

# Data Centre Excellence

# Data Centre Energy Efficiency and Metrics

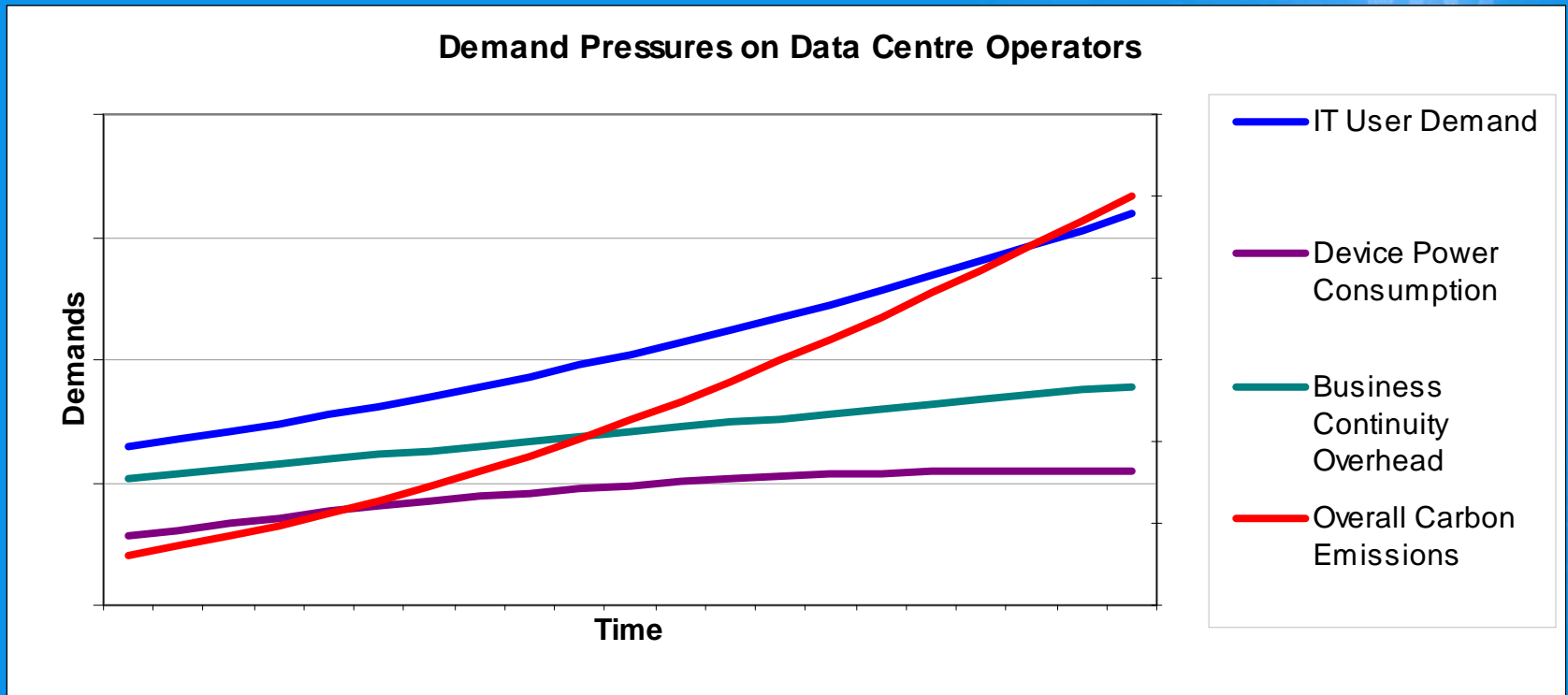
Liam Newcombe

BCS Data Centre Specialist Group Secretary

**The Energy Problem**  
**Data Centre Metrics**  
**Analysis of Metrics**  
**Per Service Accounting**  
**What You Should Do**

