Data Centre Solutions

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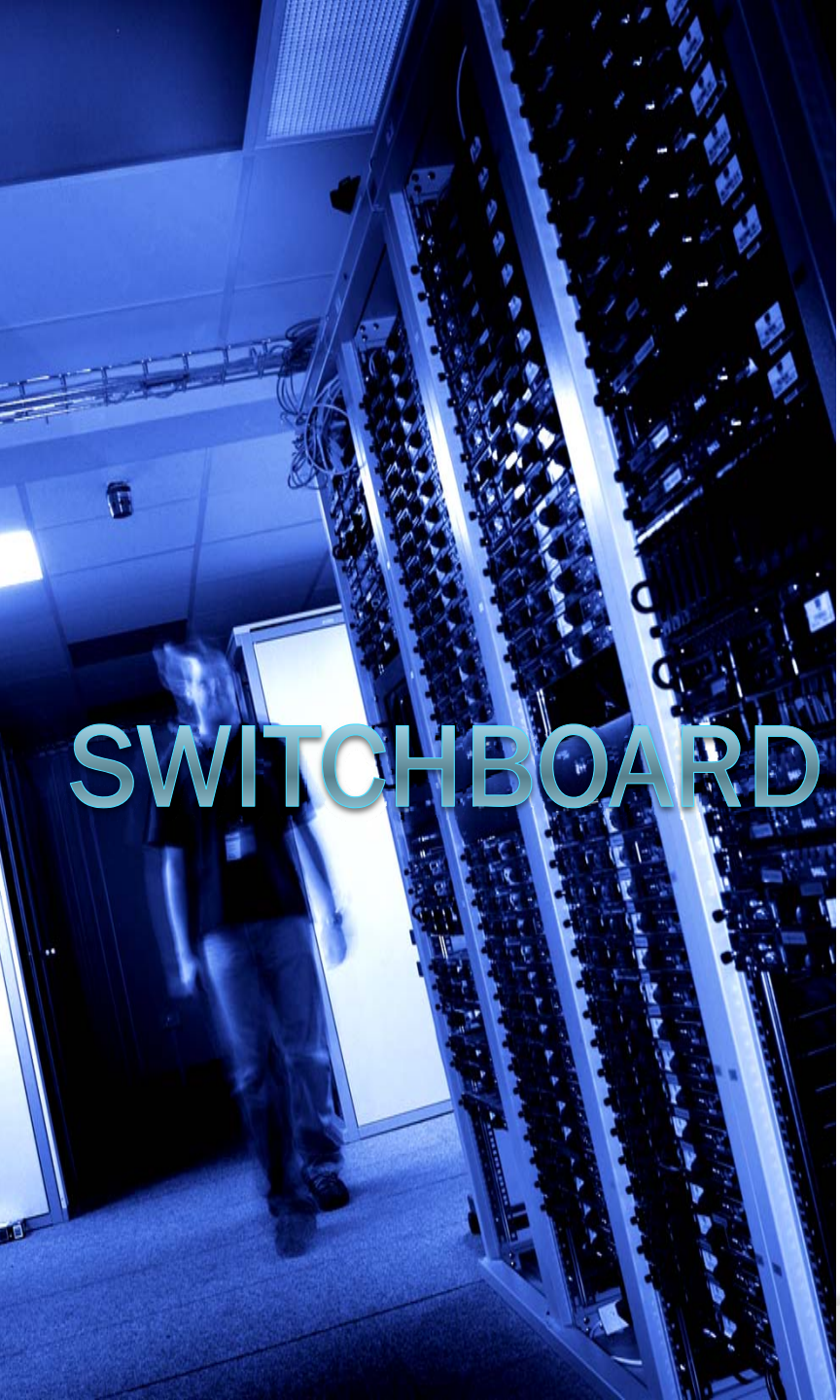
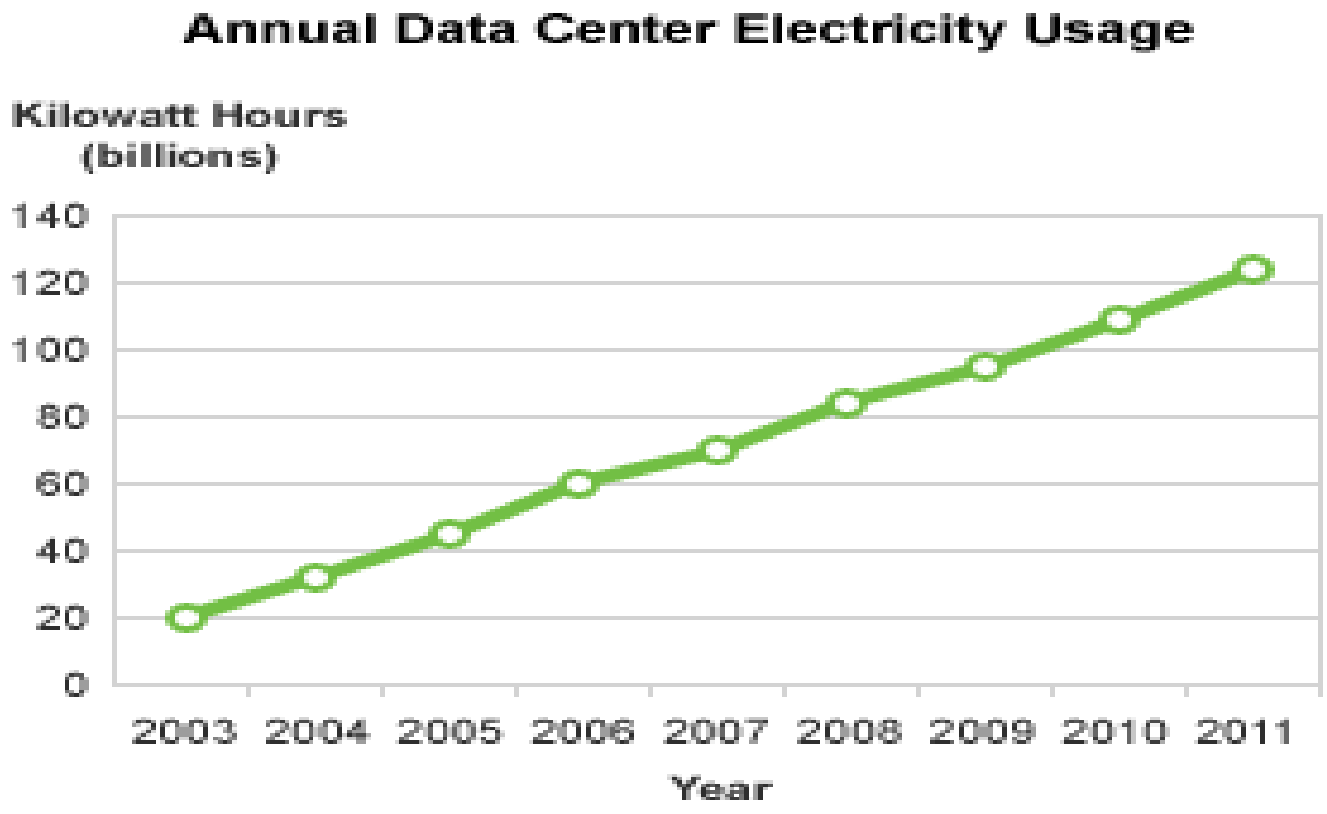


Non Invasive Per Circuit Breaker

SWITCHBOARD MONITORING

Managing Energy is now the key for Data Centres

- Data Centre energy consumption continues to increase at 15% per year



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Electricity Use in Data Centres

- A data centre's **primary** use of electricity is the production, storage and distribution of data.
- A data centre's **secondary** use of electricity is to power air-conditioning systems.
- A data centre's **primary** consumption of electricity is air-conditioning.
- A typical data centre will use three times more electricity for air-conditioning than data.
- Studies by Intel Corporation have shown optimisation of cooling can reduce this ratio by 47%.

