



**unite**<sup>TM</sup>

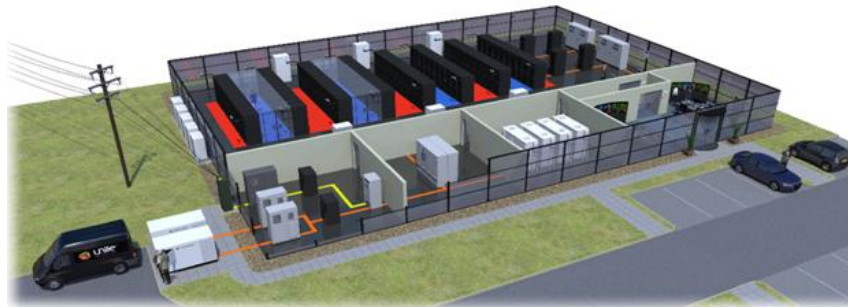
TECHNOLOGIES LIMITED

**TAKING A HOLISTIC VIEW OF DATA  
CENTRE ENERGY MATTERS**



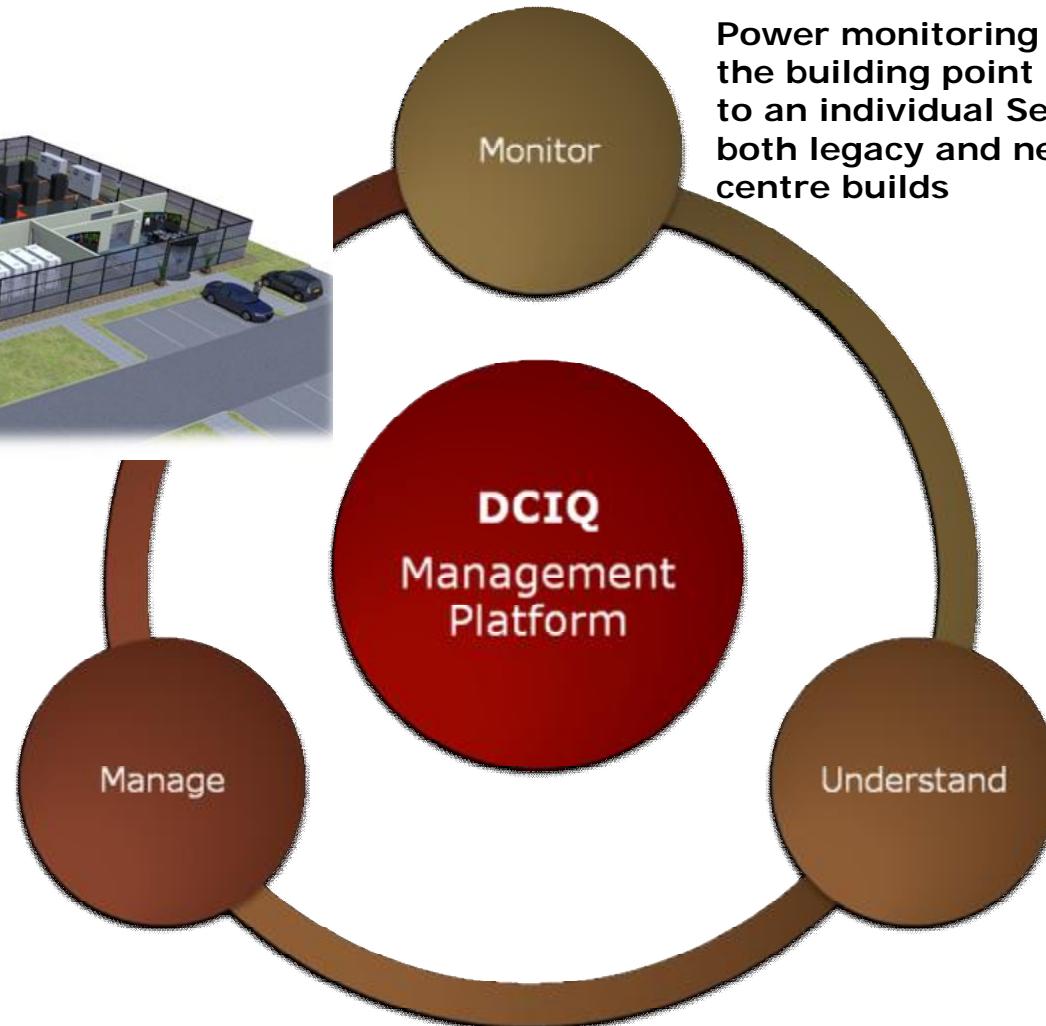
**ZONE**  
DATA CENTRE MANAGEMENT

# "MUM's the word"



Power monitoring from the building point of entry to an individual Server for both legacy and new data centre builds

Historical and dynamic reporting enables informed decision making, allowing the regain of control, optimisation of efficiencies and reduction in costs for the entire facility



Management information and reporting provides a truly holistic and consolidated view of the entire facility

# 6 Zone Data Centre Management

## What is needed



- A holistic view of the data centre environment by bridging the gap between Facilities and IT
- Monitoring and reporting of energy usage and efficiency from the building 'point of entry' through to individual Server payload
- Accurate power and environmental monitoring in conjunction a Management Platform to report all real time monitoring information required, including PUE / DCiE and other Metrics
- Tailored historical data collection and management reporting, to make informed decisions to
  - Improve energy efficiency,
  - Reduce costs
  - Increase facility resilience
- Legacy data centre deployment with first year energy saving of circa 25-30%, with an ROI of less than 12 months
- Harnesses information from all zones i.e. NMS, BMS, PMS and fiscal metering