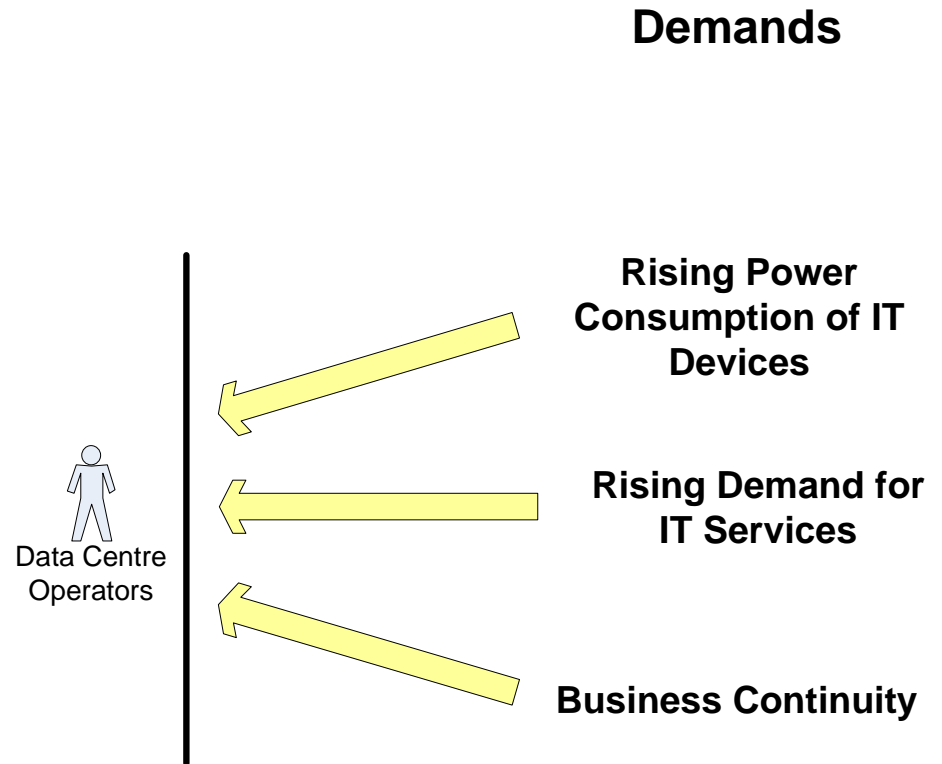
# The Energy Problem

## Energy Growth

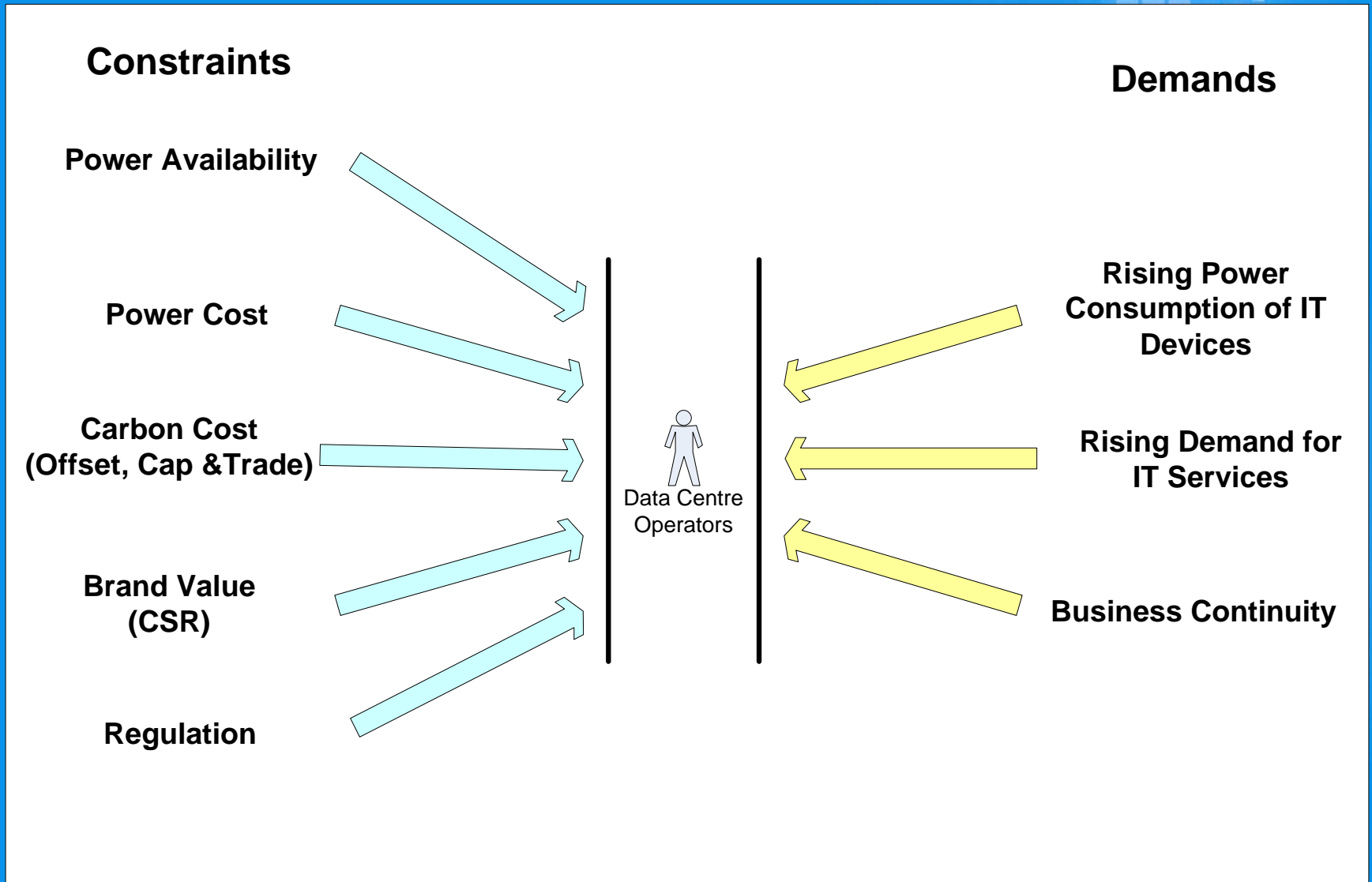


**Data Centre and IT are  
Trapped Between User Demands  
And Energy Constraints**

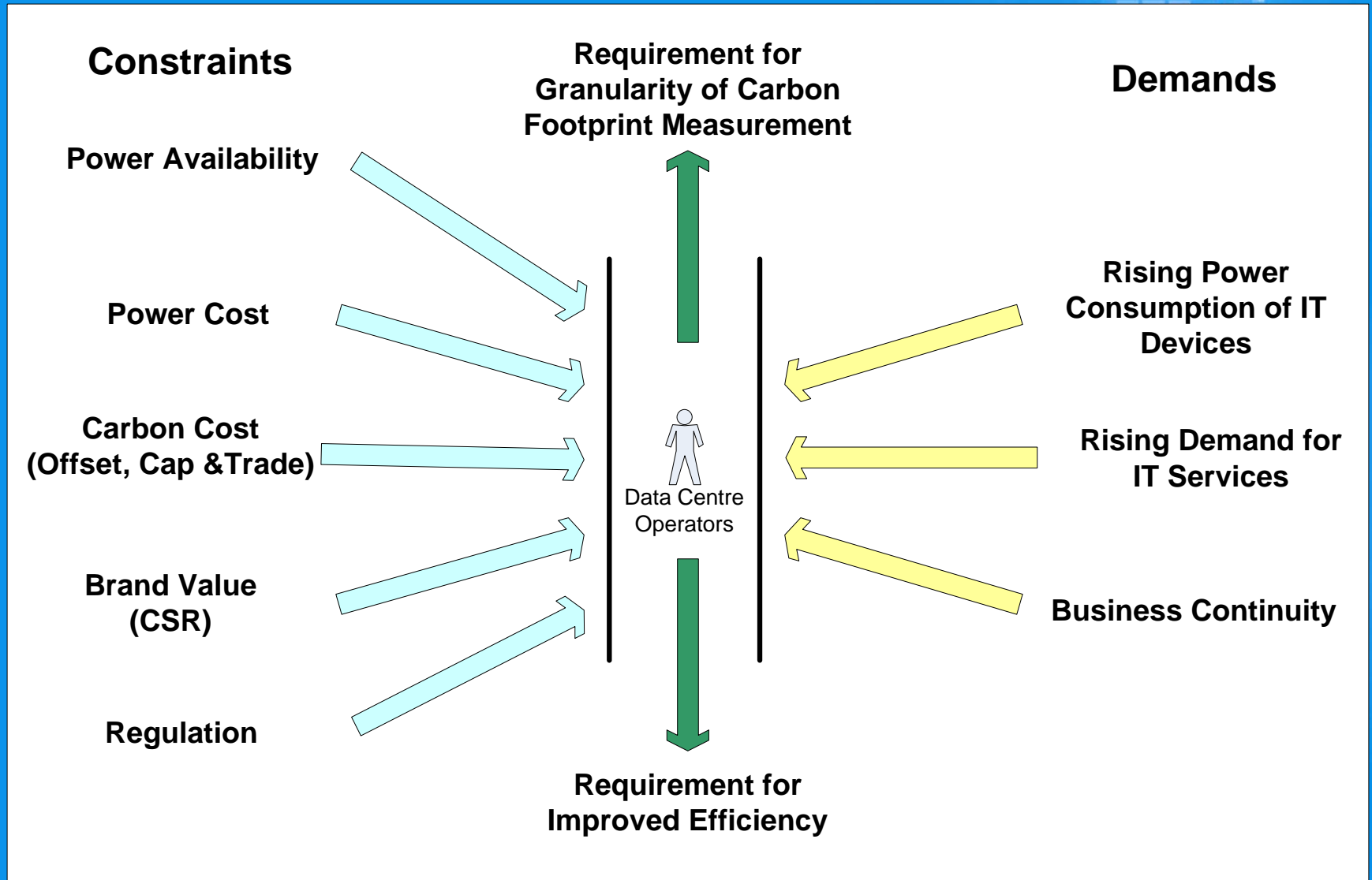
# Demands on Data Centre Operators



# Constraints



# New Requirements



# Data Centre Metrics

**Publicise and Measure**

**Understand and Improve**

**Delivered IT Services**

**Reporting Metrics**

**Analysis and Decision Metrics**

Useful Work

Data Center  
Productivity

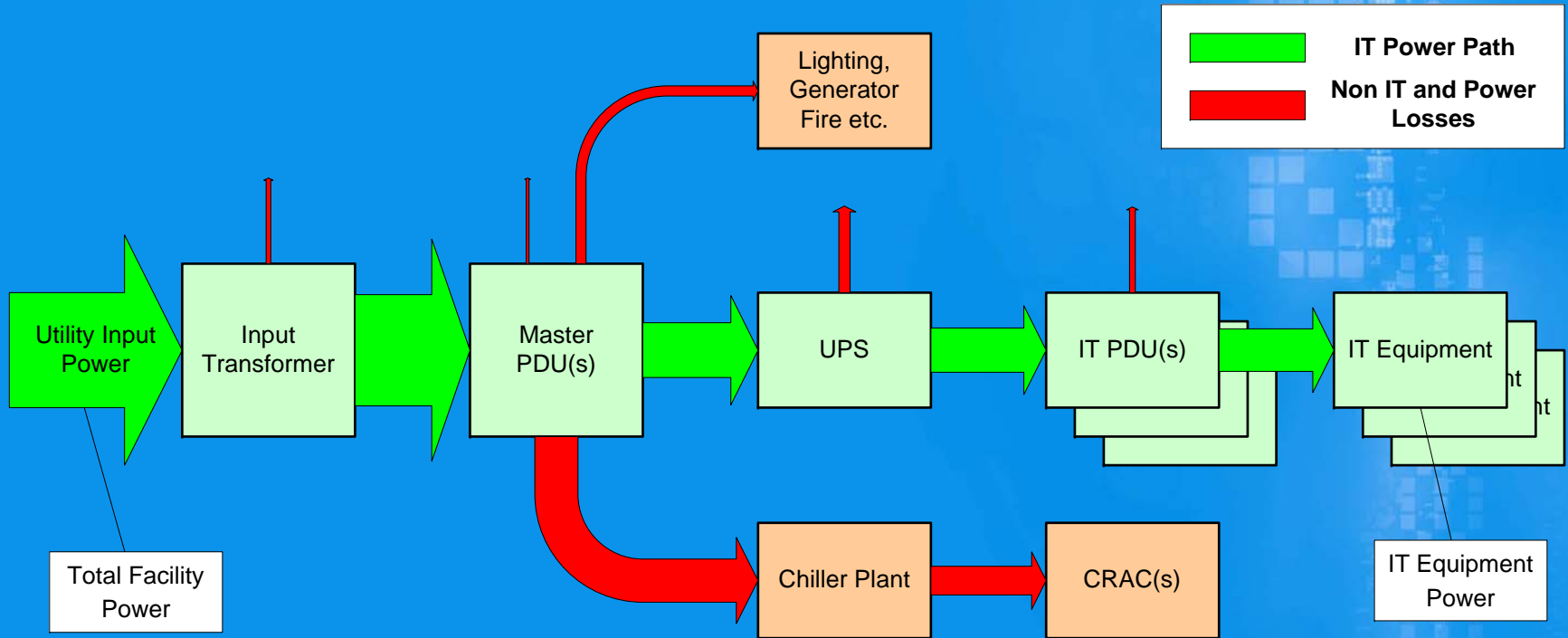
DCiE / PUE

Fixed and  
Proportional

Per Business Process / Service Accounting

**Energy**

# The Power Delivery Path



# Green Grid Metrics

Data Center infrastructure Efficiency

Power Usage (in)Effectiveness

$$PUE = \frac{1}{DCiE} = \frac{\text{Total Facility Power}}{\text{IT Equipment Power}}$$

## Where DCiE Works

- Reports a part of IT efficiency
  - The Data Centre infrastructure only
- Simple to measure and explain