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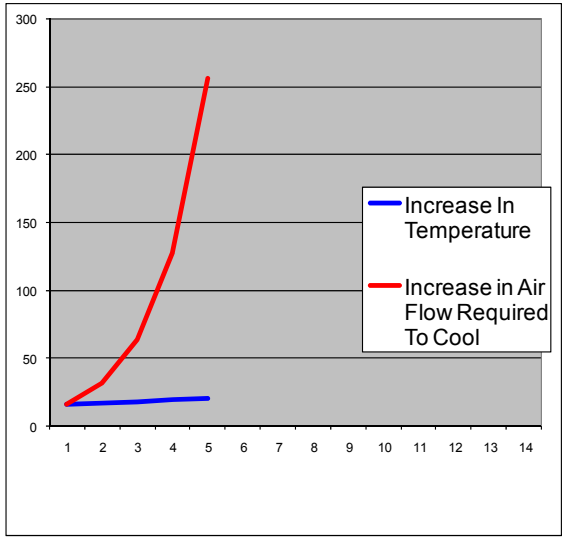
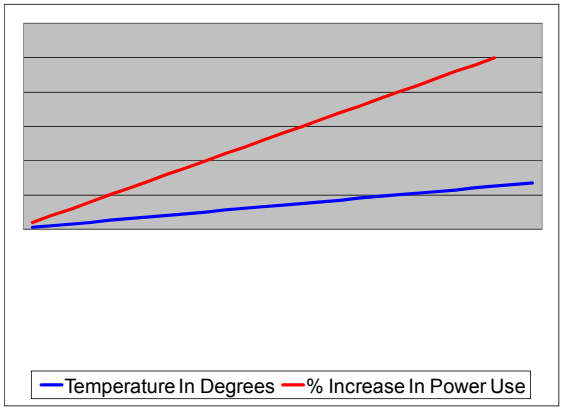
Diminishing Returns in Cooling



Arithmetic increases in temperature require exponential increases in airflow to cool.



Every one degree decrease in temperature requires a four per cent increase in electricity consumed.

- Simply increasing cooling capacity to manage increases in thermal load temperature rapidly becomes prohibitively expensive.
- Managing and matching cooling requirements at a cabinet level addresses this issue.

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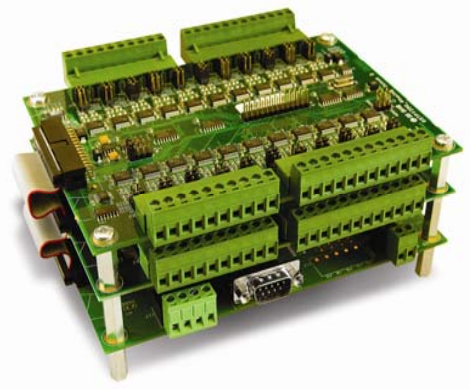
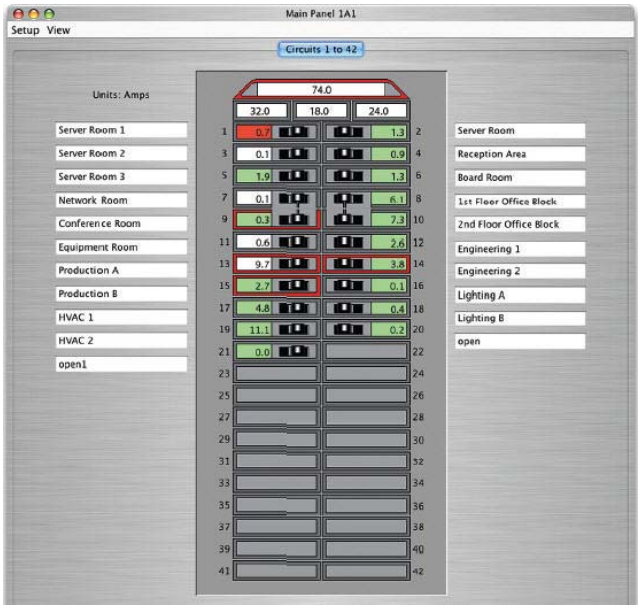
You can only Manage what you Measure





- ES One – Branch Circuit Smart Meter
  - Watts – the only true measure of server rack heat
  - Kwh – view granular and full IT vs. Cooling load
  - Accurate – only product with charge back accuracy
- TP One – Energy Manager
  - Data Warehouse – full spectrum, high granularity
  - Data Manager – Cabinet heat balancing, individual Open Protocols – upstream NSW, BMS, ERP

