JISC

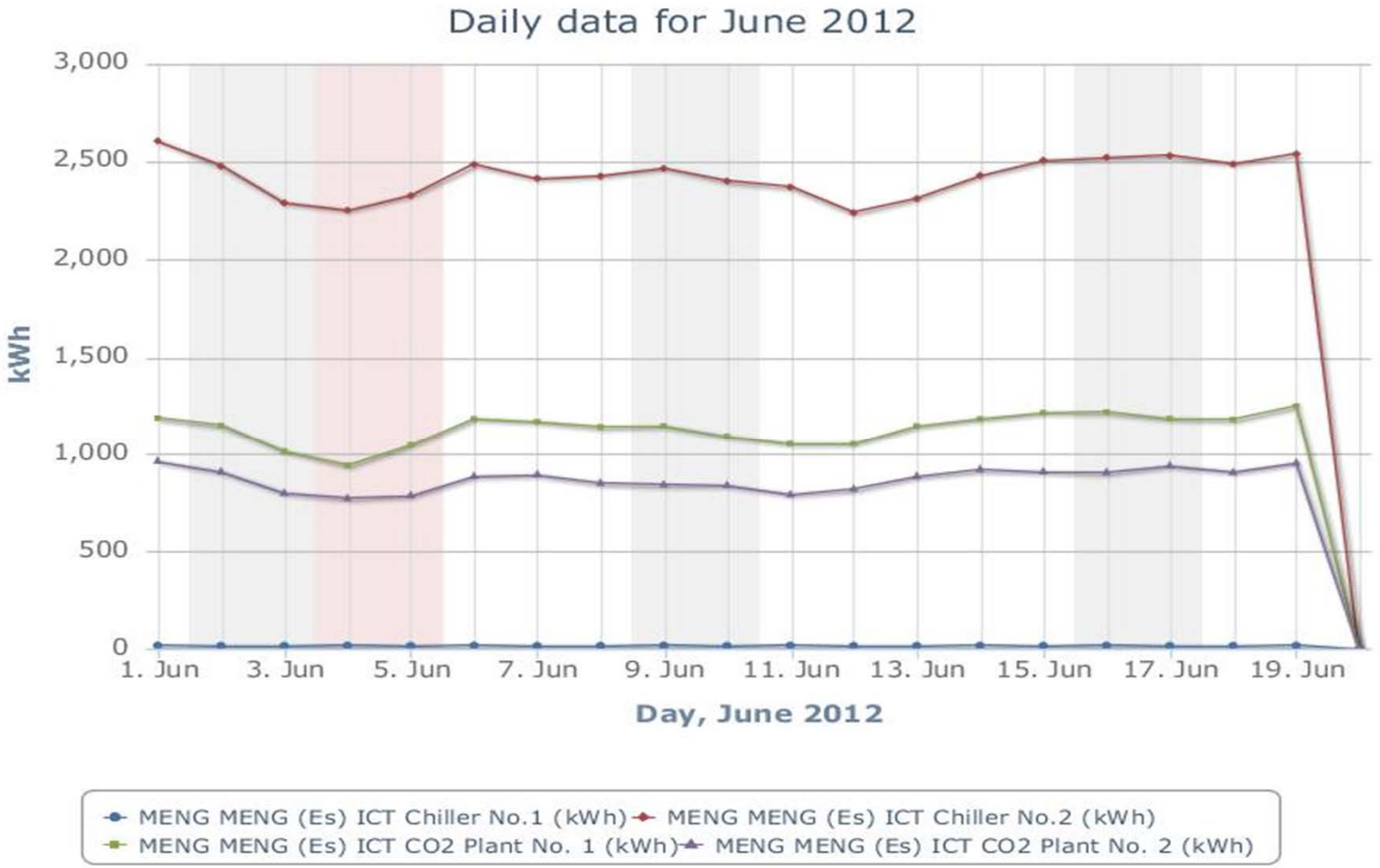
Greening ICT Programme (Phase II)