  - “Our DCiE is 0.5, that means only half of the power we paid for got to the IT equipment”
- Hard metric
  - Measurement protocols are being defined
  - Targets can be set for performance

## Issues with DCiE

- Moving Target
  - DCiE changes all the time for many reasons
- Mixed Incentives
  - Save IT power and your DCiE gets worse

## Where Not to use DCiE

- Cannot Predict
  - Cannot be used to predict impacts of changes
  - Cannot be used to build an ROI case
- Not Reversible
  - Cannot tell you how much power an IT device uses
- Too Simple for Decision Making

# An Example of Too Simple for Decision Making

# Vehicle Fuel Economy

	Family Hatchback	4 Ton Luton Van	38 Ton Articulated	
Fuel Economy	60	30	8	MPG
Load Weight	0.5	3	30	Tons

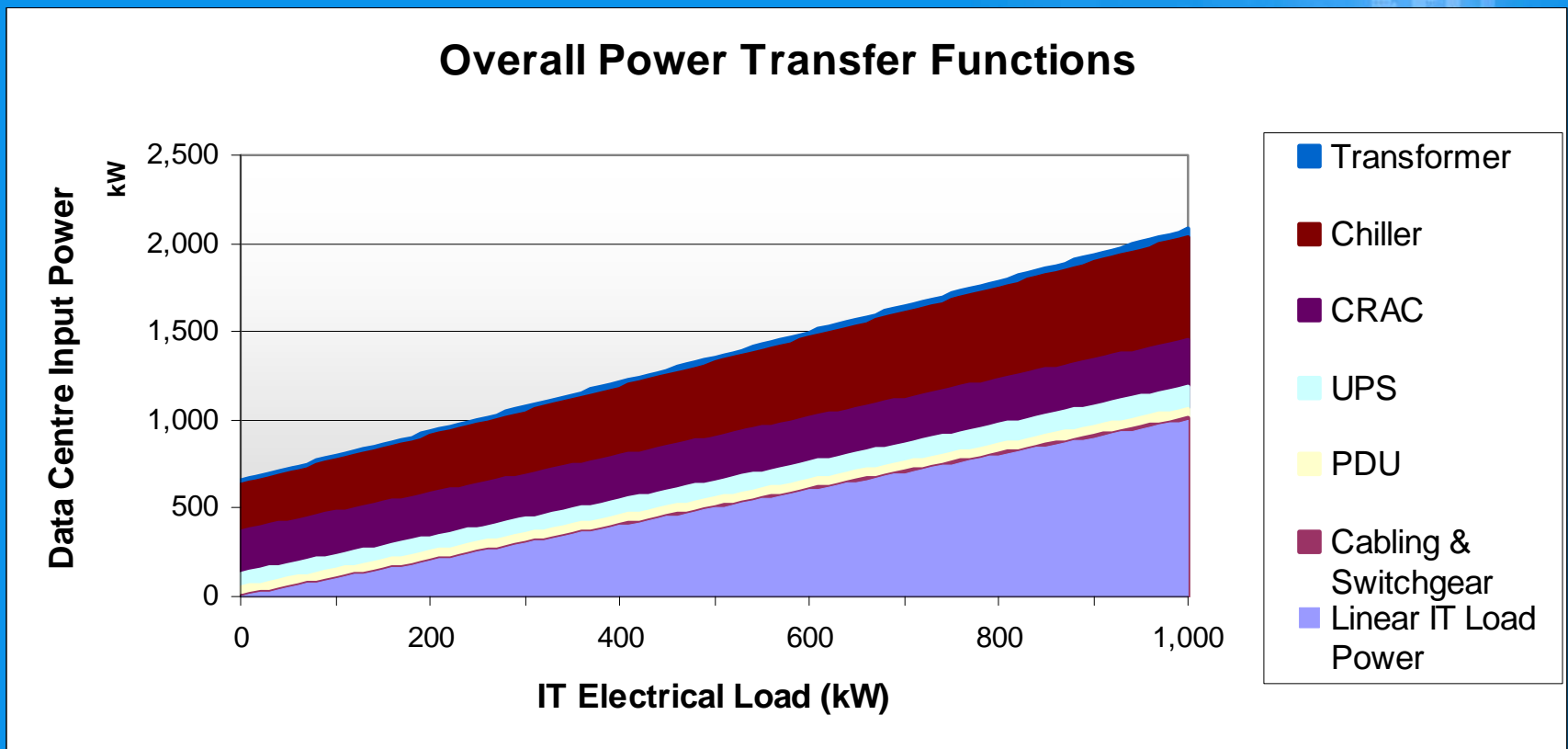
## Vehicle Fuel Economy

	Family Hatchback	4 Ton Luton Van	38 Ton Articulated	
Fuel Economy	60	30	8	MPG
Load Weight	0.5	3	30	Tons
Load Economy	<b>30</b>	<b>90</b>	<b>240</b>	Ton Miles Per Gallon