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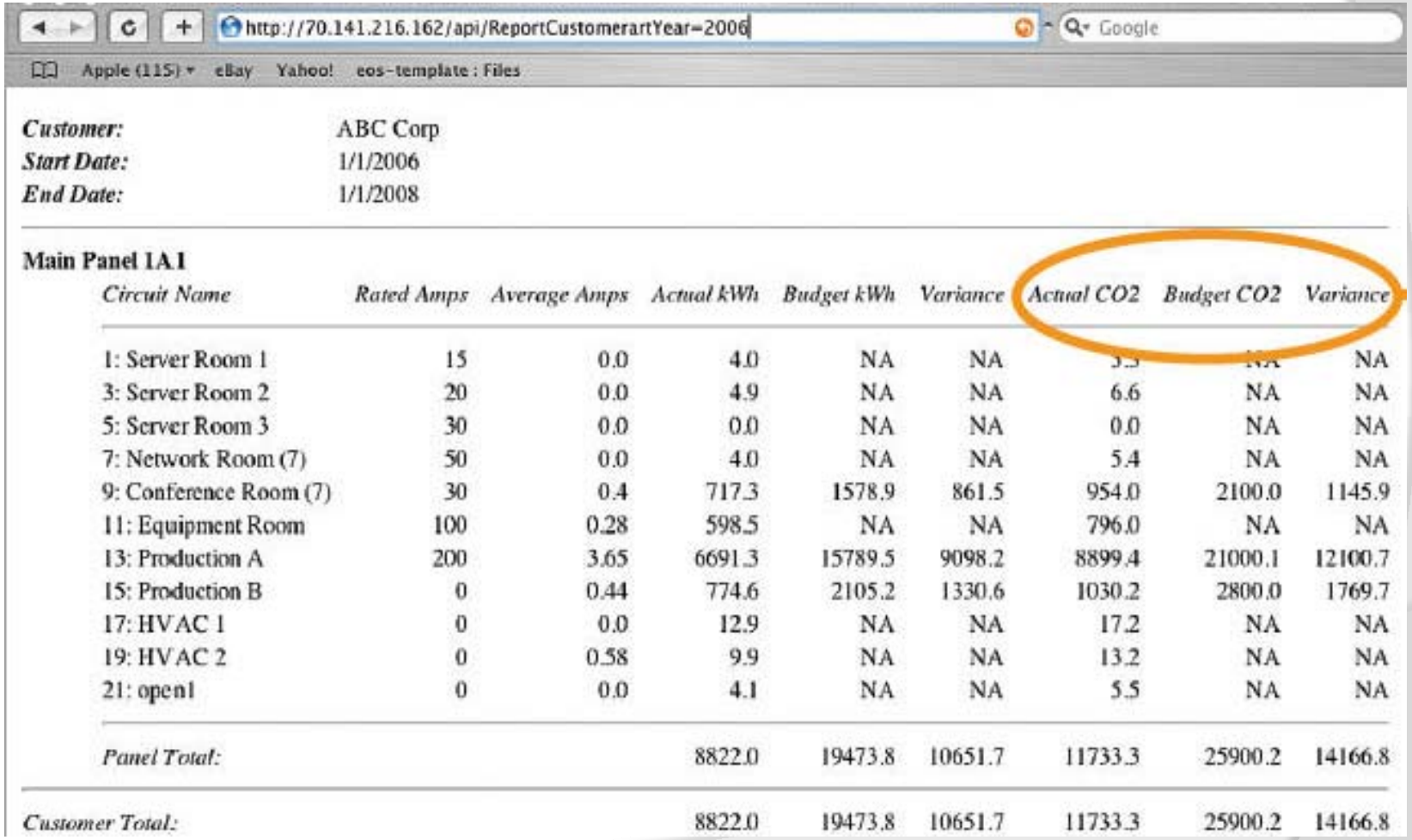
Drops into Existing Reporting Systems

Individual Energy & Carbon Accuracy



Customer: ABC Corp
Start Date: 1/1/2006
End Date: 1/1/2008

Main Panel 1A1

Circuit Name	*Rated Amps*	*Average Amps*	*Actual kWh*	*Budget kWh*	*Variance*	*Actual CO2*	*Budget CO2*	*Variance*
1: Server Room 1	15	0.0	4.0	NA	NA	[illegible]	[illegible]	NA
3: Server Room 2	20	0.0	4.9	NA	NA	6.6	NA	NA
5: Server Room 3	30	0.0	0.0	NA	NA	0.0	NA	NA
7: Network Room (7)	50	0.0	4.0	NA	NA	5.4	NA	NA
9: Conference Room (7)	30	0.4	717.3	1578.9	861.5	954.0	2100.0	1145.9
11: Equipment Room	100	0.28	598.5	NA	NA	796.0	NA	NA
13: Production A	200	3.65	6691.3	15789.5	9098.2	8899.4	21000.1	12100.7
15: Production B	0	0.44	774.6	2105.2	1330.6	1030.2	2800.0	1769.7
17: HVAC 1	0	0.0	12.9	NA	NA	17.2	NA	NA
19: HVAC 2	0	0.58	9.9	NA	NA	13.2	NA	NA
21: open1	0	0.0	4.1	NA	NA	5.5	NA	NA
Panel Total:			8822.0	19473.8	10651.7	11733.3	25900.2	14166.8
Customer Total:			8822.0	19473.8	10651.7	11733.3	25900.2	14166.8

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Circuit Reporting

Customer
Start Date 15-Oct-08
End Date 3-Nov-08

Panel Number Panel 1

Circuit Number	Circuit Name	Rated Amps	Average Amps	Actual kWh	Budget kWh	Variance	Actual CO2	Budget CO2	Variance
1	circuit 1	15	0	0.2	NA	NA	0.2	0.2	0
2	circuit 2	15	0	0.2	NA	NA	0.2	0.2	0
3	circuit 3	20	0.74	0	NA	NA	0	0.2	-0.2
4	circuit 4	30	1.42	93.6	NA	NA	124.5	100	24.5
5	circuit 5	30	0	0	NA	NA	0	0.2	-0.2
7	circuit 7	20	0	0.2	NA	NA	0.2	0.2	0
8	circuit 8	30	0	0	NA	NA	0	0.2	-0.2
9	circuit 9	30	0	0.2	NA	NA	0.3	0.2	0.1
10	circuit 10	30	0	0.2	NA	NA	0.3	0.2	0.1
11	circuit 11	30	0	0.2	NA	NA	0.2	0.2	0
12	circuit 12	30	0	0.2	NA	NA	0.3	0.2	0.1
13	circuit 13	30	0	0.2	NA	NA	0.2	0.2	0
14	circuit 14	20	0	0.2	NA	NA	0.3	0.2	0.1
15	circuit 15	15	0.97	61.1	NA	NA	81.3	50	31.3
16	circuit 16	20	0	0.2	NA	NA	0.3	0.2	0.1
17	circuit 17	15	0	0.1	NA	NA	0.2	0.2	0
18	circuit 18	20	0	0.2	NA	NA	0.3	0.2	0.1
19	circuit 19	0	1.76	0	NA	NA	0	0.2	-0.2
20	circuit 20	0	0	0.2	NA	NA	0.3	0.2	0.1
21	circuit 21	0	0	0.2	NA	NA	0.3	0.2	0.1
Panel Total				158.2	NA	NA	210.4	153.6	55.8
Customer Total				158.2	NA	NA	210.4	153.6	55.8

