



Power (In)Efficiencies in the Data Center
Lightning Talk
Monday, February 5, 2007

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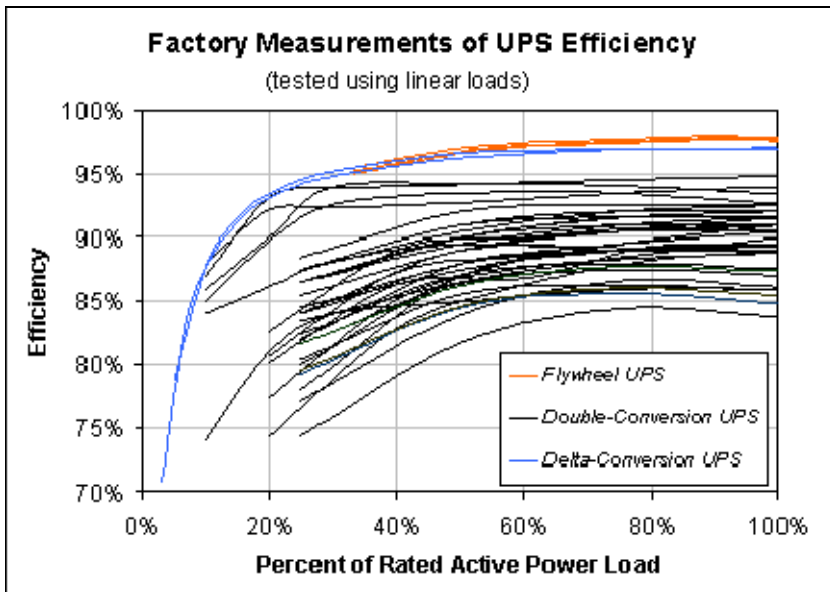
Power Distribution Systems

UPS Models

- Double Conversion
 - AC to DC back to AC
 - Redundant design compound efficiency issue
- Delta Conversion
 - Majority of power input is filtered only
 - Small portion is diverted for Battery Charge
- Flywheel
 - No conversion or battery components

DC Power Distribution

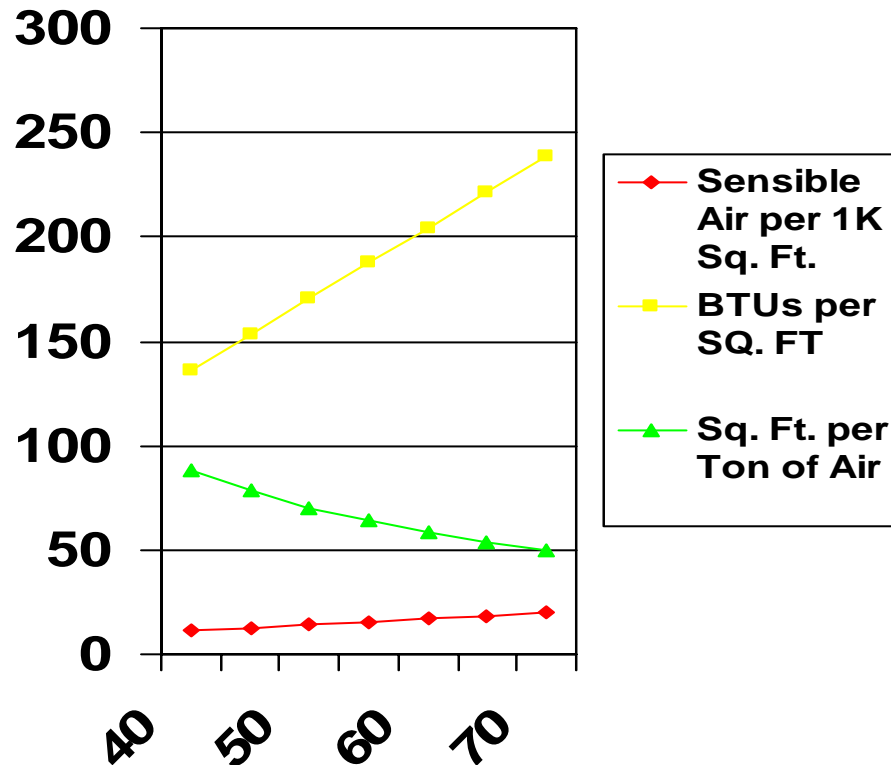
- Removes need for multi-step power conversions and the related
- Proven maintenance and reliability record
- Transmission loss due to lower voltage
- Need to investigate high voltage (370 - 550 VDC) distribution systems



Equipment Power Supplies

- Typical efficiency of power supplies are around 70%
- Multi-voltage designs are leading reason for inefficient designs

Relationship between Power and Cooling



Watts/Sq. Ft.	BTUs per Watt	BTUs per Sq. Ft.	Sq. Ft per Ton of Air	Sensible Tons of Air per 1000 Sq. Ft.
40	3.41	136.4	87.98	11.37
45	3.41	153.45	78.20	12.79
50	3.41	170.5	70.38	14.21
55	3.41	187.55	63.98	15.63
60	3.41	204.6	58.65	17.05
65	3.41	221.65	54.14	18.47
70	3.41	238.7	50.27	19.89

What can you do today?

Design Guidelines

- Facilities need to look to the future
 - Power densities will continue to climb in short to mid term
- Modular approaches to power distribution and cooling infrastructure
- If using raised floor, ensure that you are maximizing capacity by removing obstructions and placing racks

Implementation

- ASHRAE TC9.9 Specs
- Rack level discipline
 - Equipment Placement relative to CRAC units and airflow patterns
 - Cabling needs to allow airflow
 - Perf tile placements
 - High density racks in center of rows
 - Blanking Panels are a good thing
- Active Extraction Systems
 - ST key to addressing rising power densities is removing the heat
- High Density Rack Cooling
 - Focus on getting cooling to your problem areas
 - Investigate liquid cooling trends