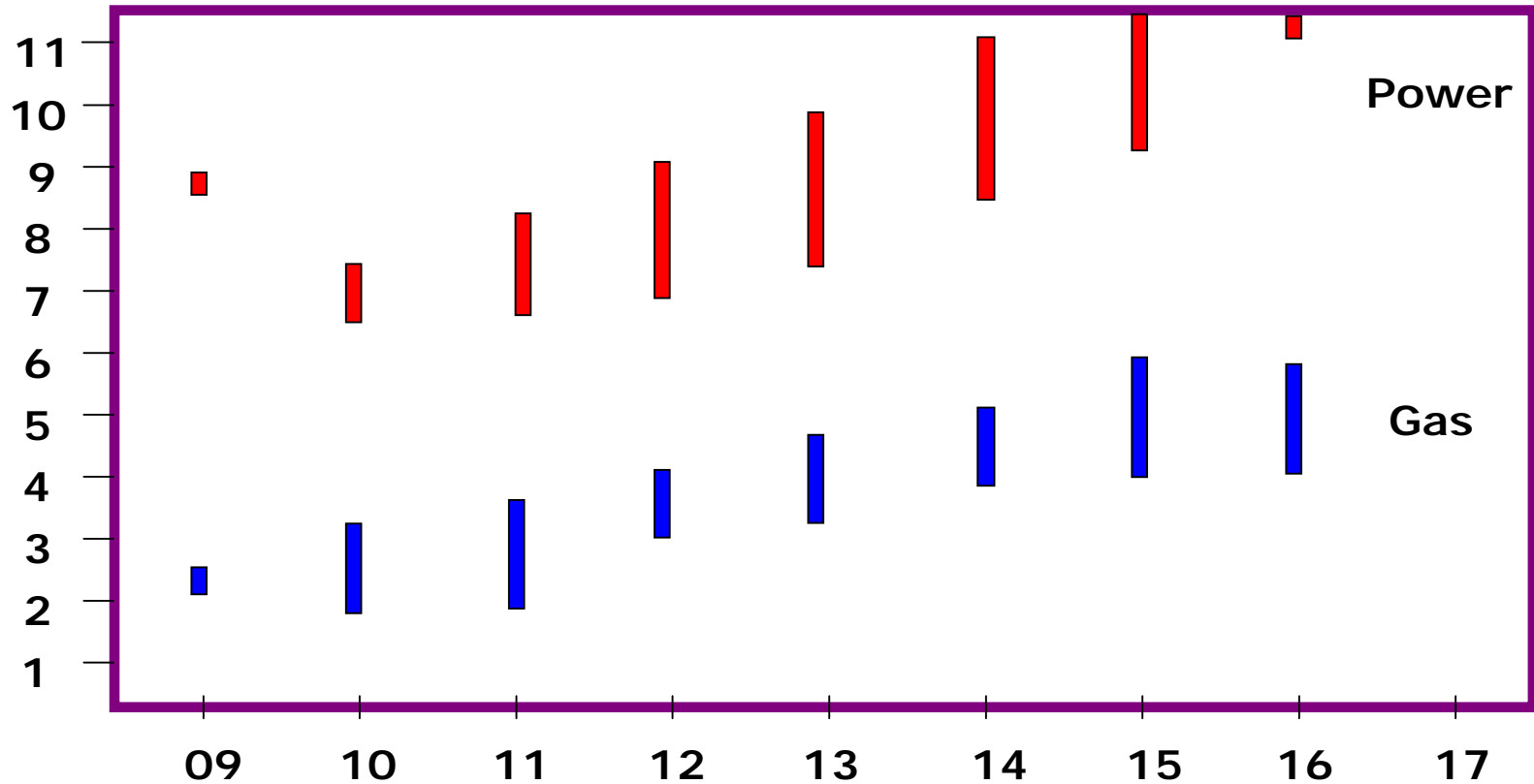
# Data Centre Infrastructure Management

## The Challenge



- Exchange of information between Facilities, Finance and IT can be disjointed
- Multiple and disparate platforms, EMS/BMS within an estate
- No single consolidated solution
- High granularity of information needed to not only monitor and measure energy, but also to deliver detailed information to identify inefficiencies and deploy energy saving initiatives

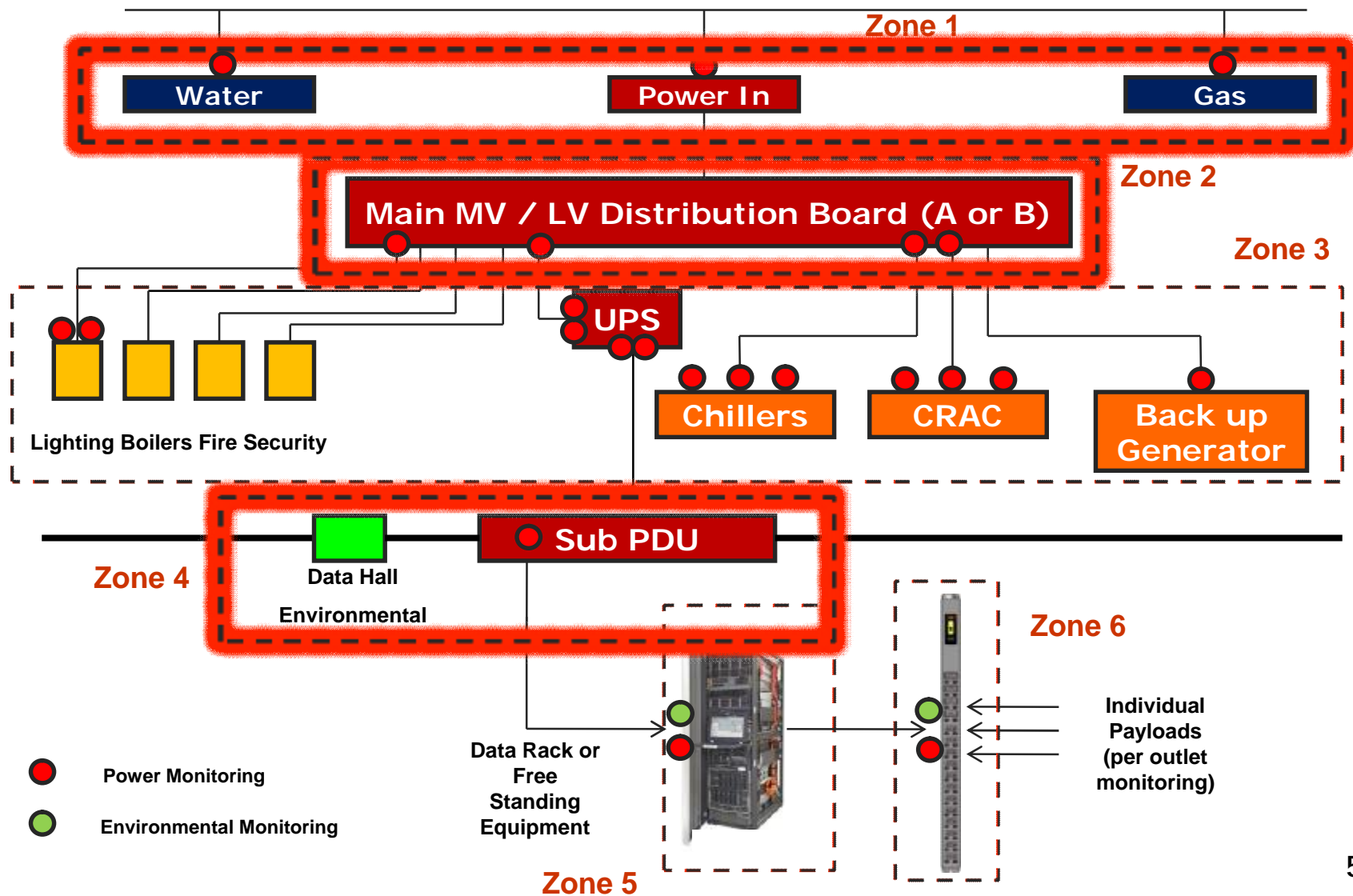
# 5 Year – Wholesale Pricing – OfGem



5 Year wholesale energy price forecasts – 45% Electricity and 57% Gas

# Data Centre Block Diagram

## 6 Zone Data Centre Management



# The Approach



- To identify and collect monitoring points in a logical step by step process
- To monitor energy use from the point of entry to an individual Server within the data centre, with respect to the following:
  - Ø Identification of monitoring locations within the data centre
  - Ø Identification of the type of monitoring required to include new installs and/or existing legacy metering/BMS integration.
  - Ø Provide granular information
  - Ø Consolidate data collection and reporting functions onto a single platform for multi department sharing of information, easy analysis and interpretation

# Zone 1

## Monitoring Points



Fiscal Meter  
Point of Entry

Monitoring Points

Input fiscal monitoring

Energy Efficiency Parameters

None

Management Energy Reporting

Billing

Billing reconciliation

Basic capacity, [is there enough]

Basic CO<sup>2</sup> foot printing CRC



## Zone 2

# Monitoring Points



### LV Switchgear Room

#### Monitoring Points

Input / Output Monitoring

Energy Efficiency Parameters

I<sup>2</sup>T losses [cables, transformer]

Basic fixed & variable energy overhead

PUE [Basic, 1st point of IT and Facilities segmentation]

Management Energy Reporting

Supporting services costs [by type, UPS, Chiller, CRAC]

Capacity Planning [Basic]

Trend Analysis [Basic]

Carbon foot printing [Basic]

PUE, DCiE [Basic Monitoring]

Fixed and variable energy overhead analysis [Basic]

Asset Management



# Zone 3

## Monitoring Points



UPS, Chillers, CRAC's, Generator, Boiler room, Plant Room

### Monitoring Points

Distributed monitoring of supporting services  
Chillers, AHU's, [individual unit monitoring]  
Lighting, UPS [input and output efficiency]

### Energy Efficiency Parameters

I<sup>2</sup>T losses  
Fixed & variable energy overhead  
External environmental monitoring  
PUE