Customer Carbon Credit Liability 0.058 Tonne
Billable Total $1.74

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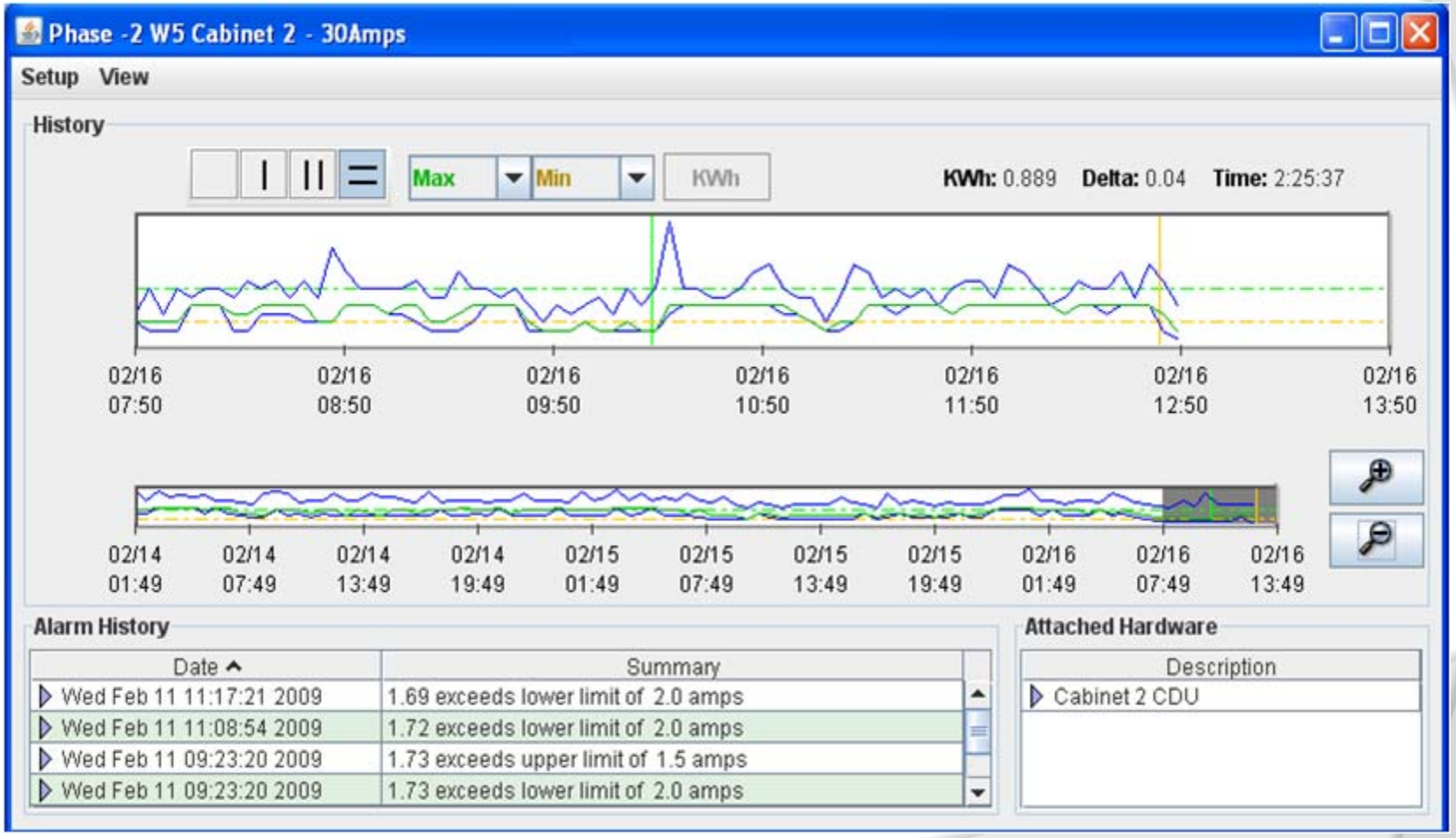
Real Time Circuit Monitoring



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Heat Management is Energy Management

- Heat in watts for each cabinet – key metric for cooling
- Match cooling to cabinet heat – saves significant energy
- Provide heat and cooling data to users – makes users your partners

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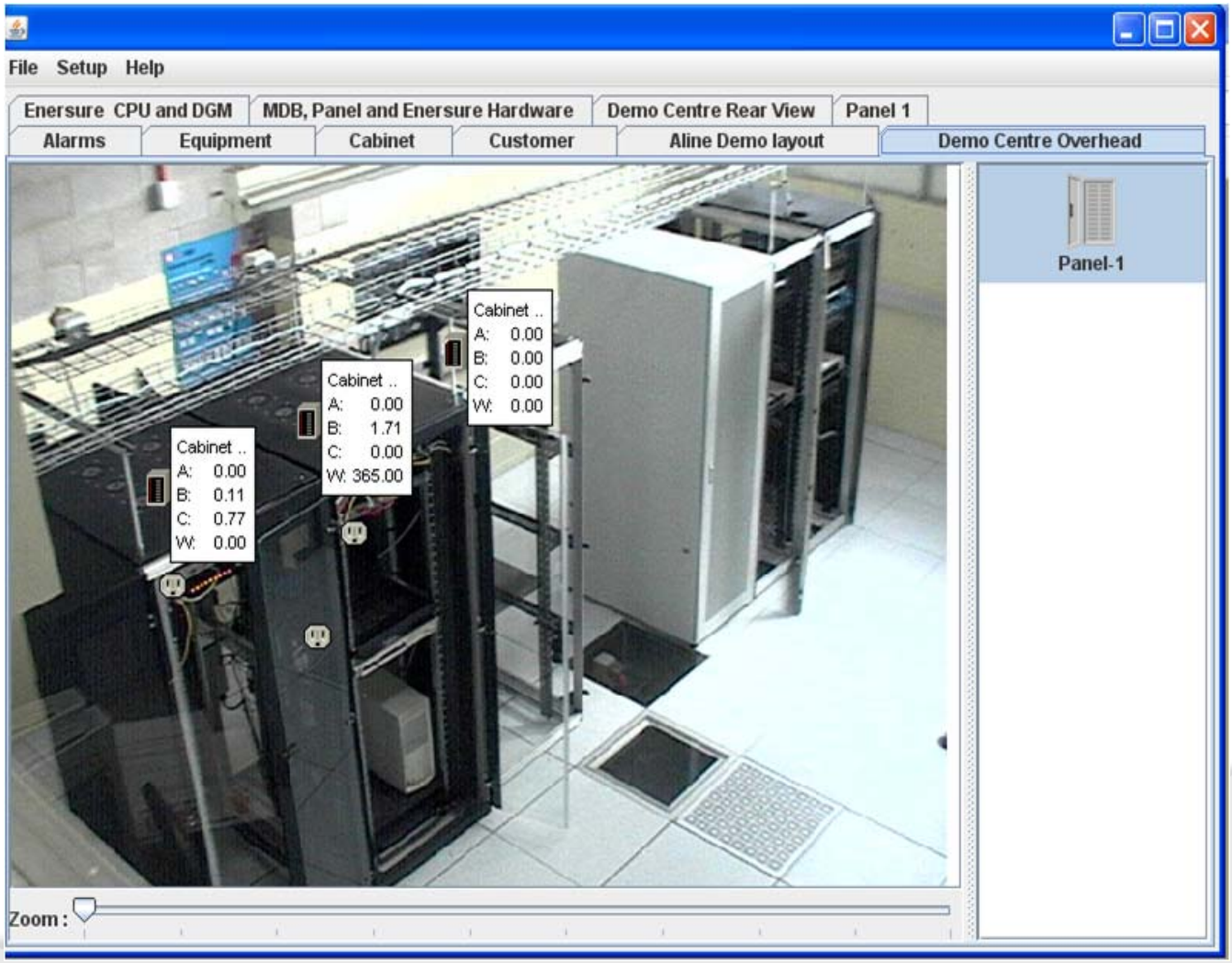
Circuit View via Your Images



