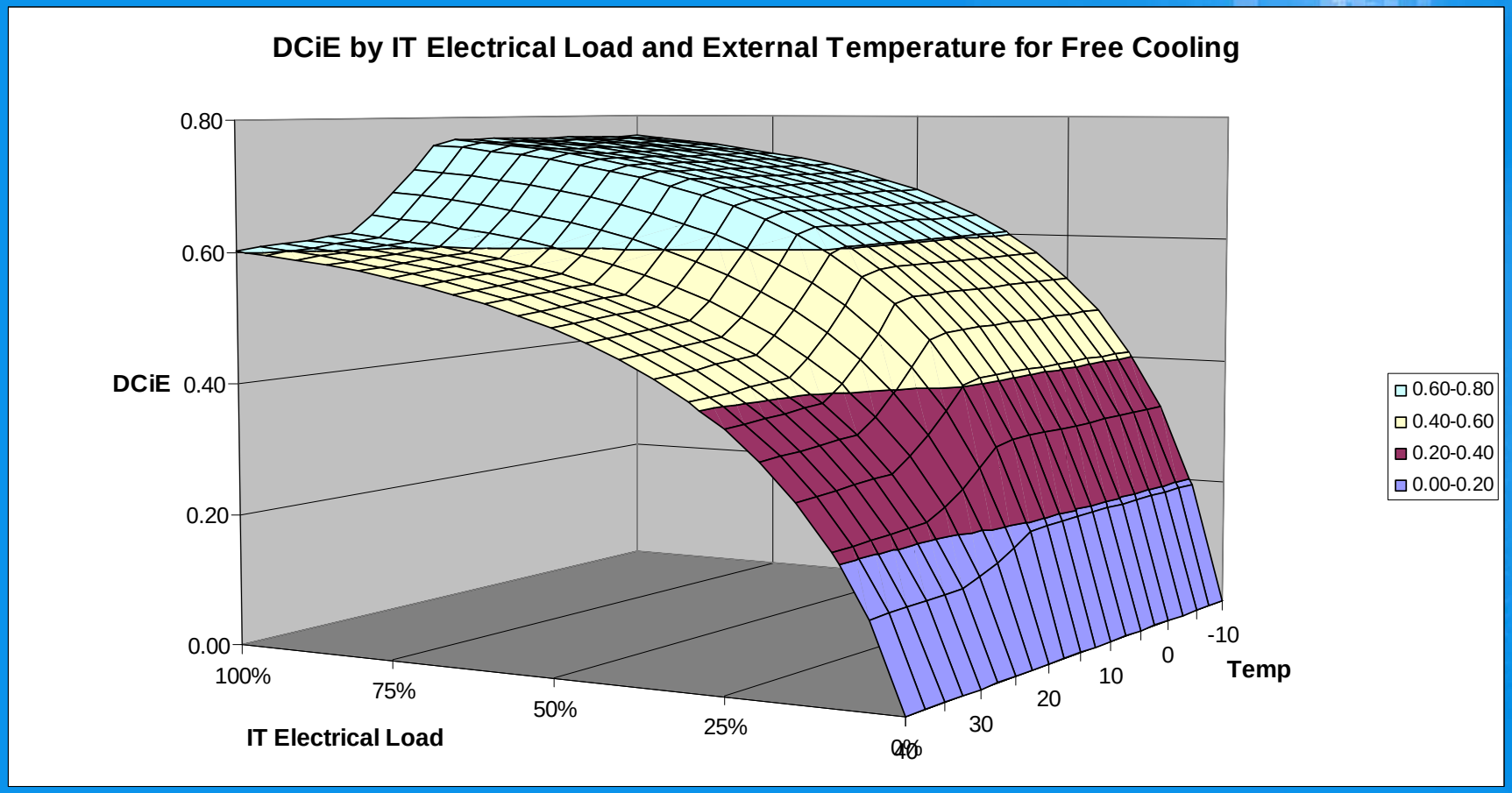
## New N+1 Data Centre, Free Cooling 19°C