Data Centre Efficiency Improvements

Background

- Imperial's main Data Centre, hosts circa 2,500 servers
- It supports; Imperial College, Natural History Museum, Royal College of Music and Janet-LMN clients
- There are two server rooms which form the Data Centre both adapted to fit in a traditional 1960's building.
- Room One has a high density CO_2 cooling system while, Room Two has a traditional water chiller.
- The Data Centre's annual consumption is circa:

7,500,000 kWh **£500,000** **4,000 tCO_2**


Daily data for June 2012
3,000
2,500
2,000
1,500
1,000
500
0
kWh
1. Jun
3. Jun
5. Jun
7. Jun
9. Jun
11. Jun
13. Jun
15. Jun
17. Jun
19. Jun
Day, June 2012
MENG MENG (Es) ICT Chiller No.1 (kWh)
MENG MENG (Es) ICT Chiller No.2 (kWh)
MENG MENG (Es) ICT CO2 Plant No. 1 (kWh)
MENG MENG (Es) ICT CO2 Plant No. 2 (kWh)

PUE

The energy efficiency of Data Centres is measured by their individual **PUE**

PUE = Power Usage Effectiveness

- The PUE is determined by dividing the amount of power entering a data centre by the power used to run the computer infrastructure within it
- Therefore the closer to “1” the PUE gets the more efficient it is.
- **Room One PUE = 1.32** **Room Two PUE = 1.52**
- We are targeting a **5%** reduction in PUE (circa **200 tCO_2**)

Data Centre Project

- We obtained funding from JISC as part of their **Greening ICT Programme (Phase II)** to make improvements to the Data Centre efficiency and reduce energy consumption.
- **Phase II** is specifically focussed on how estate departments can integrate with ICT to reduce carbon.
- This project reflects many installations of its type, where Data Centre's have evolved in existing space, rather than a bespoke build.
- The majority of our work has focussed on the least efficient Room Two.

Project Approach

- Phase 1 – Definition, modelling & recommendations
  - Document current baseline
  - Use of thermal imaging and data logging
  - Model potential solutions and make recommendations
- Phase 2 – Implementation recommendations & measure effectiveness
  - Anticipated implementations include
    - » Cold aisle containment
    - » Free cooling
    - » Elevated computer room temperatures etc
    - » Improved maintenance & cleaning regimes
  - Measure effectiveness of improvements
- Phase 3 – Reporting & dissemination
  - Document analysis of outcomes and place in public domain