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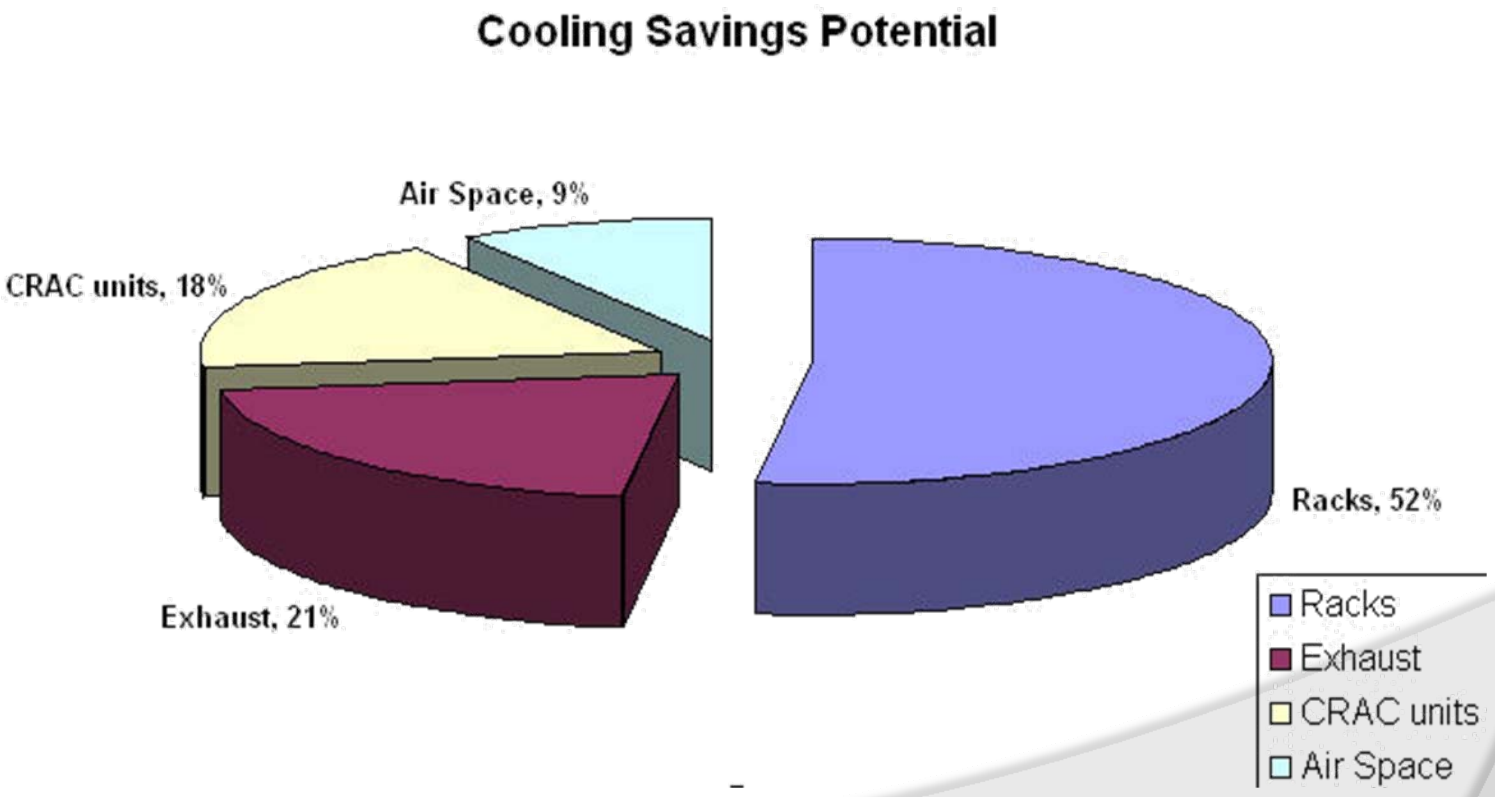
Managing Cooling: The Key to Savings

- HP proved 39% of potential savings is from managing cooling alone



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Managing Cooling: It's all about Watts

- Temperature is *dependent* on watts and resistance
- Every electronic device (ie servers) live on the following physical property:

  Δ Temperature = Wattage/Area * Heat Resistance

- In any data rack or cabinet, **if you balance wattage, you reduce resistance and lower temperature.**
- Controlling temperature by using temperature as the independent variable is a circular reference, just as if it was in an Excel Spreadsheet – it will never succeed

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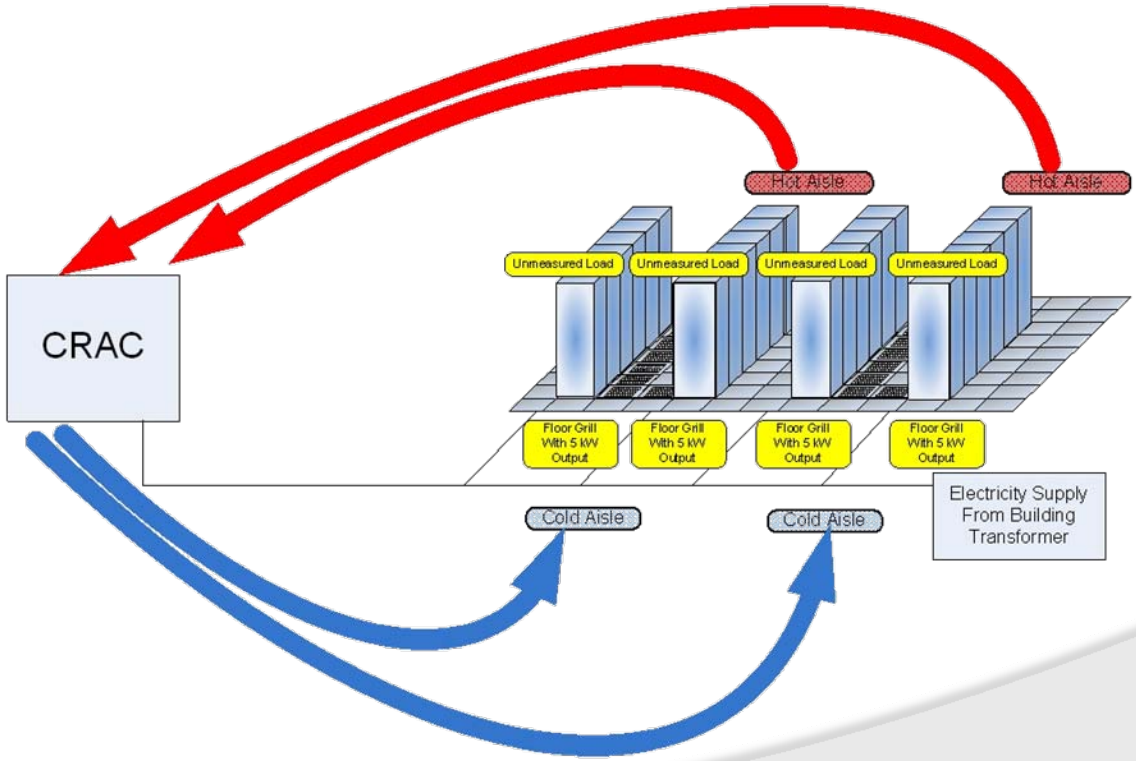
Typical Data Centre