### Management Energy Reporting

Individual supporting services costs  
Capacity Planning  
Trend Analysis  
Carbon foot printing  
Dynamic PUE, DCiE [Basic Monitoring]  
Fixed and variable energy overhead analysis  
Asset Management



# Zone 4

## Monitoring Points



### Data Hall PDU and Branch Circuits

#### Monitoring Points

PDU inputs

Distributed branch outputs

#### Energy Efficiency Parameters

I<sup>2</sup>T losses

Fixed & variable energy overhead

External environmental monitoring

PUE

#### Management Energy Reporting

Cost/Profit centre costing

Individual supporting services costings

Capacity Planning

Trend Analysis

Carbon foot printing CRC

Dynamic PUE, DCiE [monitoring only]

Fixed and variable energy overhead analysis

Phase load balancing

Asset Management



# Zone 5

## Monitoring Points



Data Hall  
Stand Alone Equipment & Data Racks

Monitoring Points

Data Hall direct feed equipment, data racks

Energy Efficiency Parameters

I<sup>2</sup>T losses

Fixed & variable energy overhead

External rack level environmental

PUE

Access and Security

Monitoring and Control

Management Energy Reporting

Cost/Profit centre billing

Fixed and variable energy overhead analysis

Individual supporting services costs

Detailed capacity planning [IT Load]

Detailed trend analysis,

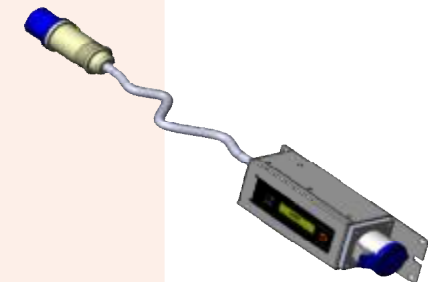
Carbon foot printing

Dynamic PUE, DCiE [Measure and optimise]

Phase load balancing

Cooling optimisation [Hot spot identification]

Detailed asset management



# Zone 6

## Monitoring Points



Data Hall  
Dynamic Monitoring of individual payloads

Monitoring Points

Data Hall direct feed equipment , individual Server, network equipment

Energy Efficiency Parameters

I<sup>2</sup>T losses

Fixed & variable energy overhead

Server level

Environmental

PUE

Access and Security

Monitoring and Control

Management Energy Reporting

Billing individual assets, services, cost/profit centres

Detailed Capacity Planning [IT Load]

Detailed Trend Analysis

Carbon foot printing

Dynamic PUE, DCiE [Measure and optimise]

Fixed and variable energy overhead analysis

Phase load balancing

Cooling optimisation

Detailed Asset Management



## Monitoring and Reporting Management Platform Requirements

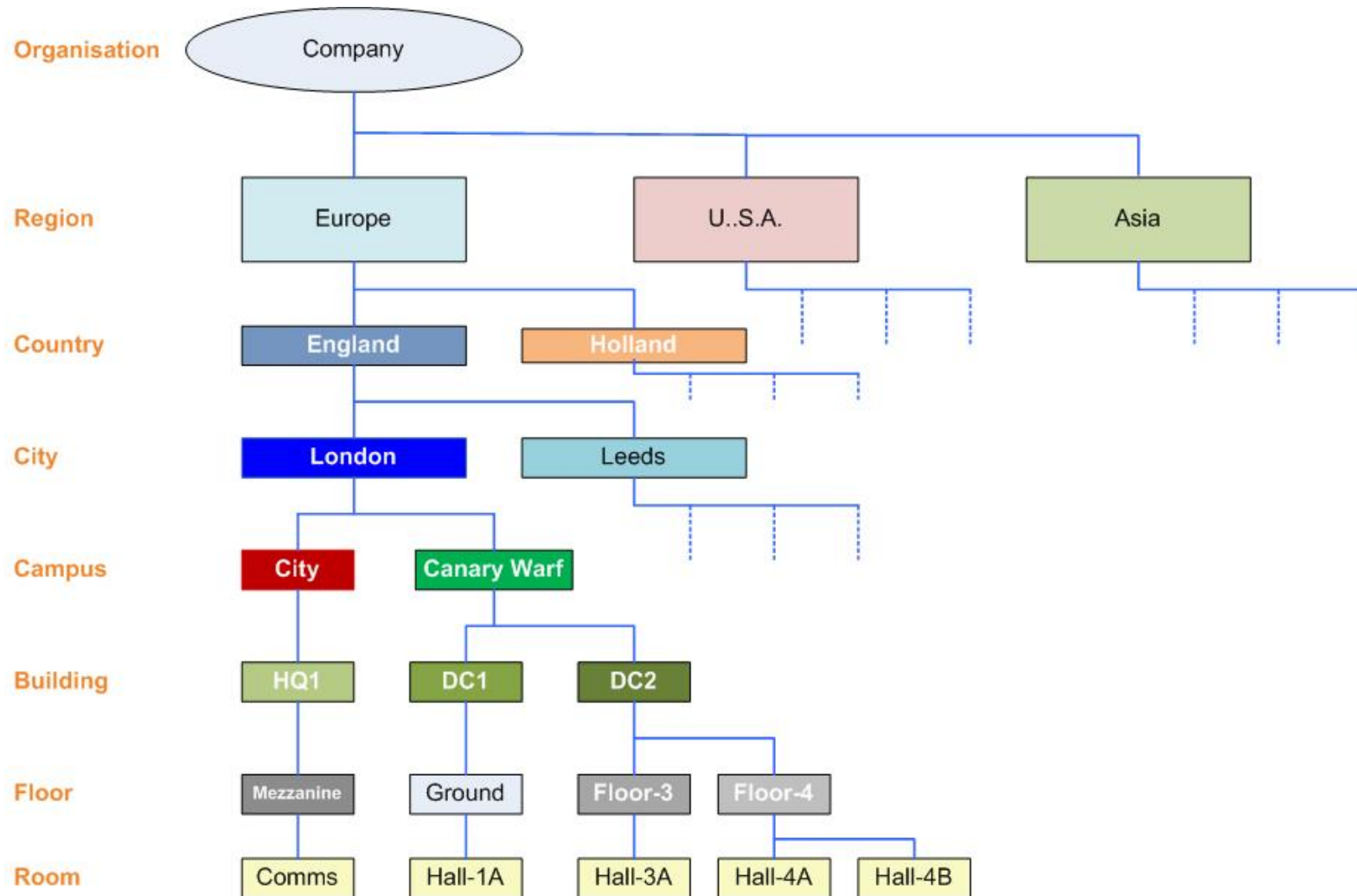


A multi site, global platform providing a consolidated view of each facility

### Primary functions:

- 'Real time' monitoring of the power, environmental and security system hardware
- 'Real time' alarm generation of the monitoring system parameters
- Historical data collection and management reporting
- Integrates with 'third party' middleware and BMS solutions
- Provides asset reporting and capacity management

# Geographic Hierarchy



# Dashboard



Logged In User: Administrator [ My Settings ]

Current System Time: 30/10/2010 09:36:38 Last Measurement Time: 30/10/2010 09:33:13 Online Users: 20

Europe : United Kingdom : Usk : Llancayo Court : Willow House : Main

Security Alarms	
Door Open	0
Lock Open	0
Handle Open	0

Devices Status	
On Line	29
Off Line	8
Service	0
Total Devices	37

Service Status	
Running	9
Stopped	0

Temperature Alarms	
Critical	0
Warning	2

Humidity Alarms	
Critical	0
Warning	0

Power Alarms	
Critical	0
Warning	2

Current Alarms	
Critical	0
Warning	3

Power Metrics	
PUE	1.9
DCIE	52.6%

Last PUE Time	
30/10/2010 09:32:49	

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# Dashboard Selecting Location