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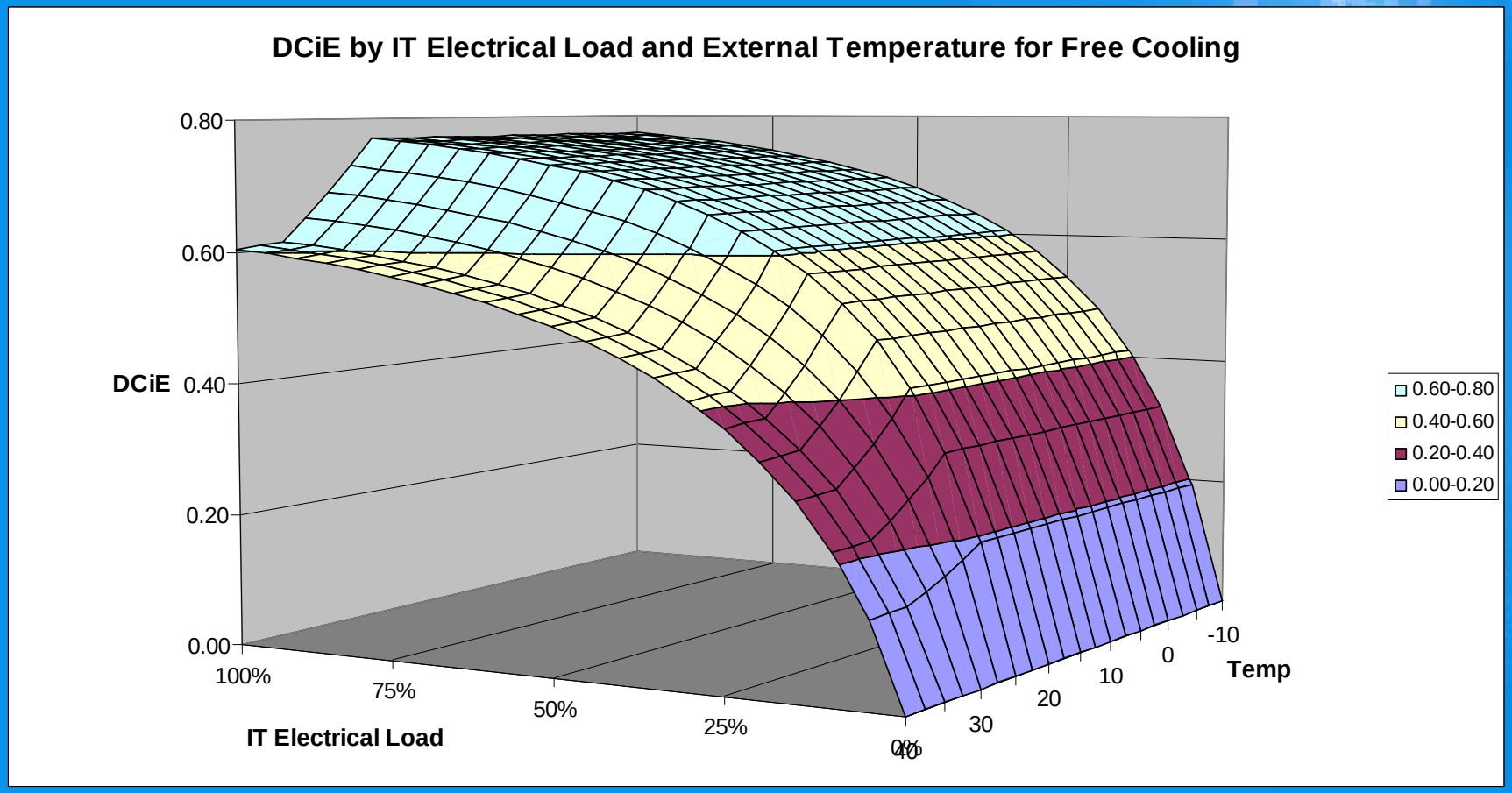
## New N+1 Data Centre, Free Cooling 25°C