- CRAC cooling output is disturbed across the entire data centre
- Thermal Load is not managed at cabinet level



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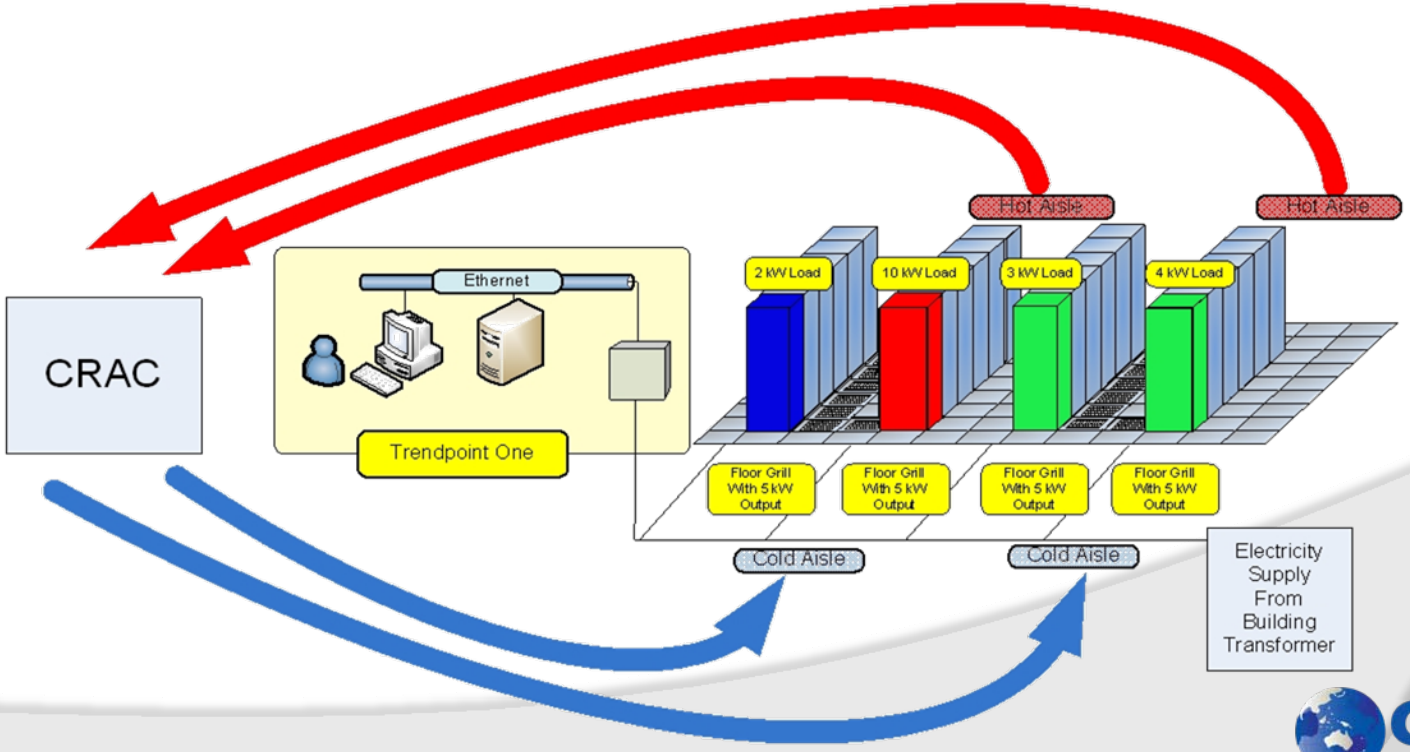
Monitoring Power Usage Reveals Thermal Loads

- Cabinets in **Blue** are overcooled, and are wasting electricity.
- Cabinets in **Red** are under cooled, and are reducing the lifespan of installed hardware.
- Cabinets in **Green** have cooling matched to the thermal load.



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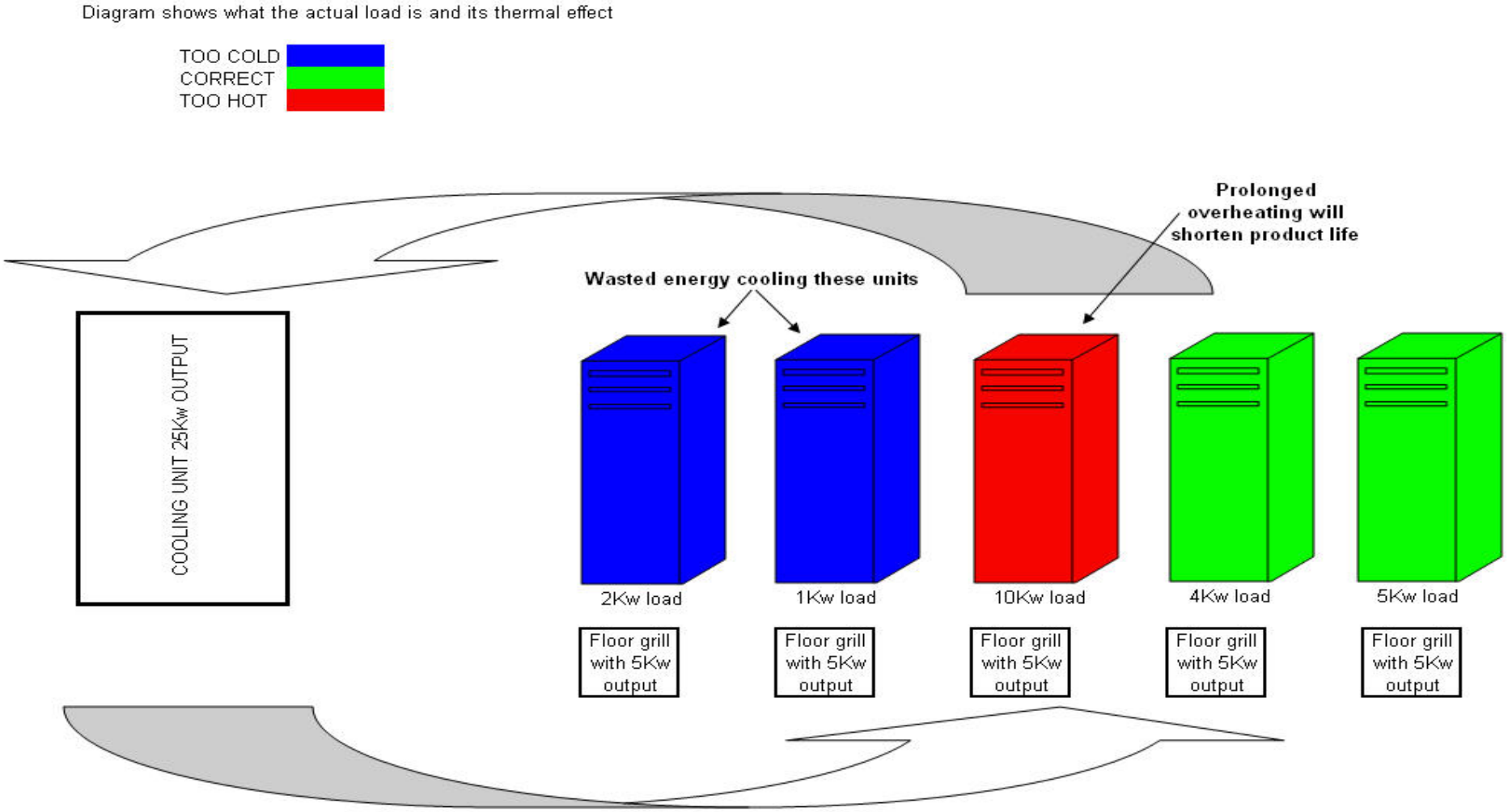
Rack Cooling; Mismatched Until Now