Dashboard ▾ Map View ▾ Alarms Reports

Current System Time: 2/4/2011 12:32:33

**Europe : United Kingdom : Usk : Llancayo Court : Willow House : Main : Server Room** ▾

Entire Estate

- Europe
  - United Kingdom
    - London
    - Usk
      - Llancayo Court
        - Willow House
          - Main
            - Demo Room
            - Lab
            - Server Room
          - Warehouse
        - Glasgow
        - Nottingham

	0
	0
	0

Devices Status

On Line
Off Line
Service
Total Devices:

Temperature °C

— Peak — Avg — Min

16.2  
14

1245 0045 1230

[Close](#)

# Alarm Handling



Logged In User: Administrator [ My Settings ]

Dashboard | Map View | **Alarms** | Reports | Manage | Setup | Help | Logout

Europe : United Kingdom : London : Example Campus : Example Company HQ : Example Floor : DC Layout Plan | Severity | Alarms

Alarm View Summary				
	Critical	Warning	Informational	Acknowledged
Entire Estate	3	4	0	0
Current View : Europe : United Kingdom : London : Example Campus : Example Company HQ : Example Floor : DC Layout Plan	1	1	0	0

Current view Alarm Viewed : 2 Filtered Out : 5

Alarm Type	Acknowledged	Time & Date	Location	Value	Binding
	<input type="checkbox"/>	16:13:28 18/5/2010	Rack_1	22.0 %RH	CRITICAL Input 02(02) Humidity Critically High 22.0 %_Hum
	<input type="checkbox"/>	12:03:50 18/5/2010	Rack_1	21.0 %RH	WARNING Input 02(02) Humidity Warning High 21.0 %_Hum

All

- Critical
- Warning
- Informational
- Acknowledged

[Apply](#) | [Cancel](#)

Alarms

- Power
  - Amps
  - Volts
  - kVA
  - kW
- Environment
  - Temperature
  - Humidity
  - Analogue
  - Switch State
  - Output Relay
  - ACU
- Security
  - Motion
  - Infr
  - Video
- Communication
  - BNC Communication Port
  - Agent Communication List

[Apply](#) | [Cancel](#)



# Enhanced Reporting

## Overview

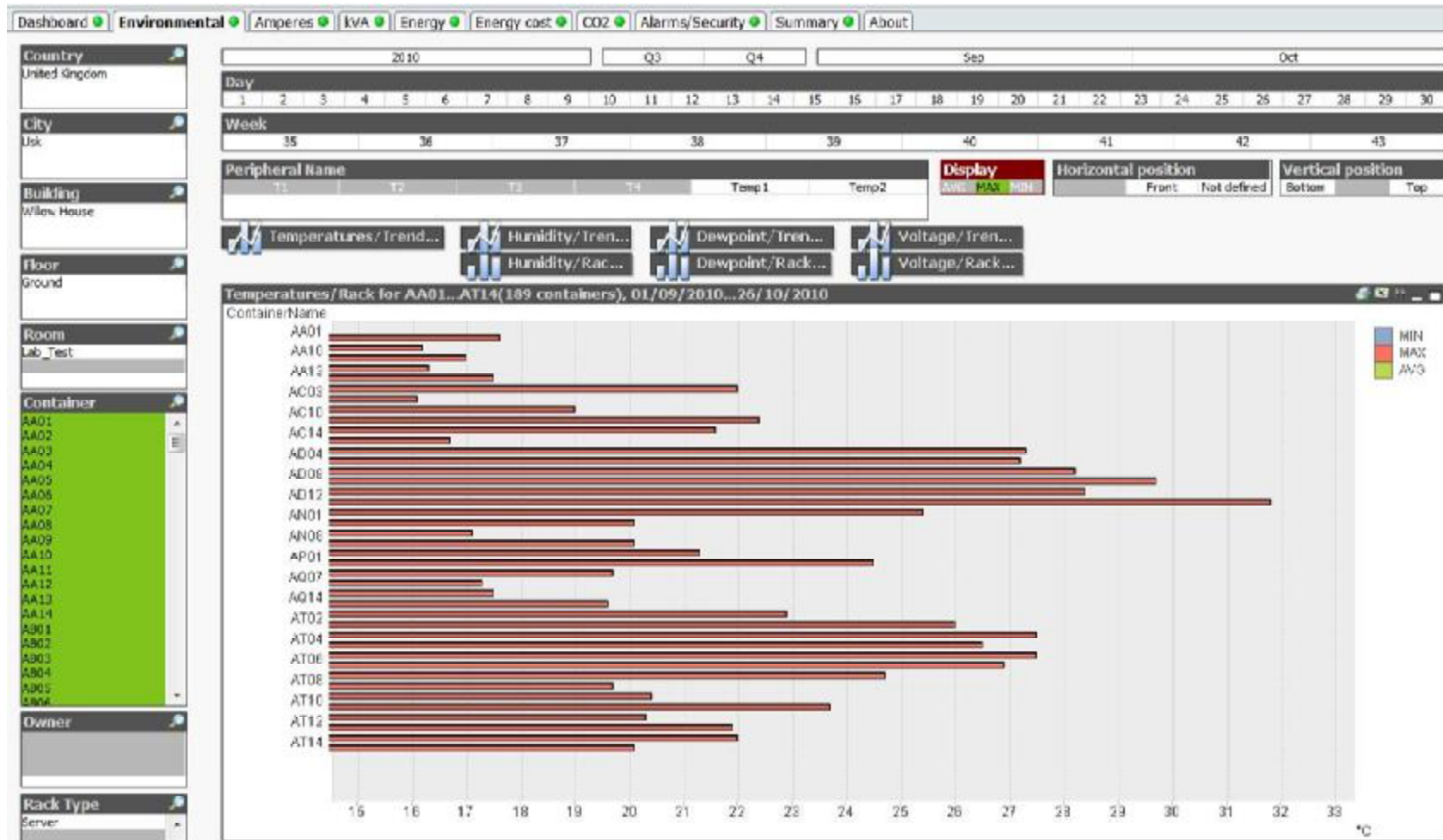
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- An easy to use operational and management tool
- Assists key decision making processes
- Fast, powerful and flexible WEB based application
- Single reporting portal for multiple data sources
- Fully configurable and dynamic search functionality
- Easy to install and commission
- Drill-down analysis providing historic information and trending