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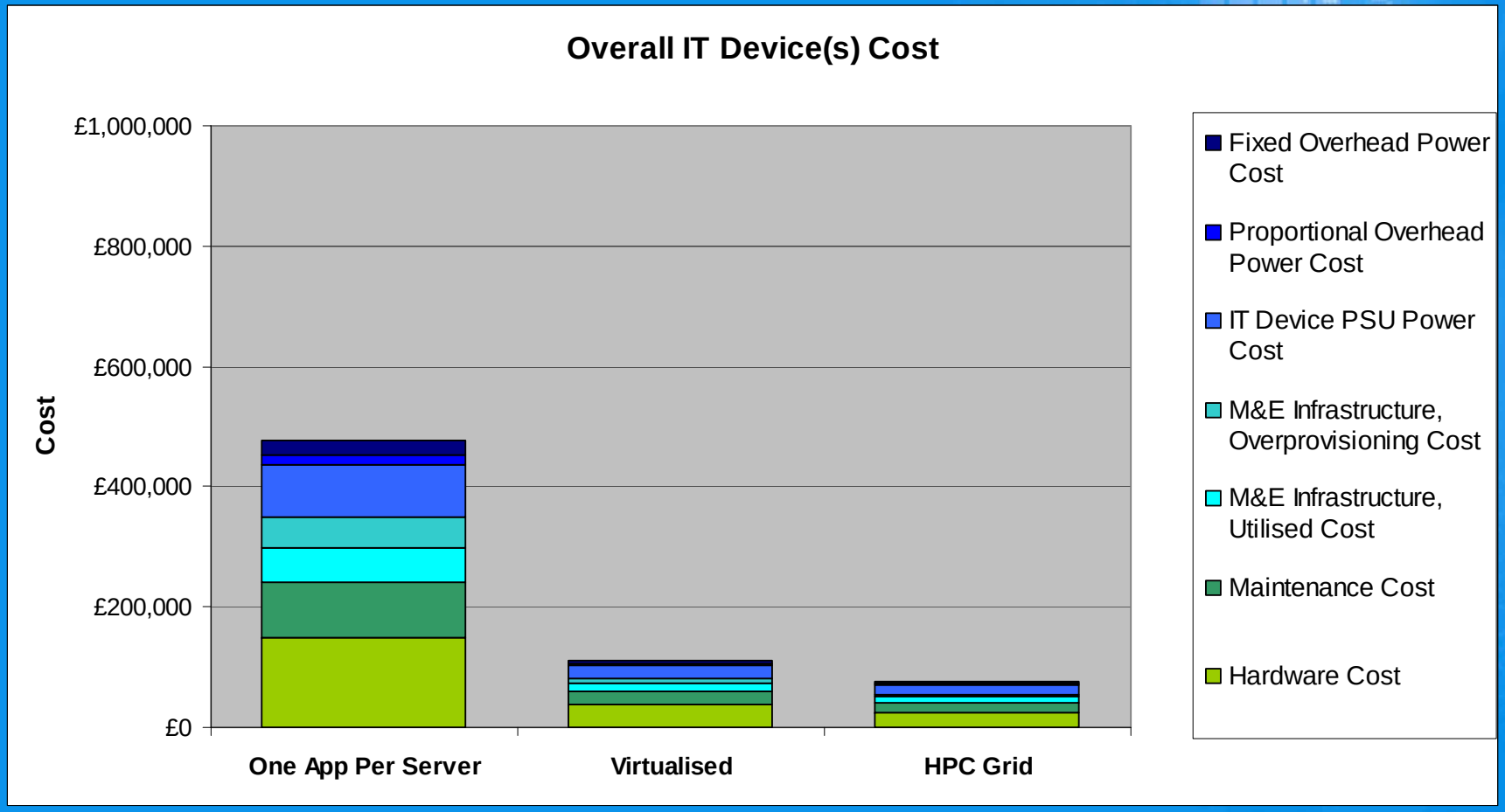
## New N+1 Data Centre, Free Cooling 25°C