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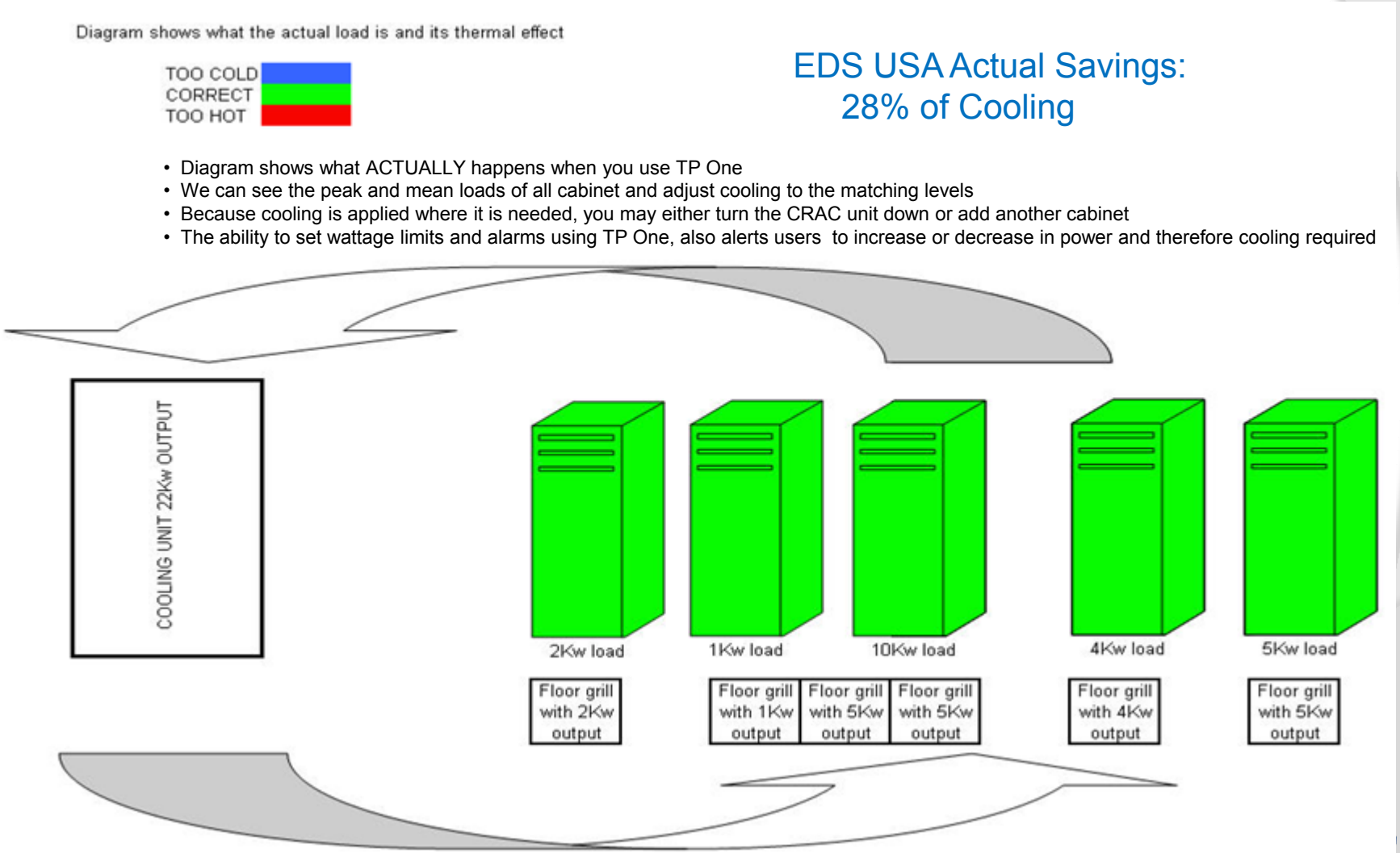
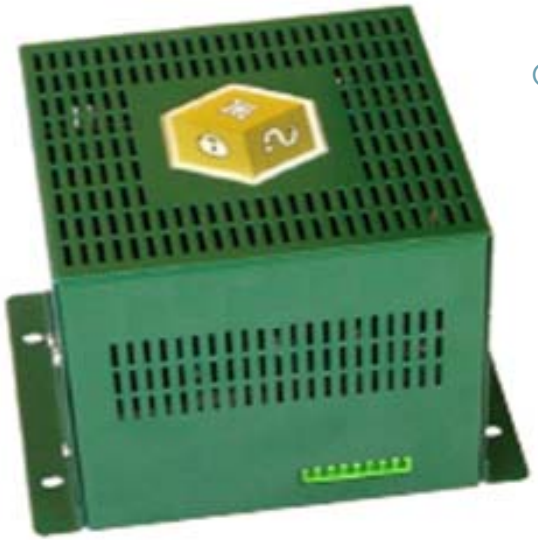
Cabinet Cooling Savings: Matching Watts of Cooling to Heat



Matching CRAC System Air to Total Cabinet Heat

Estimated Savings: An additional 18% of cooling



- The EV Cube CRAC/CRAH Management Unit
  - Wattage and BTU data for each CRAC/CRAH unit
  - Comparison of energy efficiency between **each unit**
  - Output control system to adjust VFD or ECM