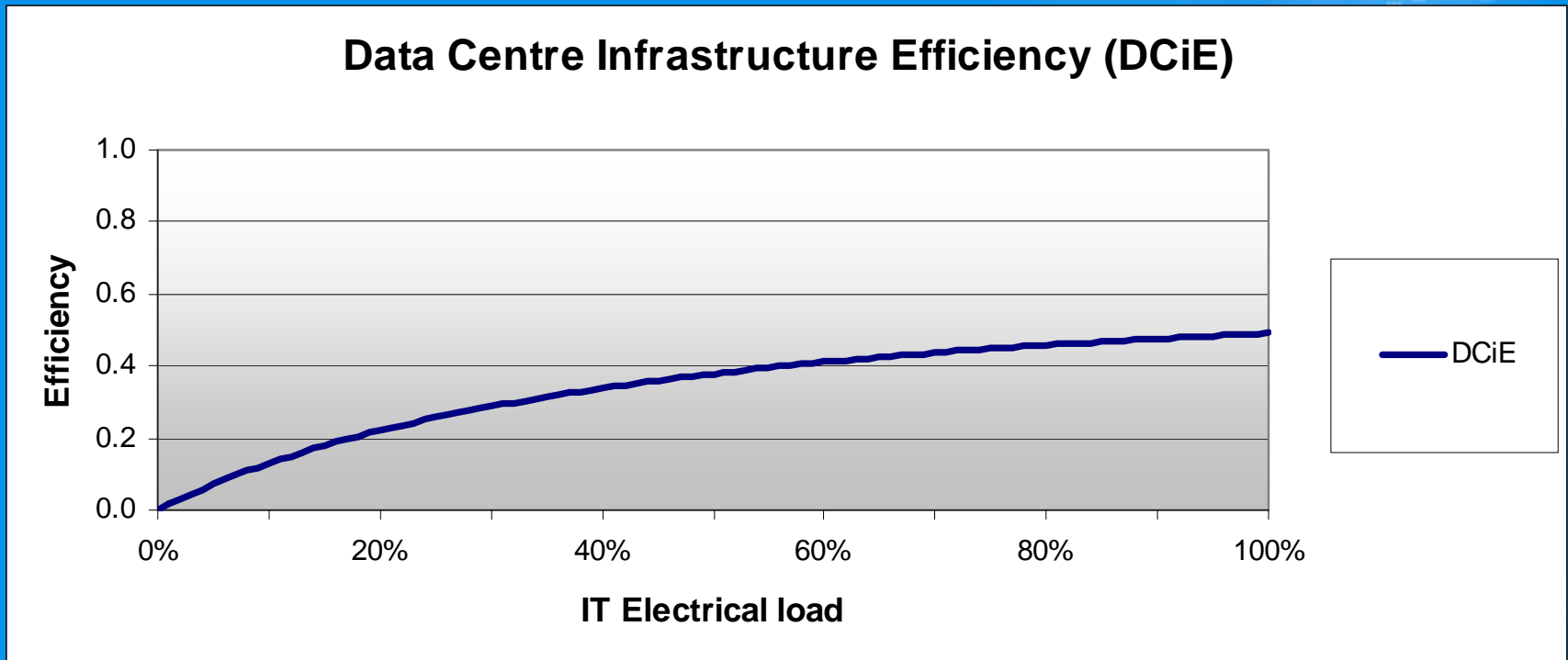
# **Analysis of Metrics**

## **The Data Centre**

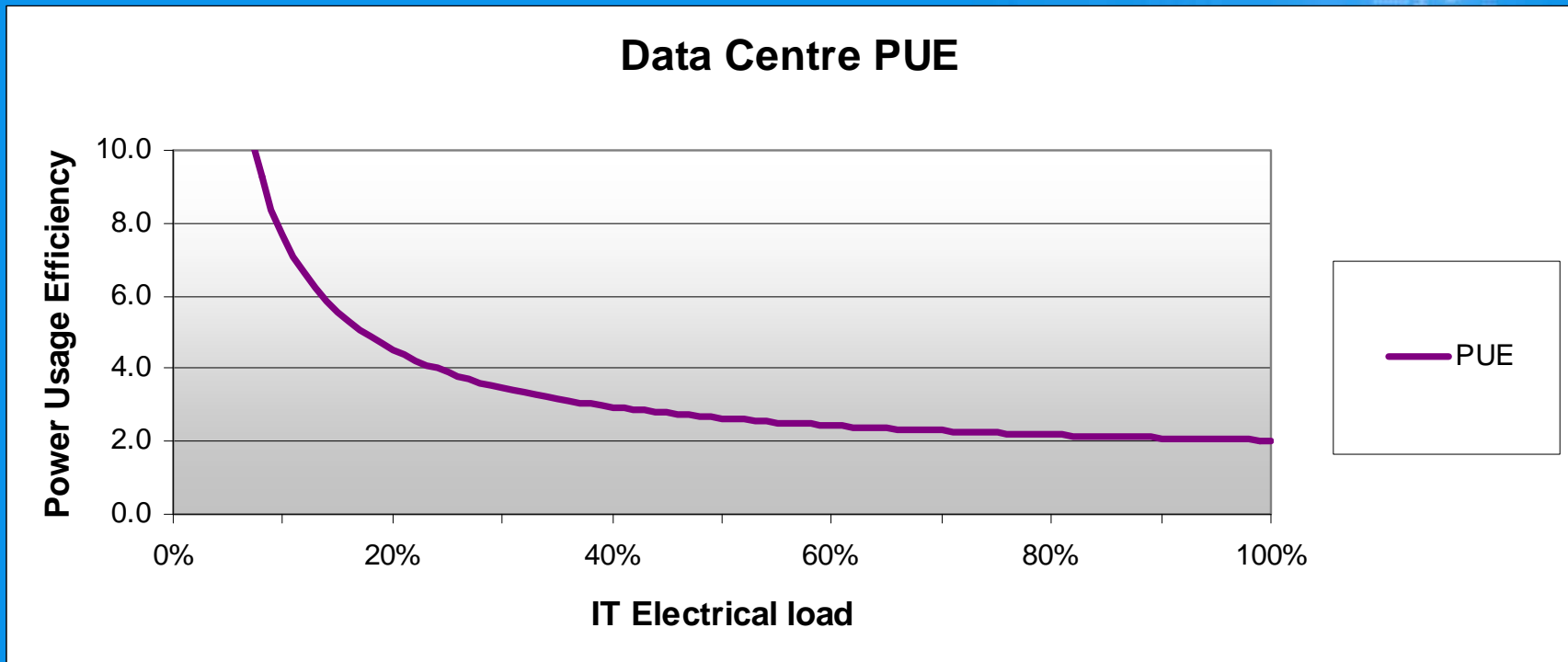
# Data Centre Power - Where does it go?