# Enhanced Reporting

## Temperature – Aggregate Max by Rack



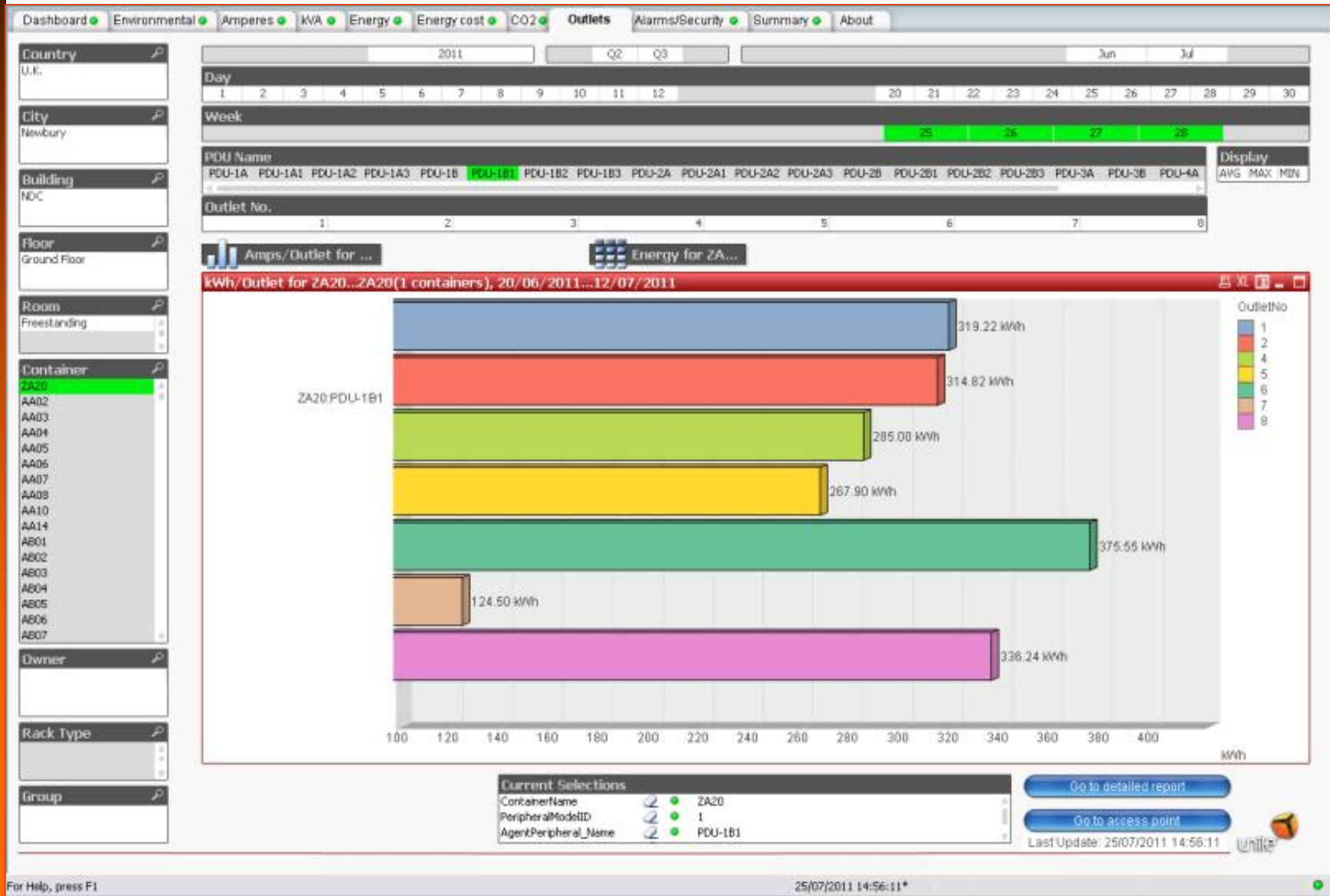
# Enhanced Reporting

## Amps – Weekly by Rack (Maximum Values)



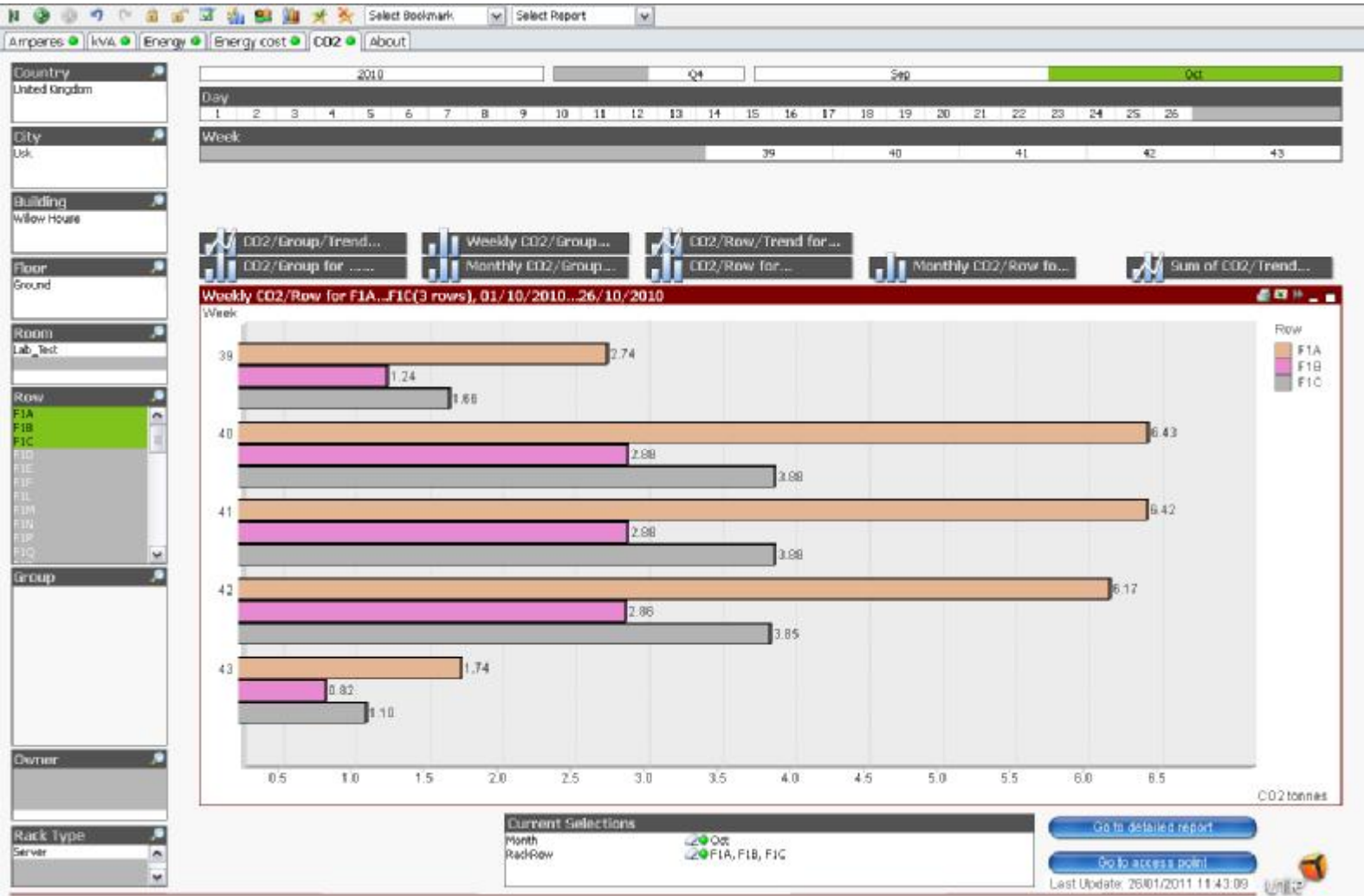
# Enhanced Reporting

## KWhr by socket outlet, individual server



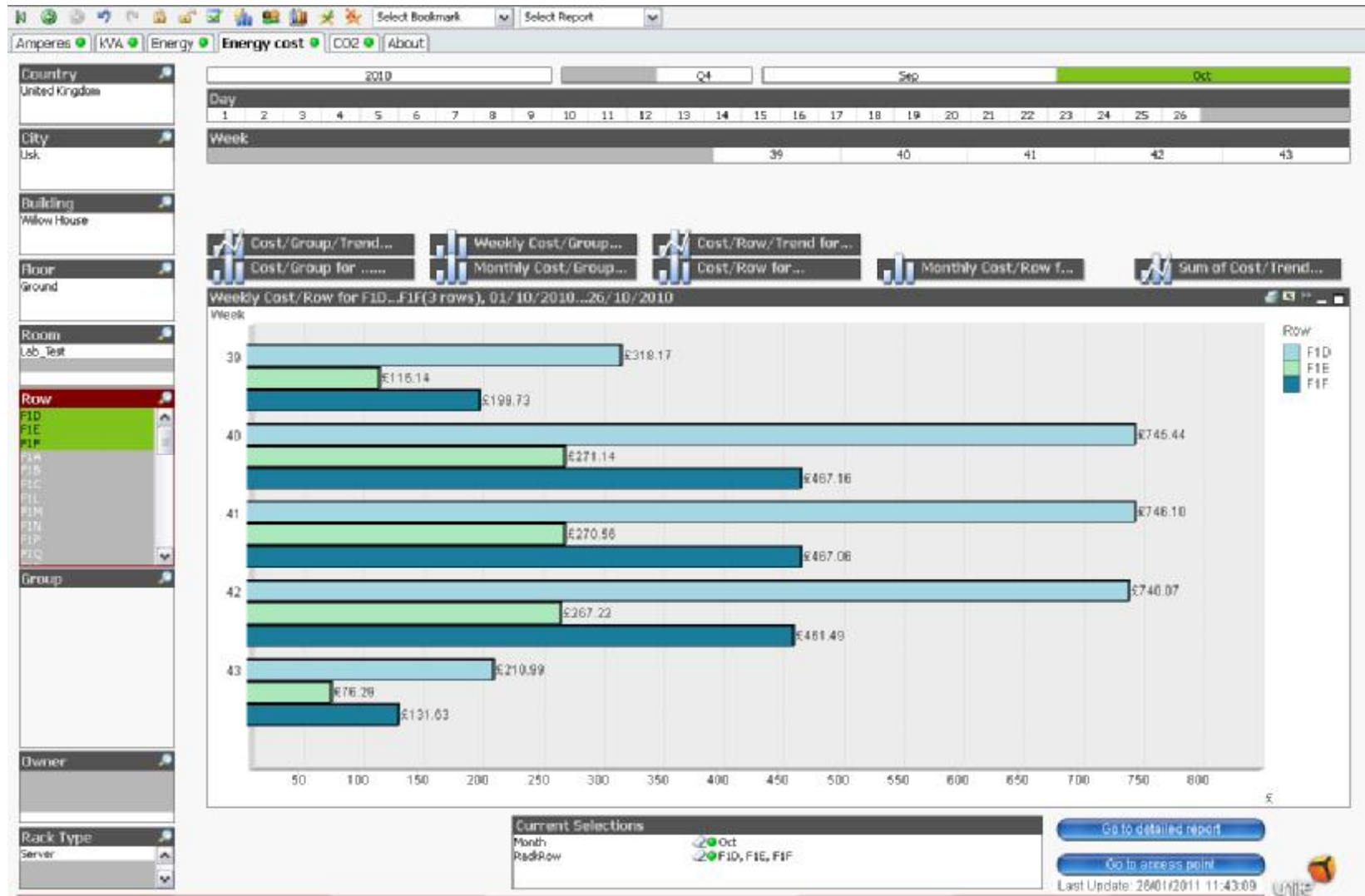
# Enhanced Reporting

## CO<sub>2</sub> Tonnage Weekly Report by Row



# Enhanced Reporting

## Energy Costs Weekly by Row



# Enhanced Reporting

## Rack abuse - Critical Warning Levels



Dashboard | Environmental | Amperes | kVA | Energy | Energy cost | CO2 | Alarms/Security | Summary | About

Country: United Kingdom  
City: Usk  
Building: Willow House  
Floor: Ground  
Room: Lab\_Test  
Container: AA01-AA07, AA08-AA14, AB01-AB14, AC01-AC07

2010 Q3 Q4 Sep Oct

Day: 1-30  
Week: 37-43

Amperes/Day for... Amperes/Week for... Operational fo...  
kVA/Day for... kVA/Week for... kVA/Month fo... Energy for...

**Amperes/Month for AA01...AC07(35 containers)**

Rack	Sep			Oct		
	MIN	AVG	MAX	MIN	AVG	MAX
AA01	30.38	30.80	32.80	30.30	31.85	32.60
AA02	31.18	31.76	33.10	0.00	30.65	33.30
AA03	30.70	31.27	32.80	0.00	30.13	32.70
AA04	32.68	33.00	33.80	32.40	32.91	33.90