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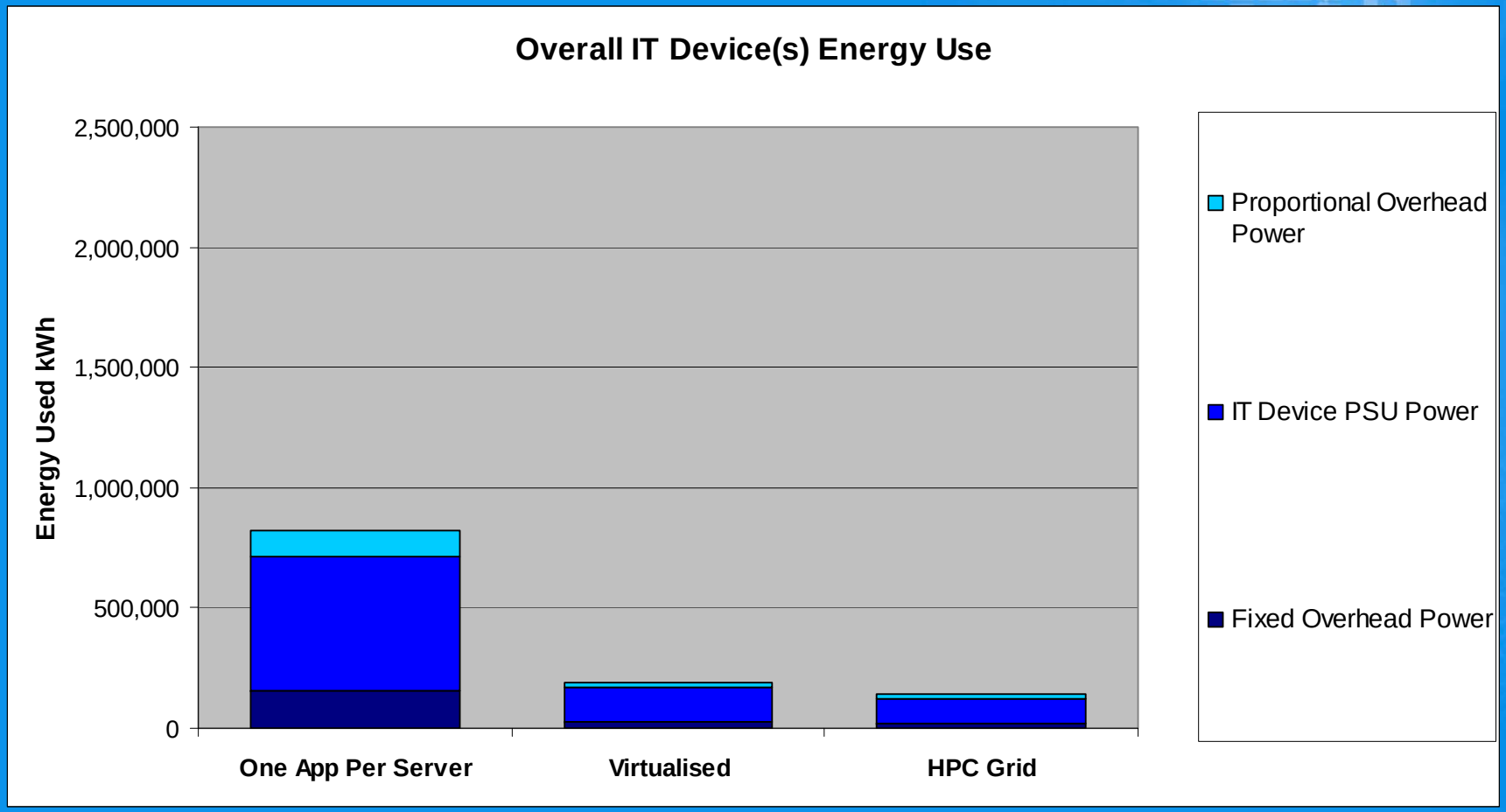
## New N+1 Data Centre, Free Cooling 25°C