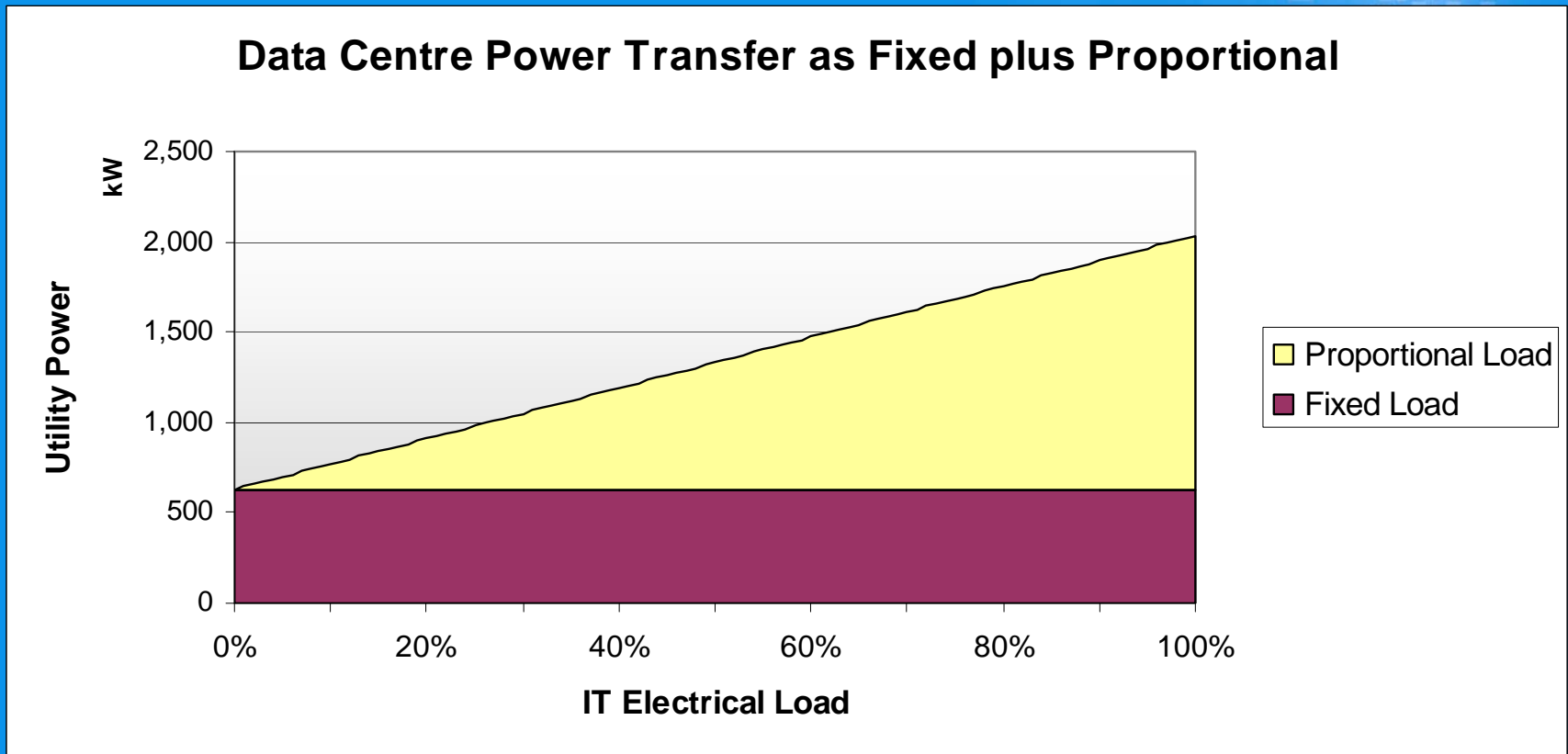
# DCiE As IT Electrical Load Varies



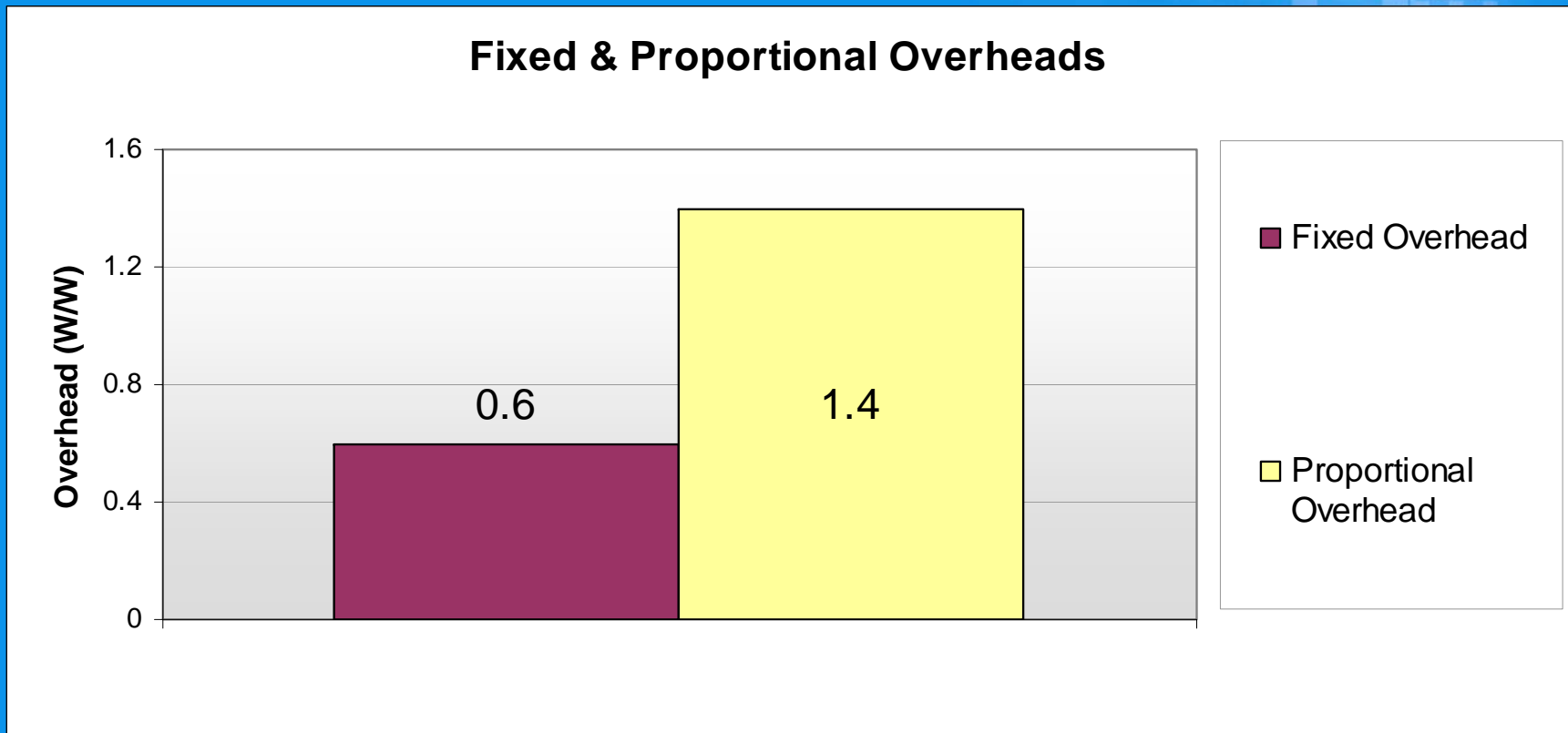
# PUE As IT Electrical Load Varies



# Fixed and Proportional Loads

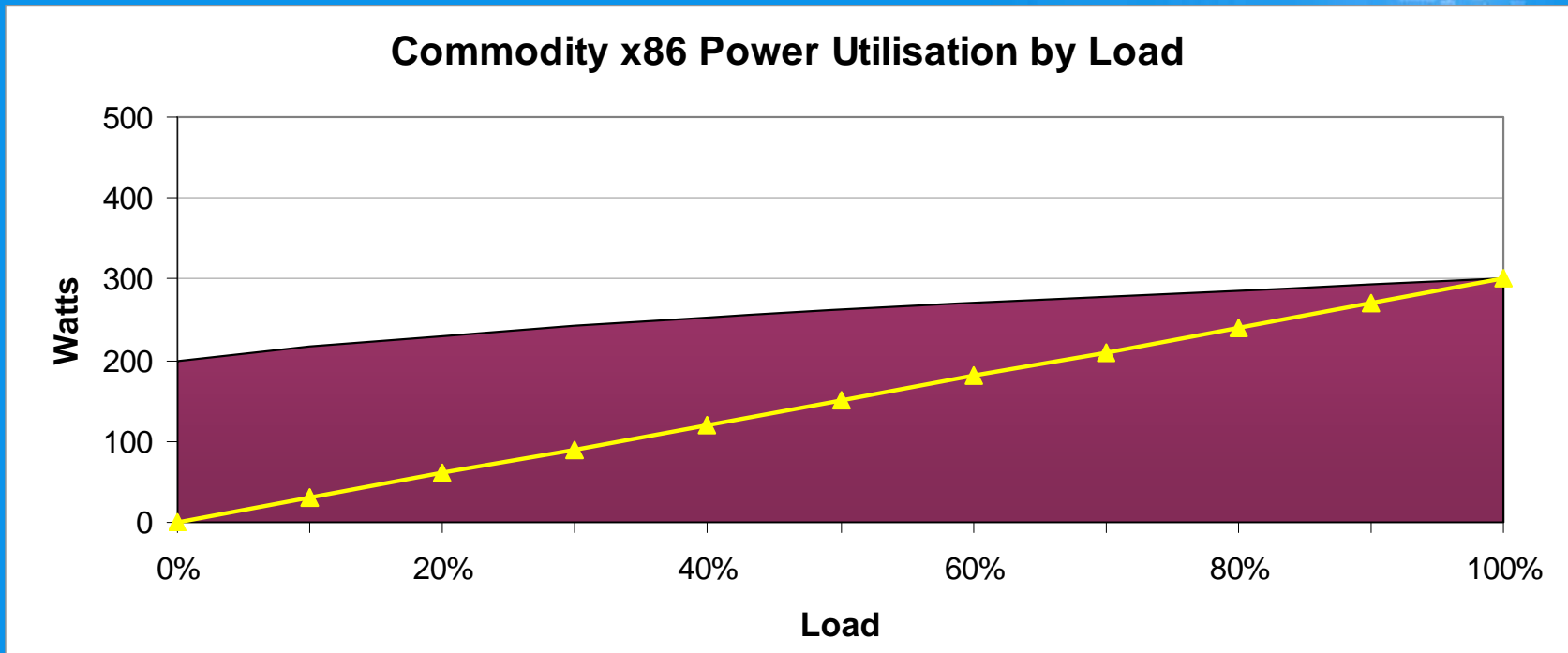