AA05	0.00	25.39	29.80	28.30	28.57	29.80
AA06	0.00	26.91	29.10	28.30	28.60	29.10
AA07	12.20	12.43	12.90	12.30	12.44	13.10
AA08	8.60	8.60	8.60	8.60	8.60	8.60
AA09	26.70	27.30	28.30	0.00	26.30	28.90
AA10	0.00	29.80	33.80	0.00	31.20	33.90
AA11	0.00	24.25	28.10	0.00	26.24	28.20
AA12	25.68	26.81	28.50	0.00	24.87	29.70
AA13	0.00	12.52	14.00	0.00	12.41	14.50
AA14	0.00	17.02	18.10	0.00	16.77	18.10
AB01	13.80	13.80	13.90	0.00	13.29	14.50
AB03	16.38	16.52	16.90	16.38	16.51	17.00
AB04	14.90	15.08	15.70	13.60	15.10	15.80
AB05	5.00	5.01	5.60	5.00	5.01	5.60
AB06	15.60	15.95	16.50	0.00	14.77	16.50
AB07	6.80	7.38	8.10	6.80	7.33	8.10
AB09	0.00	10.56	11.80	0.00	9.95	12.90
AB010	14.90	15.13	15.50	0.00	14.05	15.50
AB011	14.20	15.02	16.30	0.00	15.02	16.20
AB012	4.20	4.20	4.40	4.20	4.20	4.40
AB013	16.10	16.86	18.80	17.10	17.42	18.20
AB014	13.40	13.54	14.20	0.00	13.04	14.20
AC01	20.48	20.99	21.30	0.00	20.21	21.30
AC03	0.00	12.17	13.30	11.60	12.85	13.20
AC04	23.30	23.50	23.70	23.30	23.49	23.70
AC05	10.10	11.67	12.10	10.30	11.76	12.30
AC06	22.20	24.78	25.20	0.00	23.84	25.30
AC07	20.50	22.85	23.20	0.00	21.99	23.20
<b>Min-Avg-Max</b>	<b>0.00</b>	<b>18.95</b>	<b>33.80</b>	<b>0.00</b>	<b>18.83</b>	<b>33.90</b>

