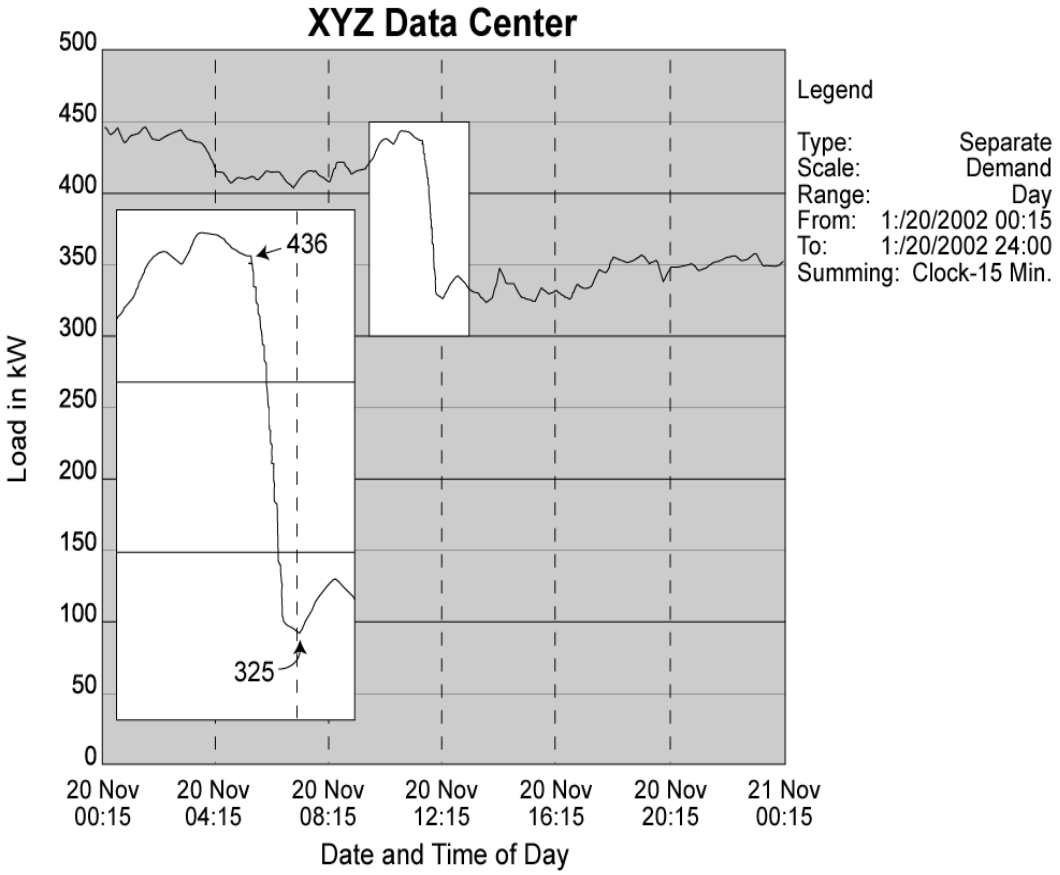
ComputerSite Engineering, Inc.®

“Case Studies on Computer Room Environmental Efficiency”

Case Study #1
Incapacity and Energy Consumption

Despite running 24 cooling units for a 5-unit load, this site had numerous hot spots. Turning off 11 units eliminated the hot spots and reduced energy consumption by 25%.



Case Study #2
Incapacity from Cold Data Center

- Cost of operating a “cold” computer room
  - 20,000 ft^2 raised floor & 2 MW of power (100 $W/ft^{2)}$
  - Data collected for each °F temperature set point below 72°F
  - At 66°F, utility cost increased $200/hr (at $0.04 to $0.06 per KWHr)
  - Total of $1.75M annually

Case Study #3
Incapacity from Cooling Unit Maintenance

- Eighteen 30-ton CRAC split system DX cooling units serving 30,000 ft^2 raised floor
- Nominal Capacity of 2062 kWc
- The UPS load = heat equivalent of only 1454 kW
- Why was the environment in this computer room unstable?

Case Study #3 (CONT)
Incapacity from Cooling Unit Maintenance

- A 30-ton CRAC does NOT deliver 30 tons of sensible cooling
- The manufacturer's 30-ton rating is the Total capacity at 80°F, 50% Rh
- Operating at a more typical 72°F, 45% Rh
- "30-ton" unit specification is 24 tons of sensible cooling (84 kWc)
- Maximum sensible cooling capacity of 18 units is actually only 1512 kWc vs. 1454 kW UPS load

Case Study #3 (CONT)
Incapacity from Cooling Unit Maintenance

- Manufacturer's nominal airflow across the cooling coil specified at 15,200 CFM
- As installed, measured airflow ranged from 7,800 – 13,900 CFM; average was 11,900 CFM (78% of the manufacturer's nominal)
  - Based on airflow, average cooling capacity reduced to 67 kWc of sensible cooling per unit

Note: Slower speeds than anticipated shift coil performance toward latent cooling, reducing sensible cooling capacity

Case Study #3 (CONT)
Incapacity from Cooling Unit Maintenance

- Two layers of pleated filters for an “extra clean” environment reduced nominal airflow dramatically
  - Dirty filters have same impact
  - Slower air movement means more “dwell time” on the coils, so more dehumidification and less sensible cooling