## Fixed and Proportional Overheads



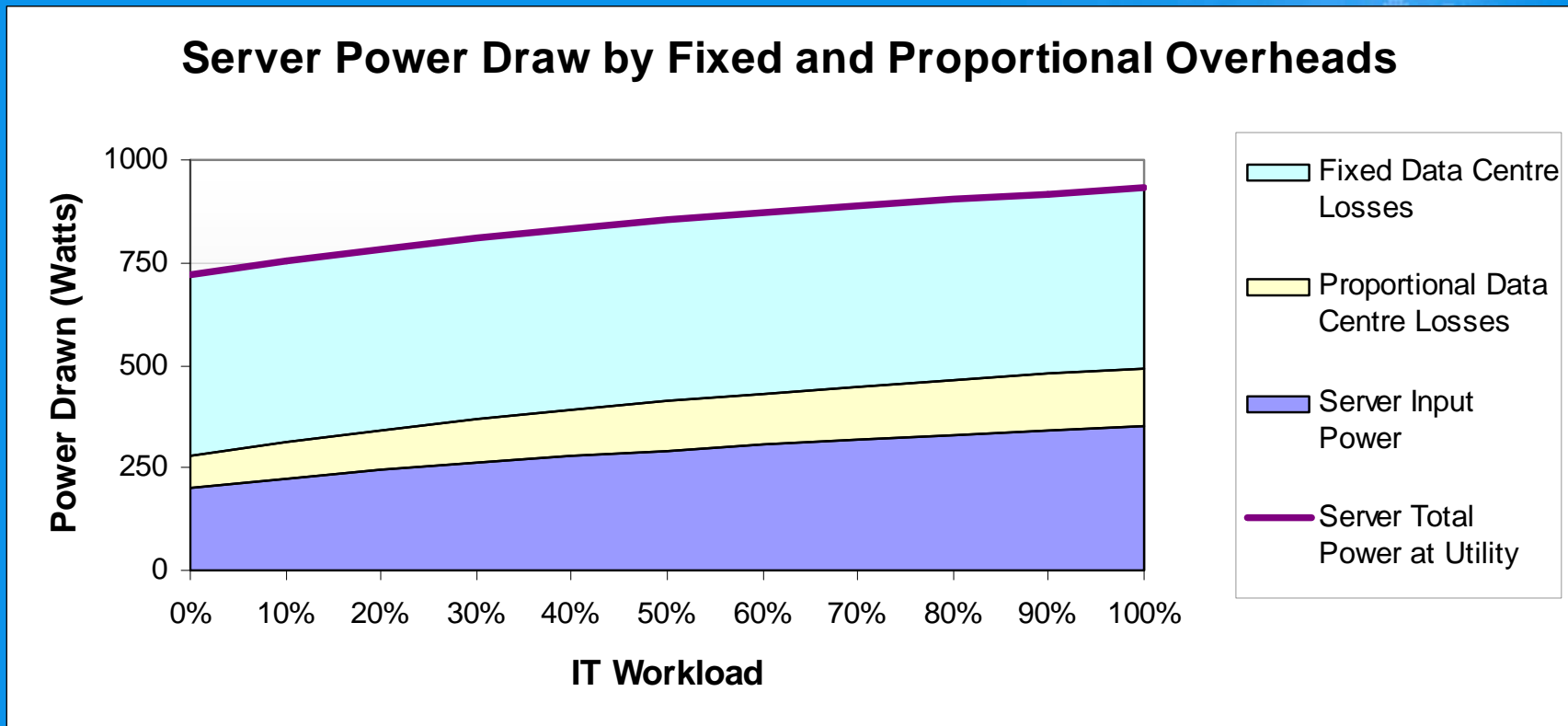
# **Analysis of Metrics Server in a Data Centre**

## Server Power vs. Workload



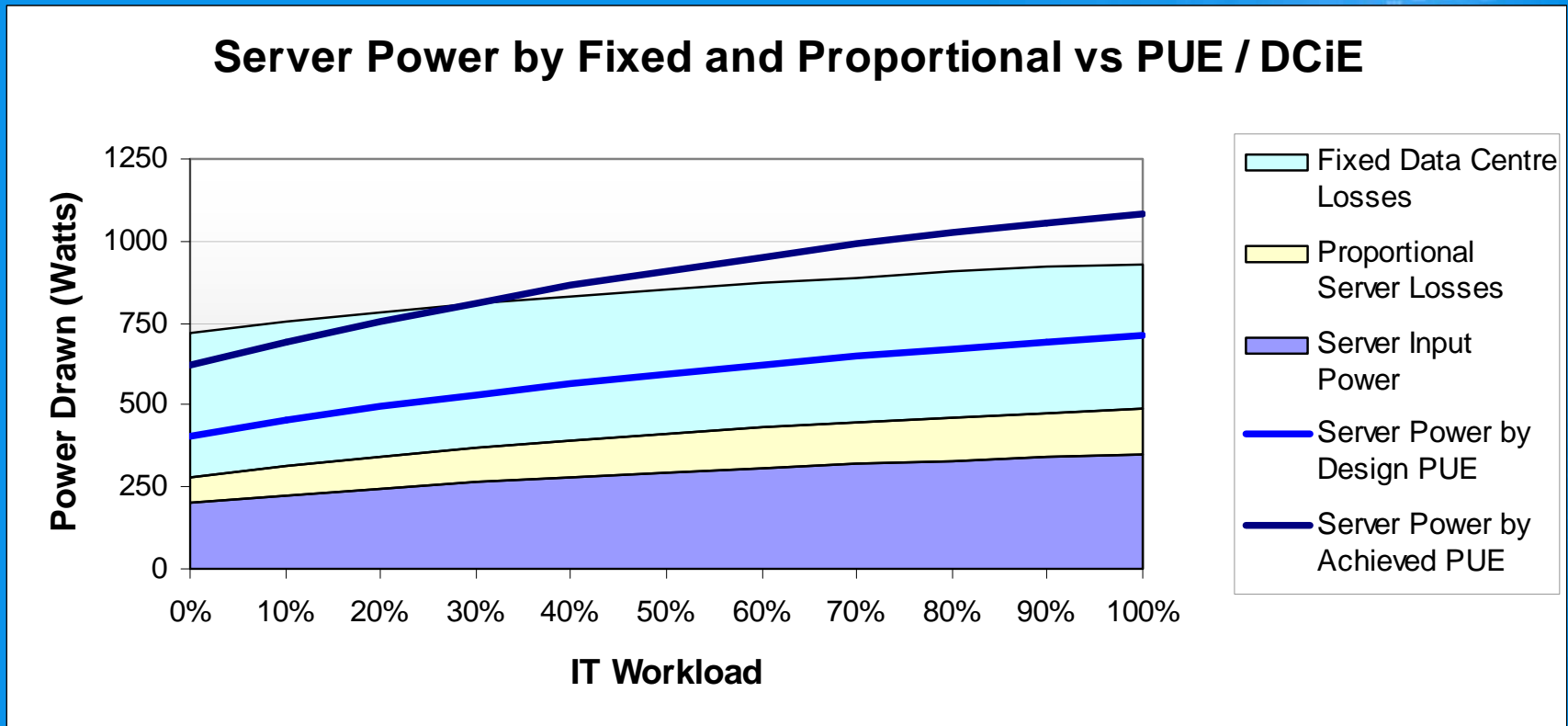
## Put the Server in a Data Centre

- What Power is Drawn at the Utility Feed?