Current Selections: Container/Name 35 of 217

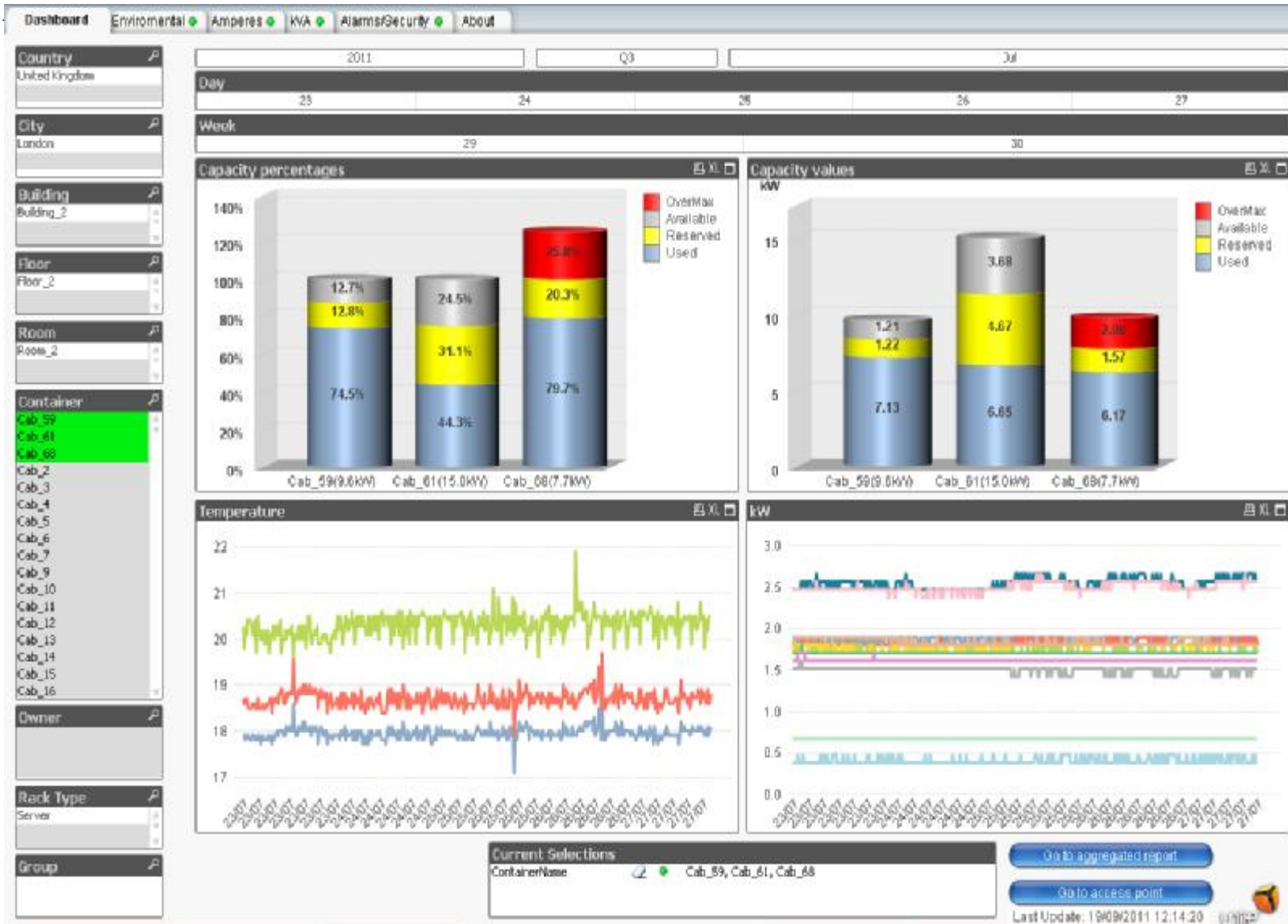
Go to detailed report  
Go to address point

Last Update: 28/01/2011 11:42:39

# Room power capacity summary report



# Rack power capacity (with warning condition)



# Single room power report showing equipment being populated



# Reporting



## Real time Alarming

### Environmental

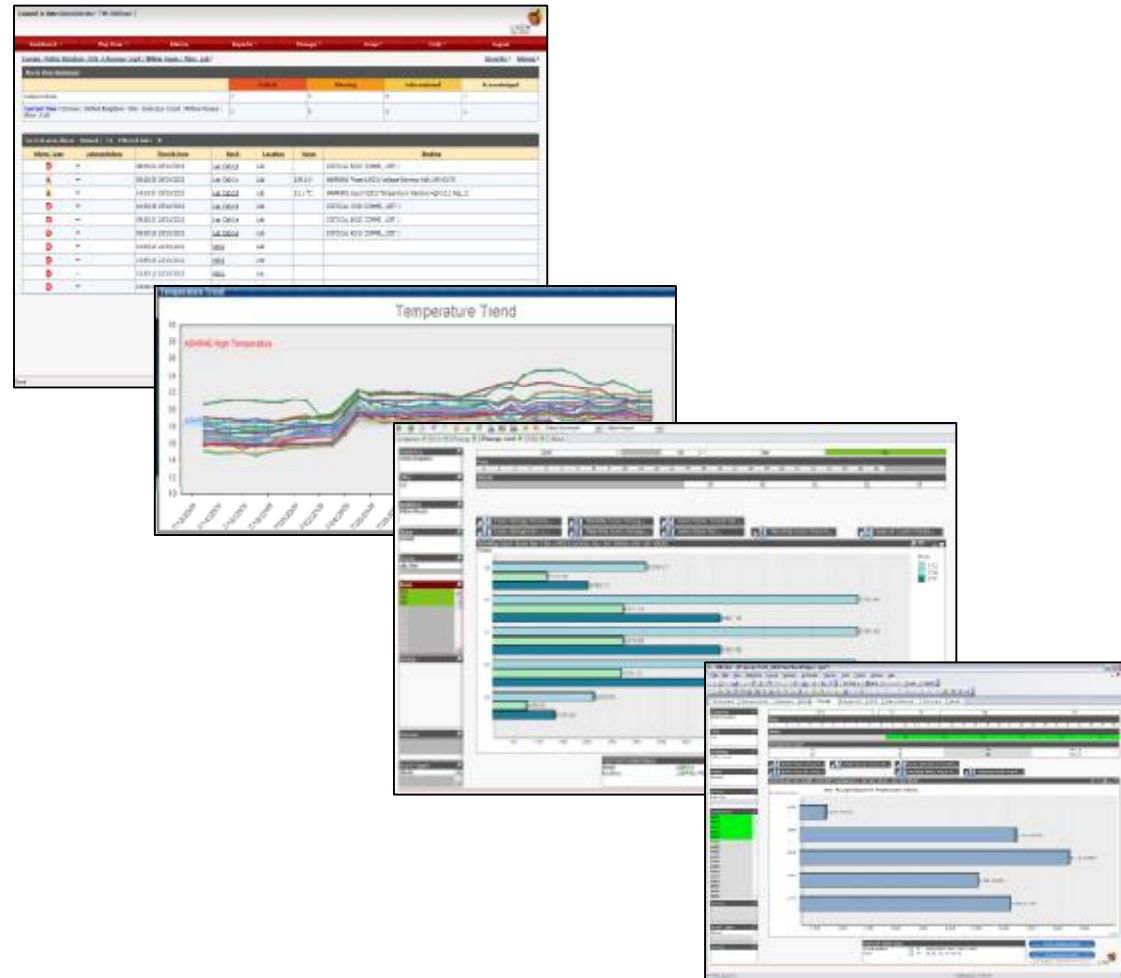
- Temperature
- Humidity
- Water leakage
- Air flow
- Smoke

### Power

- True RM Volts
- True RMS Amps
- kVA
- kW
- kWhr
- PF
- PUE
- Energy Costs

### CO<sup>2</sup> Footprint from

Point of entry, supporting services, individual supporting service equipment, group of racks, individual rack, individual Server



# Analysis and Interpretation



- Phase balancing
- Rack abuse by customer SLA's
- Energy cost apportionment against:
  - IT process
  - Customer
  - Cost /profit centre
- Computational process energy use
- Capacity planning/trend analysis
- Future energy/cooling for future business expansion

A screenshot of a data table with multiple columns and rows, likely representing energy usage or performance metrics for different racks. The table is partially obscured by a larger table in the foreground.