Case Study #3 (CONT)
Incapacity from Cooling Unit Maintenance

- Adjusted delivered capacity of 18 units is a total of 1200 kWc vs. 1454 kW UPS load
- The actual heat load is 111% of the delivered theoretical cooling capacity
- This room will overheat

Case Study #3 (CONT)
Incapacity from Cooling Unit Maintenance

- Additional contributing factors included:
  - Refrigerant charge low in most of the CRAC units, further significant reduction in capacity
  - Outdoor condenser units recirculating previously rejected hot air, further reducing capacity, especially on hot summer days when heat rejection capacity most needed

Case Study #3 (CONT)
Incapacity from Cooling Unit Maintenance

- Do you have any of these conditions in your data center?
  - Less than optimum cooling capacity
  - Set points below 72 °F / 45% Rh
  - Below specified airflow volumes
  - Below specified “delta T” at 100% capacity
    - Low refrigerant charge
    - Below capacity dry cooler capacity
    - Low chilled water flow rate

Case Study #4
Impact of Chilled Water Temperature

- A centralized chiller plant serves a large multi-building campus including major data center
- People (comfort) cooling supplied by the same mechanical systems as the data center
- Data center was too warm; humidity unstable

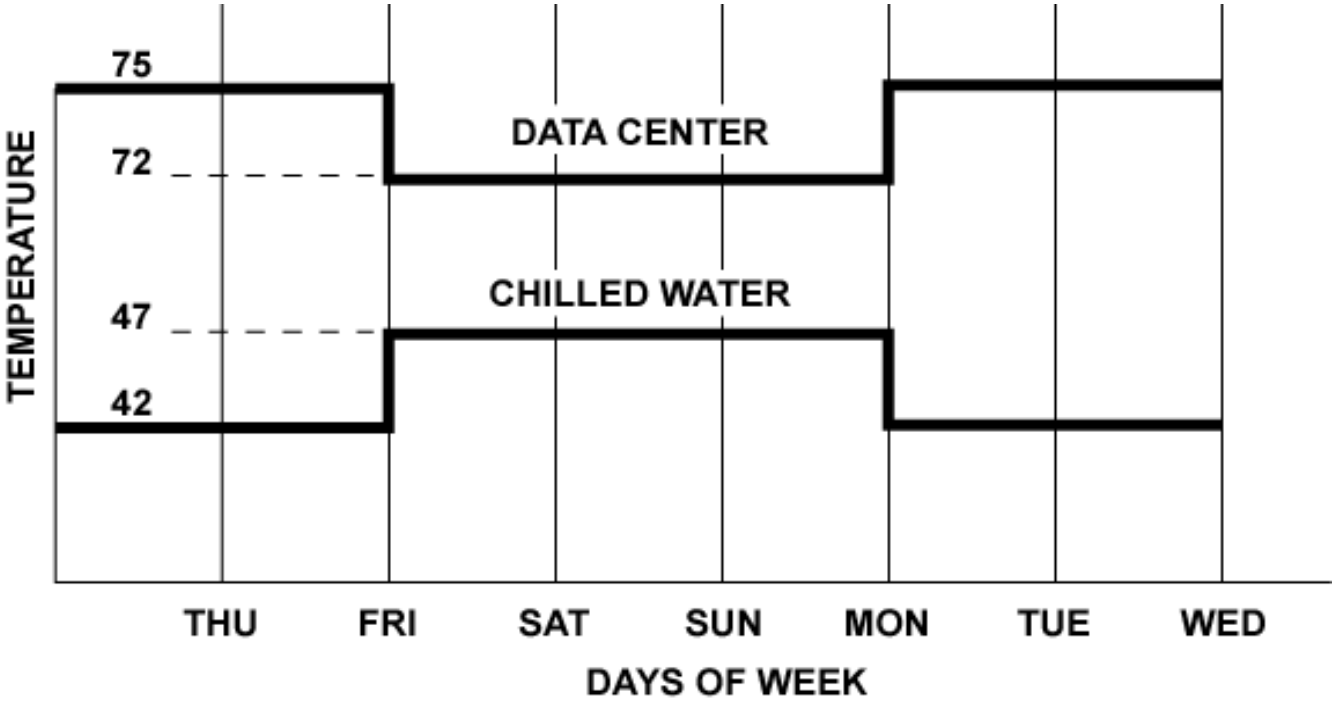
Case Study #4 (CONT)
Impact of Chilled Water Temperature

- Friday afternoons, staff RAISED chilled water temperature
- Monday mornings, they LOWERED chilled water temperature
- Question: What happened to the data center over the weekend?

Case Study #4 (CONT)
Impact of Chilled Water Temperature

- Data center got COLDER on Friday when chilled water temperature RAISED
- Data center got WARMER on Monday when chilled water temperature LOWERED
- Wide humidity swings in data center during week ceased on weekend
- Question: Why?

Case Study #4 (CONT)
Impact of Chilled Water Temperature



Case Study #4 (CONT)
Impact of Chilled Water Temperature

- Explanation
  - Warmer chilled water resulted in higher dew point on cooling coil
  - Higher dew point stopped dehumidification and stabilized moisture content in the room
  - Converted wasted latent cooling capacity to sensible capacity
  - As a result, dry bulb temperature dropped

ComputerSite Engineering
Case Studies