

Confederation of Indian Industry



"Thermal Management Strategies for Existing Data Centres"





IGBC

Data Centers Main Thermal Management Needs

Capacity:

Always available, following the dynamic data centre's environment: peaks, load variations.

Efficiency:

Optimized for all conditions \rightarrow minimizing the pPUE value

Availability and Reliability:

100% cooling guaranteed even in the most extreme conditions







50% of DC Power for Physical Infrastructure









The Data Center World - Operating Thresholds







Everything Starts from the Server

...When IT Works, IT Makes Heat









Everything Starts from the Server

...When IT Works, IT Makes Heat

If Airflow is Not Enough...



Cold Aisle





Air Distribution Concept







pilot project "ENERGY" Steps to improve Energy in existing Data Center

- Focus "ENERGY EFFICIENCY"
- Two test conditions:
- > full load: 280 kW in the room
- ➤ partial load: 180 kW in the room







Consistent Covering







pilot project "ENERGY"



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Airflow Can Vary -Thermal Solution Always Needs to Match It!



IIII

Server Airflow Dynamic Control



Control and Different IT Loads per Aisle Server Airflow Dynamic Control



TEMPERATURE SENSOR T3

A step forward!





Underfloor Pressure Control –

Type of control to keep a constant pressure in the raised floor based on the differential pressure sensor



- Readings:
 - Inside the unit body or outside in the room (room pressure)
 - \circ In the raised floor or cold aisle,
- Typical Application:
 Open architecture: ~ 50 70 Pa , Hot / cold aisle cont





Control and Different IT Loads per Aisle - Pressure Control



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Note: Heat blowers used; efficiency results are depending from energy efficiency of the servers

Hot-Cold Separation

Conclusion

pilot project "ENERGY"

- complete change of the philosophy (open frame → closed racks and CoolFlex)
- CRAC units (n+1 \rightarrow 2n) \rightarrow redundancy and more security
- Up to and more than 90% energy reduction for the run of the CRAC units (or more kW load is possible)
- Regulation of the cold aisle

Power Savings in Chiller after deploying CAC - (Aircooled, Capacity-305 kW)

Chiller Outlet	Chiller Inlet	Power Consumption
۵°	S°	kW
7	12	103
10	15	91
18	24	69

Concept of the organized cold and hot areas

Direct Expansion Solution

India

Common ant	Basic	State-of-the-Art	
Component	Technology		
Compressor	ON – OFF	Modulating	
Fan	AC/EC	Fiberglass Infloor EC	
Control and Related Devices	Return Air Control	Rack Level Monitoring & Controlling	
Supply Air	10 to 12 DegC	18 to 27 DegC	
Return Air	22 to 24 DegC	35 to 38 DegC	

Upgrade/Replace - Direct Expansion Units

SL No	Description	Unit	Existing (22°C RAT)	With Containment (30°C RAT)
2	Sensible Capacity	TR	6.95	11.8
3	Total Airflow	Cfm	3740	5600
4	Power Consumption @ Full Capacity	kW	14.35	10.8
5	Specific Power Consumption (Total Capacity)	ikW/TR	1.46	0.85

Energy Consumption of Different DX Systems

Energy Consumption / 1 kW Cooling

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Chilled Water Solution

How to Optimize Chilled Water Systems

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Efficiencies improvements in the CW SOLUTIONS

Energy Consumption / 1 kW Cooling

Where Indirect Evaporative Freecooling / Adiabatic Works

DX/CW INTEGRATION:

- At 24°C and 90% relative humidity, the unit might require DX/CW integration.
- But, at 30°C (higher temperature) and 35% (lower relative humidity) the unit can work just with evaporative.

WET OPERATION

The unit can here exploit the evaporative effect via humidification.

Assumptions:

• Data Center $36^{\circ}C \rightarrow 24^{\circ}C$

Typical Installation

Roof Configuration

 Data centers located on the top of the building

Perimeter Configuration

- Green field sites
- Warehouse data centers

Indirect Evaporative Solution Operation Modes

MAXIMUM Optimization : System Logics of the Control

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Steps for Exisitng Data Centres

- Follow ASHRAE Cold Aisle / Hot Aisle Layout, Avoid Air mixing > Implement Aisle Containments
- CFD Analysis
- Convert Fix Capacity Systems to variable (Fan / Compressors)
- Apply Supply Air control
- Raise the RA temperature
- Monitoring and control of Fans speed from Remote Cold Aisle sensors / Pressure sensors
- Raise the CW temperatures and Raise the CW deltaT

• Apply Free cooling/ Adiabatic wherever possible

Two Steps for Data Centre Efficiency Improvement

• Increase data center temperatures to the limit of the Recommended Envelope

• Move to the Allowable ranges A1-A4 as a result of evaporative cooling and adiabatic chilled water solutions

Questions & Answers

Thank you

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