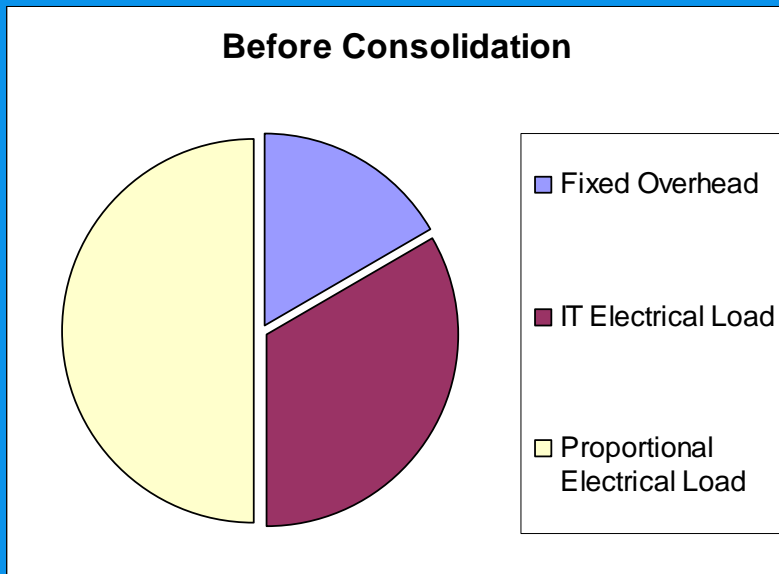
## Put the Server in a Data Centre

- What does DCiE / PUE tell us?



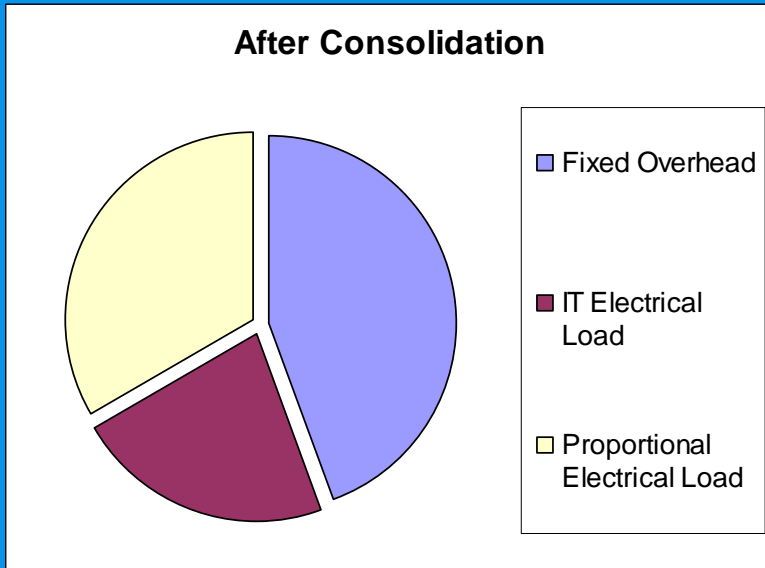
## ROI Forecasts

## IT Equipment Consolidation



IT Load	200kW
Fixed Overhead	0.2
Proportional Overhead	1.5
Total Utility Load	400kW
Achieved DCiE	0.5

# IT Equipment Consolidation

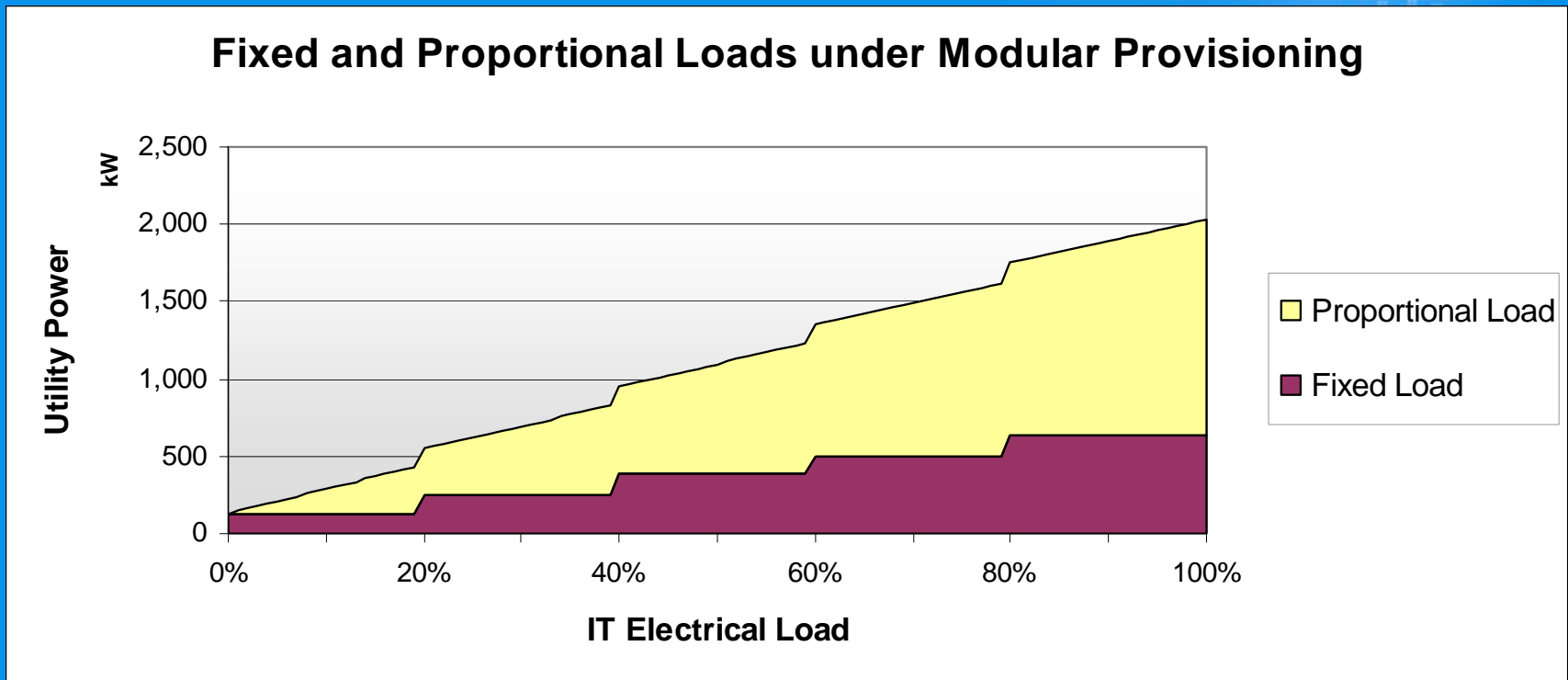


IT Load	50kW
Fixed Overhead	0.2
Proportional Overhead	1.5
Total Utility Load	175kW
Achieved DCiE	0.29