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# Example Scenario

## 15 Virtualised Servers

**Old N+1 Data Centre, Nameplate Provisioning**

**Old N+1 Data Centre, Peak Provisioning**

**New N+1 Data Centre, Free Cooling**

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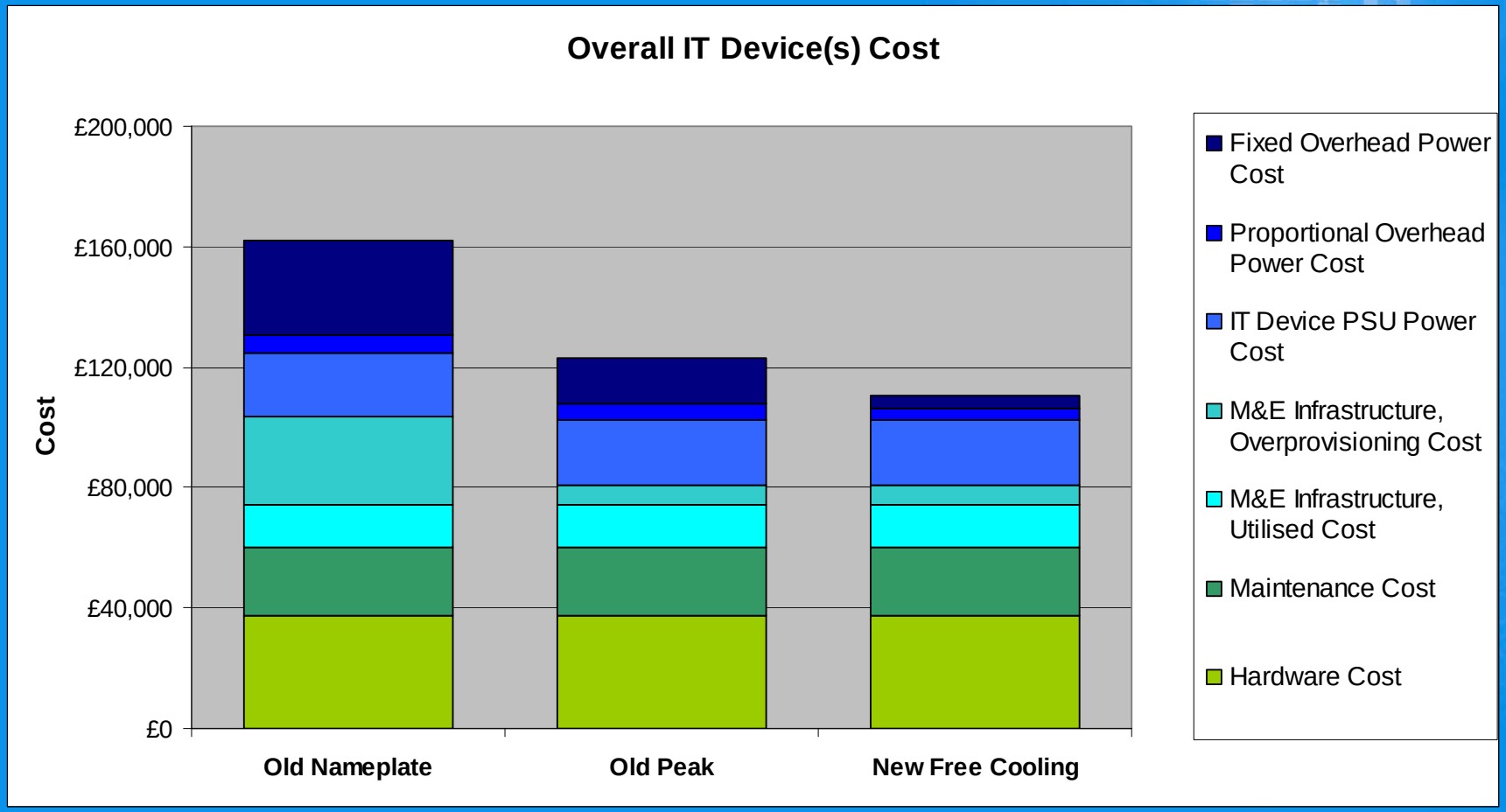
## Comparison of Virtualised Scenarios