Data Centre Photos

Present Cold Aisle Containment

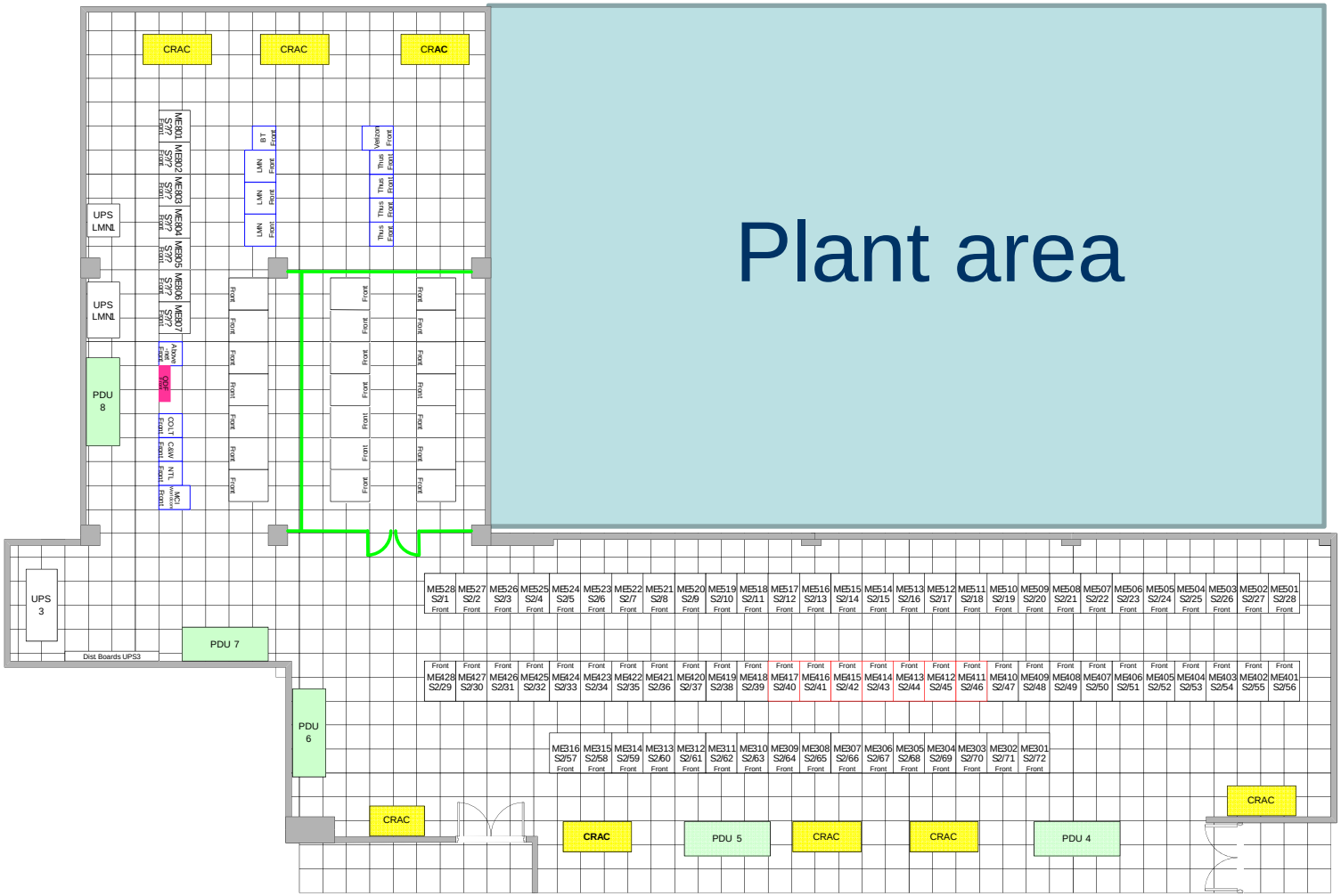
High density CO2 Cooling

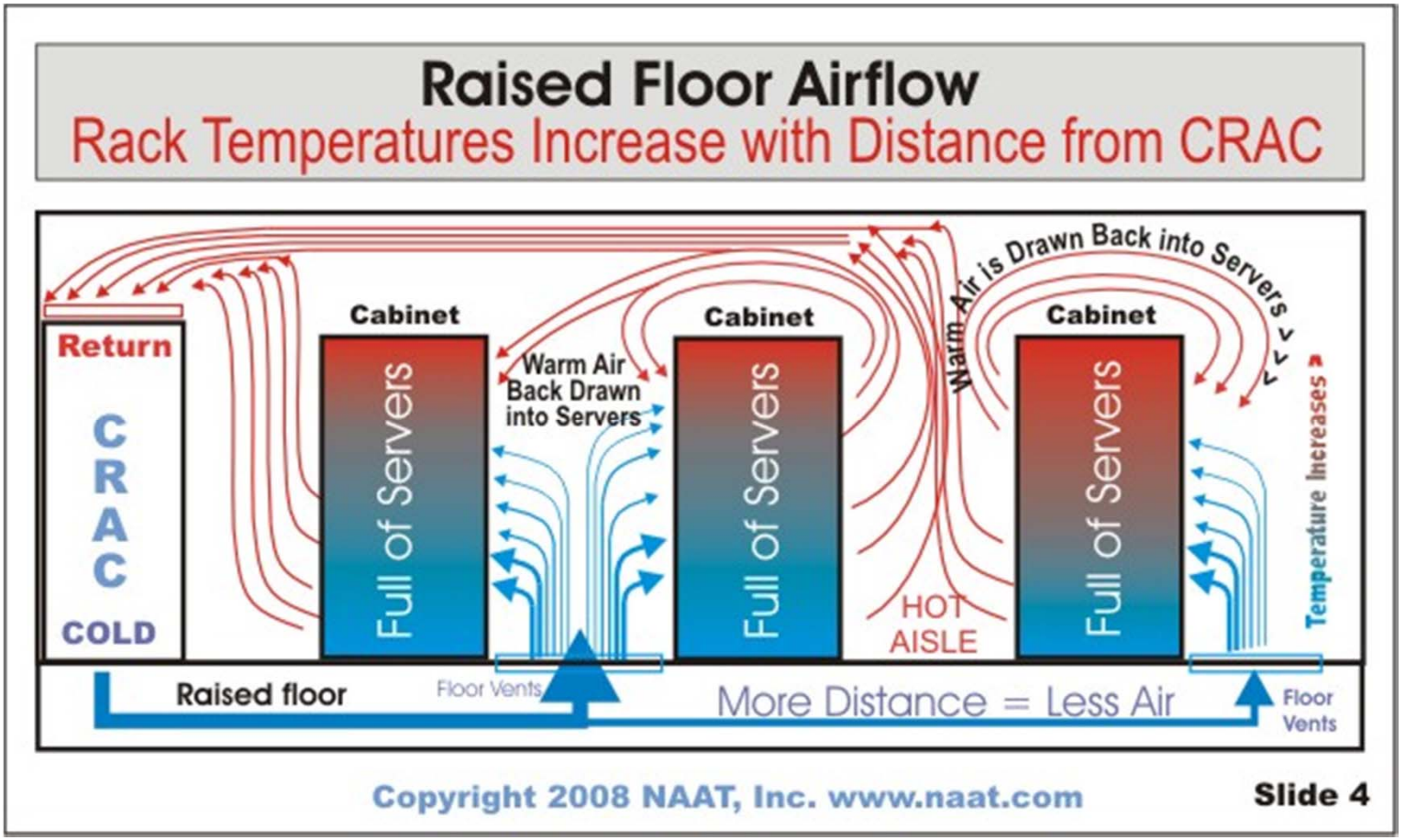
Extend Cold Aisle containment (further 56 racks)

Low Ceilings: Challenge to Return Hot Air to CRACs

Free Air Cooling Option: Supplement Existing Chilled Water

Data Centre Plan – Room Two





Note: **CRAC Unit** – Computer Room Air Conditioning Unit

Progress

Phase 1 **– complete**

- Thermal images of the data aisles were produced, identifying the primary hot spots.
- Flow measurements across the floor grills taken, identifying inconsistencies in the distribution of air – vents were adjusted.
- Temperature logging in the server rooms was undertaken
- Light levels in both rooms were assessed.

Phase 2 **- complete**

- Designed and procured cold aisle solution for room two (401)
- Designed and procured a free cooling solution for room two (401)
- Designed and procured a lighting solution for the area
- Automated meter reading, so consumption can be readily assessed

Phase 2 **- benefits**

Cold aisle containment; design of adaptive system complete, works awarded

- Projected savings: **14,482** kWh **8** tCO^2 **£1,138** per annum
- Increase chilled water temperature savings can result +2°C
  91,980 kWh **50** tCO^2 **£7,227** per annum

Free cooling; design of plant & controls completed, works awarded

- Projected savings: **200,424** kWh **109** tCO^2 **£15,747** per annum

Lighting; proposal to upgrade fittings and install new lighting controls developed, works complete.

- Projected savings: **52,976** kWh **29** tCO^2 **£4,162** per annum

Chiller; improved cleaning regime;

- Projected savings: **56,018** kWh **31** tCO^2 **£4,401** per annum

Total projected savings: **415,880** kWh **227** tCO^2 **£32,675** per annum