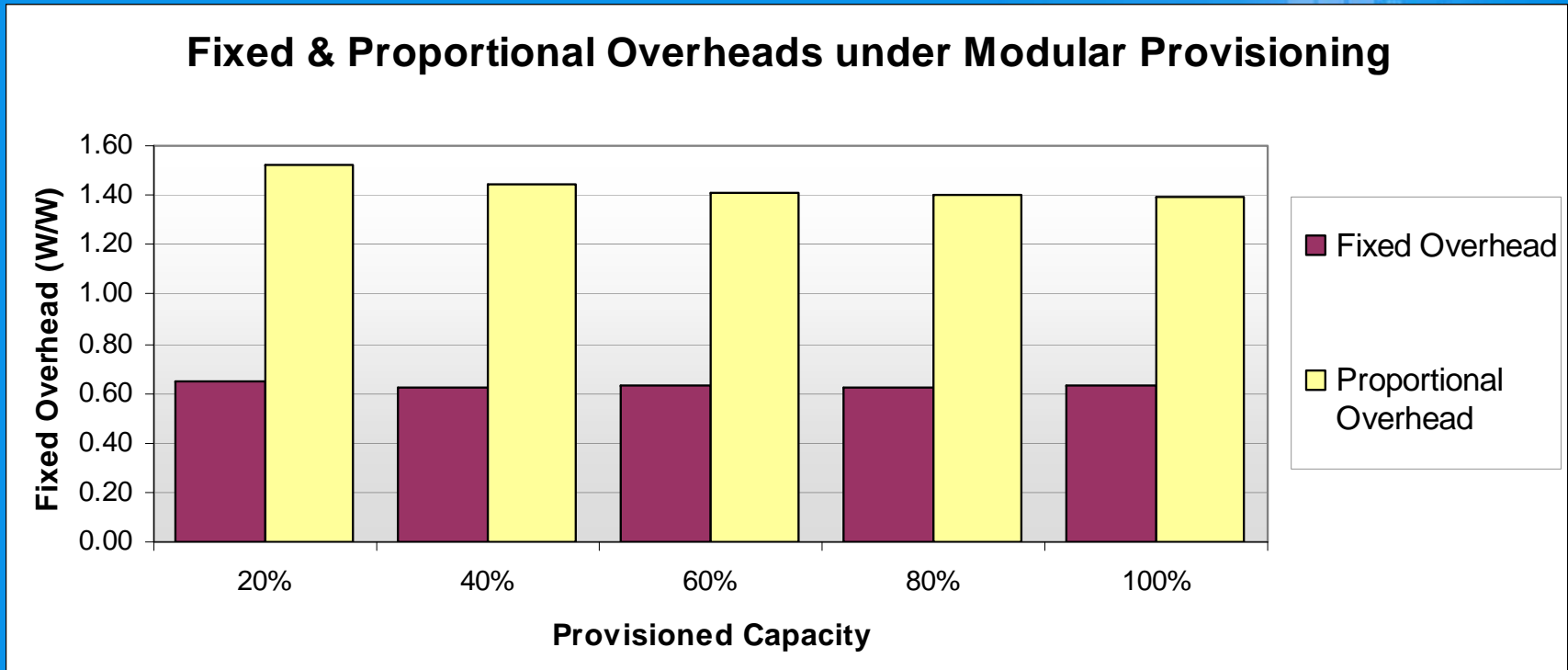
# **Analysis of Metrics**

## **Modular Provisioning of Data Centre Capacity**

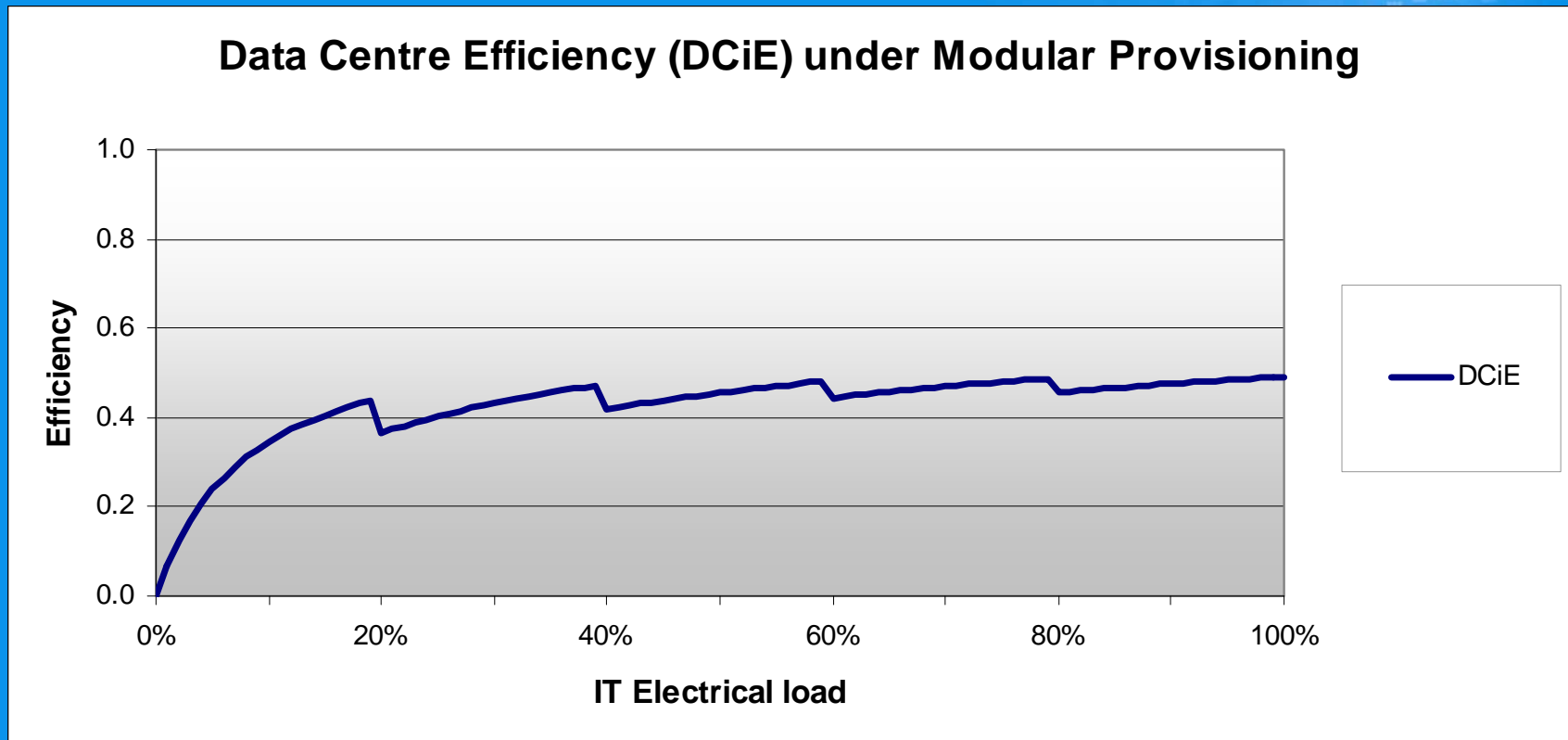
## Modular Provisioning Utility Electrical Load by IT Electrical Load



## Modular Provisioning How Do Fixed and Proportional Cope?



## Modular Provisioning What Happens to the DCiE?



# Per Service Accounting

# Target Demand as well as Supply

## Existing Metrics

- Target IT Department
- Little Control
- Sell Changes to the Business

## BCS Approach

- Per Service Accounting
- Target Demand
- Compare Cost with Delivered Value

**Publicise and Measure**

**Understand and Improve**

**Delivered IT Services**

**Reporting Metrics**  
**Whole Building**  
**Expose the Issue**  
**Apply Targets**  
**Create Incentive to Change**

Useful Work

Data Center Productivity

DCiE / PUE

**Analysis Metrics**  
**Detailed Breakdown**  
**Why is my IT Inefficient?**  
**How do I Change?**  
**Should I buy Product X?**  
**How much £/CO2 will I Save?**

Fixed and Proportional

Per Business Process / Service Accounting

**Energy**

# What You Should Do

# Stop Talking And Start Measuring



**Thank you**  
**Find out more**  
**Data Centre Specialist Group**  
**<http://dcsg.bcs.org>**