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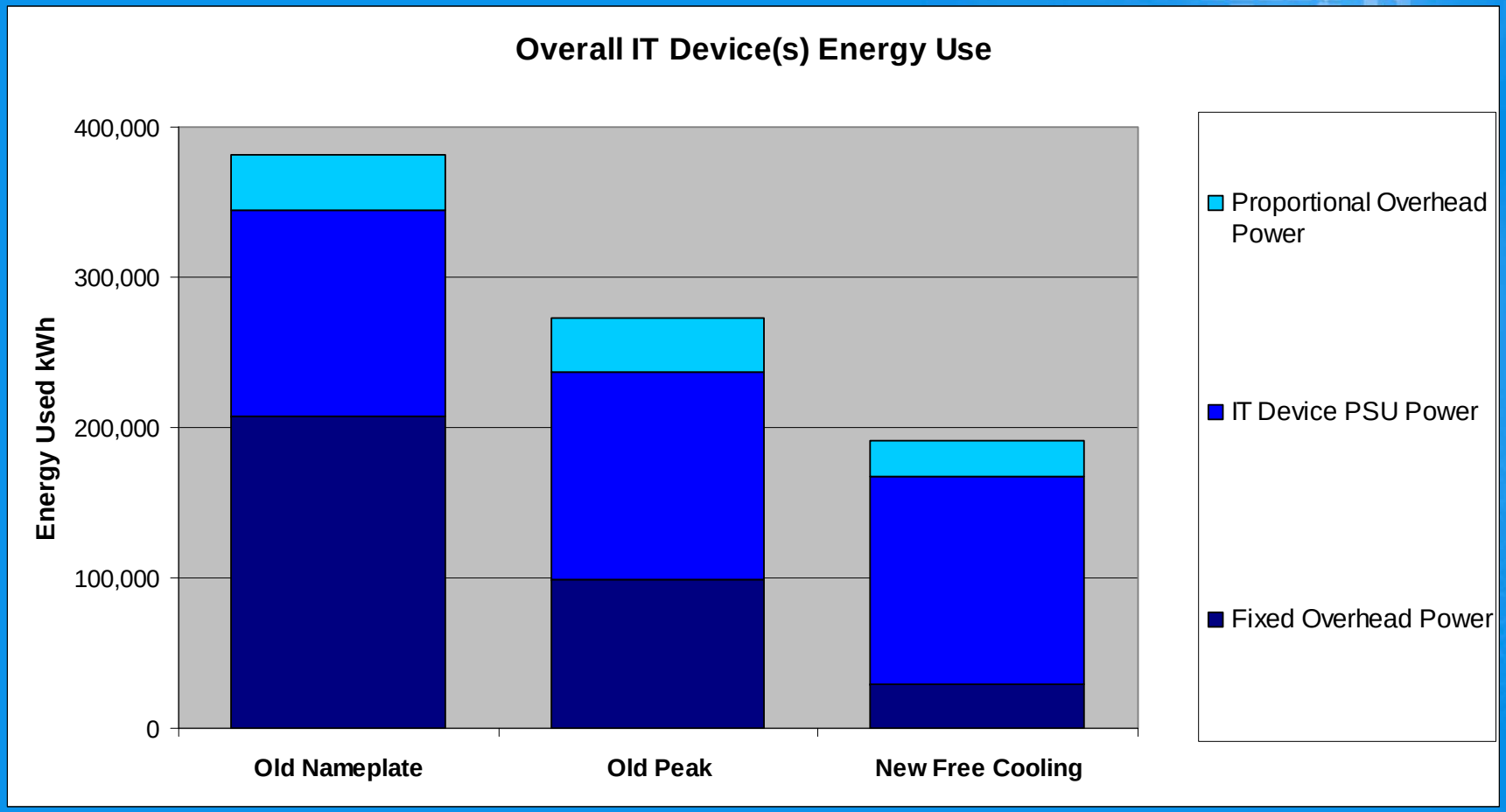
## Comparison of Virtualised Scenarios



# Required Practices – Retrofit or New

- Cooling
  - "Design – Contained hot or cold air"
  - "Variable Speed Air Fans"
  - "Rack air flow management"
- Utilisation, Management and Planning
  - "Lean provisioning of power and cooling for 18 months worth of data floor capacity"

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# CoC Release

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# Release Target

# Draft released 30th April

# 1st Release October 2008

# Thank you

# Find out more

# Data Centre Specialist Group

# http://dcsg.bcs.org