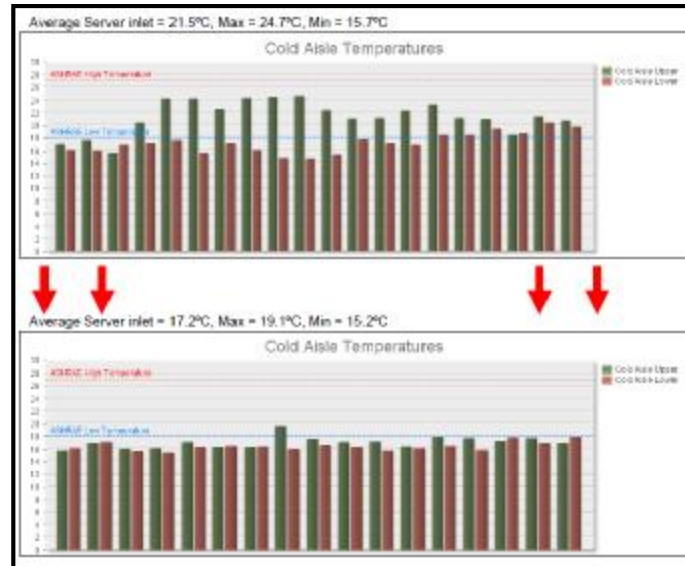
Cabinet Name	Aggregate PVA	Cabinet P/W Rating	Temp Rise Point	Temp Lower Point	15k Cabinet Utilization
Rack-01	1.6	3	19.3	19.3	20.60%
Rack-02	3.1	3	19.8	19.8	46.35%
Rack-03	6.7	12	20.4	20.5	55.60%
Rack-04	4.4	3	19	19.7	55.60%
Rack-05	6.7	3	19.3	20.2	73.75%
Rack-06	5.3	3	19.3	19.8	61.60%
Rack-07	7.0	12	21.3	20.4	61.60%
Rack-08	6.3	3	21.4	21	76.75%
Rack-09	5.4	3	21	-	67.50%
Rack-10	8	12	21.8	21.3	76.60%
Rack-11	6.6	3	20.8	21	61.25%
Rack-12	6.5	3	20.2	20.2	61.25%
Rack-13	6.5	3	20.1	19.2	61.25%
Rack-14	6.5	3	21	19.8	61.25%
Rack-15	2.5	3	21	19	21.25%
Rack-16	0.2	3	21	19.1	2.60%
Rack-17	4.6	3	20.3	19.1	67.50%
Rack-18	6.7	3	20.1	19.7	63.75%
Rack-19	2.1	3	19.5	19	28.25%
Rack-20	0	3	19.1	19.4	3.00%

# Hot Spot Identification

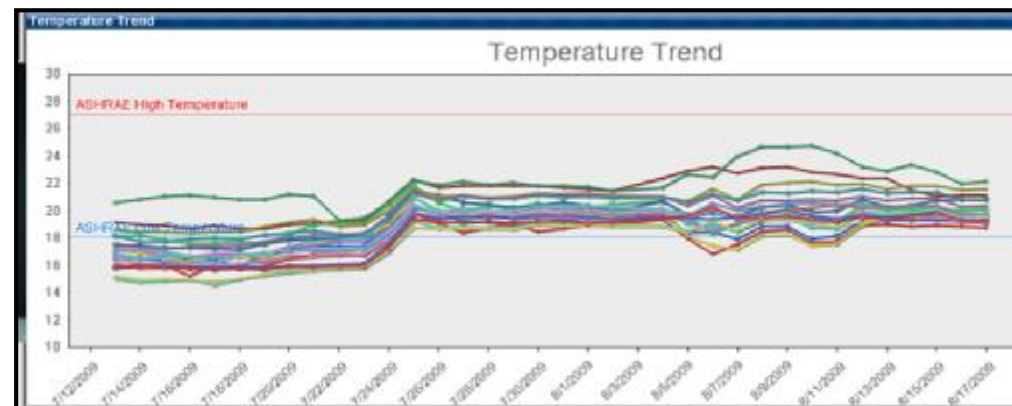
## Cooling Optimisation



- Increase set point on CRAC Units



- Reduces energy consumption



# Non Invasive real time Energy Audit



Rack Audit Data analysis Summary										
Amps [MAX]				Annual	Annual CO <sup>2</sup>	Temperature [ °C]				
Rack No	PDU A	PDU B	PDU C	Aggregate	Rack cost [£]	Tonnage	Comment	MAX	MIN	Range °C
1	7.4	4.8		12.2	2,511	13.3		27.6	22.5	5.1
2	5.6	6.4		12	2,470	13.09		25.1	21.1	4
3	10.6	8.3		18.8	3,870	20.52	Phase A close to max load of 12.8A	26.3	22.9	3.4
4	7.1	4.4		11.5	2,367	12.54		27.6	23.3	4.3
5	5.6	6.5		11.8	2,429	12.87		25	21.5	3.5
6	12.2	17.2		29.2	6,011	31.85	Max aggregate load of 25.6A exceeded. Feed B exceeded max load limit. Phase Balance critical	27	22.2	4.8
54	20.9	19.5		40.4	8,317	44.1	Max load of 25.6A exceeded. Critical Phase A and B exceeds Max load limit.	29	23.5	5.5
68	11.8	12.1	12.5	36.3	7,472	39.6	Feed C at max load limit	26.9	17.6	9.3
69	6	6.6	2	14.2	2,923	15.49		24.8	17.5	7.3
70	7	10.6	13.8	31.2	6,423	34.04	Feed C exceeds max load limit	23.8	17.8	7

# Interpreting the Data - Power

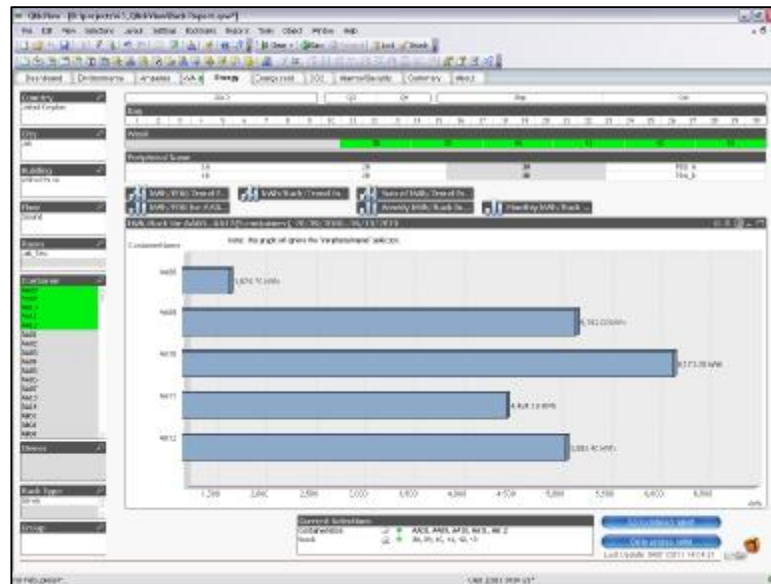


## • Rack with low power

- What services are they running?
- Can they be switched off?
- Can they be virtualised?

## • Rack with high power

- What equipment is running?
- Are they old Servers?
- Are the fans always on? (check temperature)



# Carbon Reporting and Management



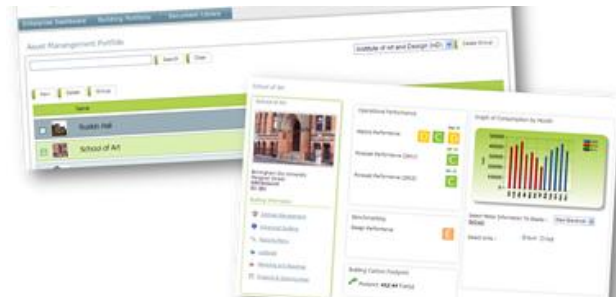
Carbon Reduction Commitment, compliance management, CRC EES reporting and evidence pack creation



Asset Management, of utility and Fiscal meter equipment suppliers



Operational Ratings, a solution to demonstrate to employees and customers compliance to the Energy Performance of Buildings



# Cost Benefits



- 25% - 30% energy savings can be identified by implementing the 6 Zone Monitoring and Management Solution
- ROI in deploying 6 Zone Monitoring and Management Solution, less than 12 months
- Savings straight off the bottom line
- Key solution to meet CRC requirements
- Key solution to meet CSR requirements

# 6 Zones Management

## Summary

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- Provides a holistic approach to energy monitoring and management optimisation from the point of entry into a data centre to an individual Server
- All monitoring points provide real time and polled performance data to a centralised management platform for the whole data centre space, from point of entry to an individual Server
- Information is provided in a simple, easy to understand format, customised to the clients specific requirements
- Reports highlight operational performance, energy use, costs, trending, capacity and resilience
- Information available to multi departments, IT, Facilities & Finance
- Detailed granular information to manage and optimise energy consumption
- Regain control, optimise, maintain resilience, plan



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THANKYOU



ZONE  
DATA CENTRE MANAGEMENT