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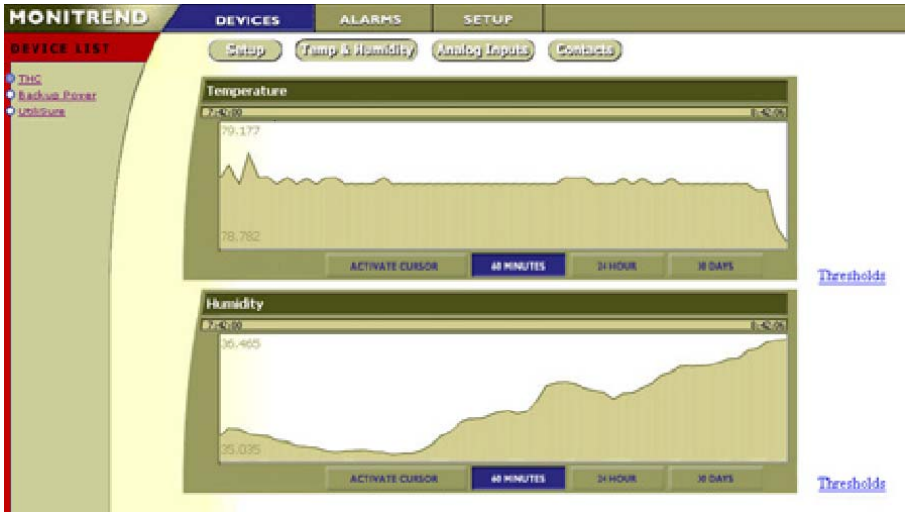
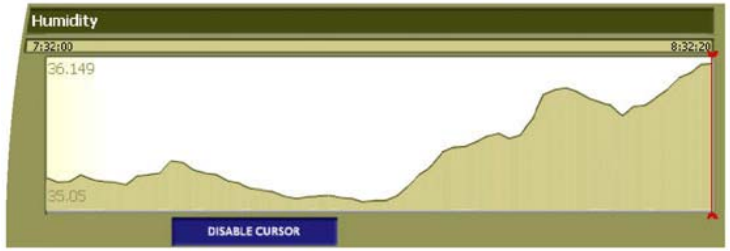
Matching CRAC System Air to Total Cabinet Heat





- EV Cube monitors CRAC or CRAH supply and returns values for temperature, supply and return humidity, Delta T, pressure & BTU's
- EV Cube receives group cabinet heat data from TP One & automatically adjusts the air flow and BTU's of cooling via a VFD drive to match the heat output of adjacent IT cabinets

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Optimisation of CRAC Performance

- Optimal performance requires management.
- Before you can manage, you must measure.
- CRAC Optimisation requires measurement of CRAC electricity consumption.
- TP One delivers :
  - Measurement and balancing of thermal load at the cabinet level.
  - Management of the effect of each cooling strategy, including hot aisle/cold aisle topologies.

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Reporting Metrics

- The Reporting is based on the following metrics:
  - **Budget kWh** = Wattage High Limit Alarm x Number of Hours in the selected reporting period
  - **Actual kWh** = kWh as reported by the Circuits
  - **Budget CO2** = Budget kWh x Carbon factor
  - **Actual CO2** = the measured CO2 emissions using the equation Carbon Factor (CO2 per kWh) multiplied by the actual kWh value.

- The Circuits Samples from the CPU at the rates below:
  - **kWh** = Real time (several thousand times per second)
  - **Amps, Watts, Volts, Power Factor** = Every 5-10 seconds

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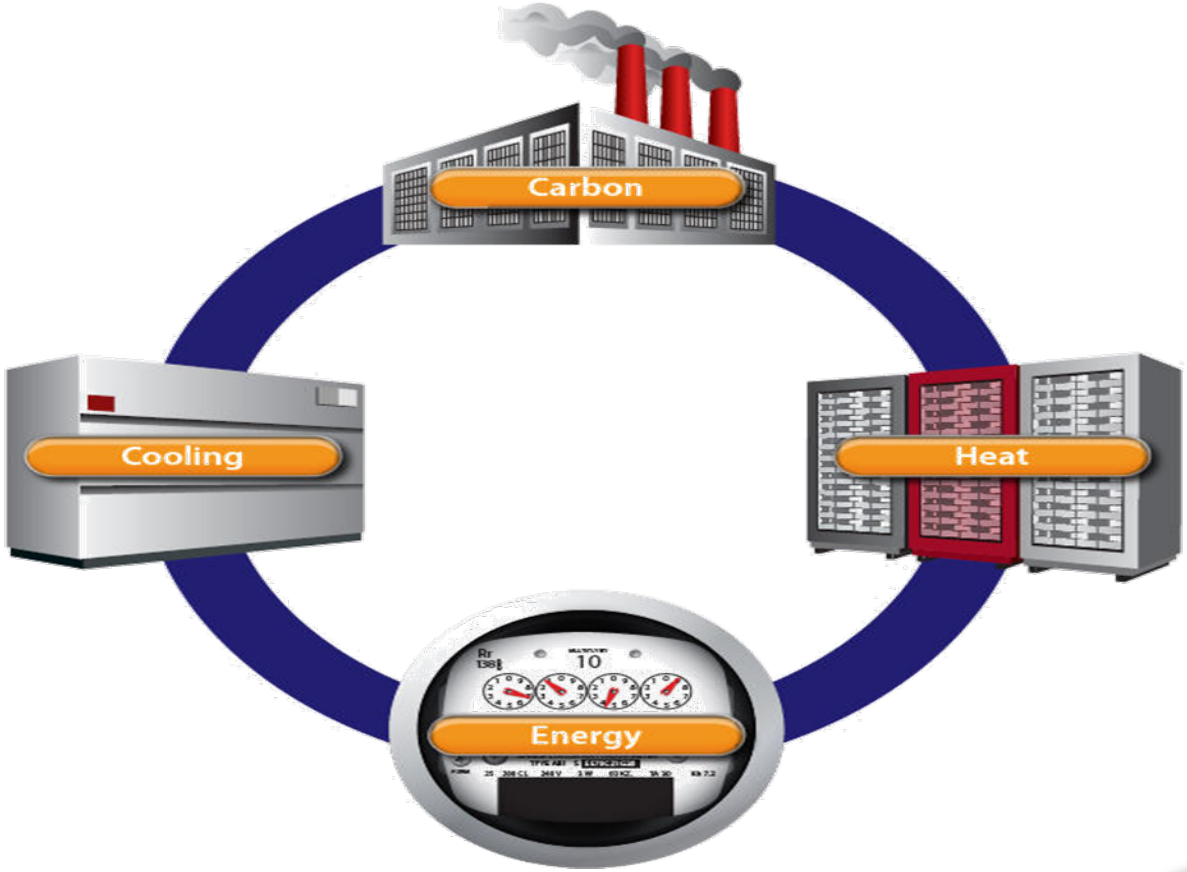
Thank you for your time



…for a live demonstration call us on

02 9669 2494…

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