Case Study:
The design of a modern data centre

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EMEA Roll-out

UK – Swindon/Newbury area (15,000m$^2$)
Germany – Russelsheim(main)/ Bad Homburg Mirror (10,000m$^2$)
Netherlands – Limburg/Maastricht area (6,000m$^2$)
Belgium – Hasselt area (6,000m$^2$)
Sustainability

Target PUE Factor Development with HP Data Center

<table>
<thead>
<tr>
<th>Year</th>
<th>PUE Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Swindon Alpha</td>
<td>2.59</td>
</tr>
<tr>
<td>DC BBN</td>
<td>1.7</td>
</tr>
<tr>
<td>DC IDA</td>
<td>1.65</td>
</tr>
<tr>
<td>DC Vantaa</td>
<td>1.5</td>
</tr>
<tr>
<td>HP NGDC</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Target PUE Factor for HP NGDC: 1.2

PUE trends - HP
Overview

• **Scope:**
  – Generic Design, Main (2/8kw m²) & Mirror Sites (1/4kw m²)
  – Modular DC for Out-Sourcing to be built anywhere in Europe
  – Minimise Capital Cost
  – Optimise TCO (over Life time)
  – Minimise Energy Costs
  – Flexible. Accommodate changes in Technology
    (Future Proof)
  – Tier 3

• **Deployment**
  – CFS produce Generic Design
Striking the Right Balance between -

- Reliability
- Green
- Total cost of ownership
Data Centre Electrical Infrastructure Topologies – Reliability Table

<table>
<thead>
<tr>
<th>Description of RBD</th>
<th>MTBF (Hours)</th>
<th>Inherent Availability ($A_i$)</th>
<th>Probability of Failure in 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>N + 1 UPS system - dual cord loads</td>
<td>32,509</td>
<td>0.99981626</td>
<td>58.16%</td>
</tr>
<tr>
<td>Utility and N + 1 UPS system, ASTSs - dual cord loads</td>
<td>65,056</td>
<td>0.99999821</td>
<td>8.02%</td>
</tr>
<tr>
<td>Distributed Redundant (2-3) UPS system - dual cord loads</td>
<td>161,646</td>
<td>0.99997994</td>
<td>7.43%</td>
</tr>
<tr>
<td>2N UPS system - dual cord loads</td>
<td>214,182</td>
<td>0.99998723</td>
<td>6.56%</td>
</tr>
<tr>
<td>2(N + 1) UPS system - dual cord loads</td>
<td>305,251</td>
<td>0.9999868</td>
<td>6.49%</td>
</tr>
<tr>
<td>Redundant Reserve (2-3) UPS System, ASTSs - dual cord loads</td>
<td>257,459</td>
<td>0.99999058</td>
<td>2.58%</td>
</tr>
<tr>
<td>Distributed Redundant (2-3) UPS system, ASTSs - dual cord loads</td>
<td>256,674</td>
<td>0.99999046</td>
<td>2.72%</td>
</tr>
<tr>
<td>2N UPS system, ASTSs - dual cord loads</td>
<td>445,691</td>
<td>0.99999845</td>
<td>1.12%</td>
</tr>
<tr>
<td>2(N + 1) UPS system, ASTSs - dual cord loads</td>
<td>989,960</td>
<td>0.99999839</td>
<td>0.88%</td>
</tr>
</tbody>
</table>
## Data Centre Characteristics

### by business

<table>
<thead>
<tr>
<th></th>
<th>Enterprise</th>
<th>Internet Provider</th>
<th>Co locator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density kwatts/m²</td>
<td>1.5-3</td>
<td>9.5-14</td>
<td>1-1.2</td>
</tr>
<tr>
<td>Tier</td>
<td>3-4</td>
<td>1-2</td>
<td>2-3</td>
</tr>
</tbody>
</table>
Energy Modeling

Air-Cooled Chilled Water Annual PUE and Electricity Usage

Water-Cooled Chilled Water Annual PUE and Electricity Usage

Air-Cooled Chilled Water Monthly Electrical Demand

Water-Cooled Chilled Water Monthly Electrical Demand
Efficiency at 100% and 50% loading

Electrical Systems Efficiency - 100% and 50% loading

<table>
<thead>
<tr>
<th>System Configuration</th>
<th>DCiE at 100%</th>
<th>DCiE at 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x2(N+1) w/ ASTS Module</td>
<td>88.0%</td>
<td>82.0%</td>
</tr>
<tr>
<td>2x2(N+1) Module</td>
<td>88.0%</td>
<td>82.0%</td>
</tr>
<tr>
<td>2N Module</td>
<td>86.0%</td>
<td>80.0%</td>
</tr>
<tr>
<td>RR w/ ASTS module</td>
<td>92.0%</td>
<td>86.0%</td>
</tr>
<tr>
<td>DR UPS w/ ASTS Module</td>
<td>94.0%</td>
<td>88.0%</td>
</tr>
<tr>
<td>U&amp;(N+1) w/ ASTS Module</td>
<td>94.0%</td>
<td>88.0%</td>
</tr>
<tr>
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www.efocus.sk (or other source)
Next Generation Data Centres
SAMPLE PROJECT
Free Cooling - Bratislava

Bratislava – Dfb classification

- PUE 1.21 Direct Air-free Cooling achievable
- PUE 1.22 Indirect Free Cooling achievable

Global PUEs with Free Cooling (Air)
Free Cooling

- Free cooling allows a significant reduction in the energy required.
- Legacy data centres typically have PUEs of 2-2.5. Our leading edge data centre designs achieve a PUE of 1.2.

*Free cooling supply air-contained system*
ASHRAE Levels

These environmental envelopes pertain to air entering the IT equipment

18-27 degrees C

ASHRAE Guidelines

Bratislava
Recommended ASHRAE Levels
Core Design - Mechanical

Objectives

• Provide a high efficiency cooling system
• Ability to run in 100% recirculation mode to deal with adverse external conditions
• Elevated supply temperatures 23°C ± 1°C to increase operational efficiency and effect energy savings
• Benchmarking comparisons with air cooled chillers and CRAC systems

1 Outside warm dry air
2 After evaporative cooler – cooled humid air
3 Return heat exchanger – hot humid air
4 After heat exchanger – cool and dry
5 After cooling coil – cooler and dry
Innovative Free Cooling/Adiabatic Cooling System (PUE 1.25)

- Fresh air into data hall by separate system
- Redundancy in fans (N+1) on re-circulated and fresh air
- Redundancy in Units
- Large filtration and adiabatic cooling for increased efficiency and reduced maintenance
- Supplementary cooling coil for peak conditions
- Duplicated to provide UPS room cooling
- Recirculation damper to prevent de-humidification of the data centre in low ambient conditions
- Patent Applied for System
NGDC Layout
Overall Plan

www.efocus.sk (or other source)
Elevation/Section
Budget

10 Year High Level Cost Comparison @£0.08/kw/h

10 Year High Level Cost Comparison @£0.10/kw/h

Pay Back – Energy Savings
Site Visuals
Site Visuals
Thank you for your attention
Email:

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