Data Center Control
with
Wireless Sensor Technology
and
Airflow Management

Demonstration at the
California Franchise Tax Board
August 2008 - April 2009
Opening Remarks:
Welcome & thank you for attending...

- In August 2008, FTB partnered with California’s Department of General Services and the California Energy Commission to install a Data Automation Software and Hardware (DASH™) system from Federspiel Controls.

- The DASH system uses wireless sensors and web based software to control computer room air handling (CRAH) units.

- The project also included installing variable frequency fan drives and fusible-link curtains.
Opening Remarks:
Thanks to our supporters!
Project Overview: Significant Results...

- **Reduces** fan energy by 66%
- **Lowers** total energy by 21.3%
- **Saves** 475,000 kWh/yr
- **Eliminates** >400 tons CO$_2$/yr
- **Payback** in 3.1 years
- **Bottom-line:** $42,722 per year saved
Demonstration Support: Primary Goals…

- Demonstrate wireless, mesh-network technology to directly control air handlers.
- Analyze supervisory software and hardware.
- Eliminate over-cooling caused by contending controls.
- Examine air management best-practices.
- Ensure CRAH unit operational redundancy.

LBNL mission:
- Perform independent “white-paper” review of project.
- Provide knowledgeable support to all parties involved.
- Share project findings with data center community.
- Satisfy PIER and CEC resource needs…
Executive Summary: FTB Data Center

Description:
• 10,000 Sq Ft
• 12 CRAH cooling units
• 135 kW load

Challenges:
• Over-provisioned
• History of fighting
• Manual shutoff not successful

Solution:
• Intelligent supervisory control software with inlet air sensing
**Project Tasks:**

- Establish baseline
- Adjust floor tiles
- Install Variable Frequency Drives (VFDs)
- Install supervisory control software
- Isolate hot-aisles
- Blank racks
DASH:

- 50 wireless temperature sensors (Dust Networks radios)
- Intelligent control software

FACS Dashboard:
Smart software: learns about curtains

CRAH 3 influence at start

CRAH 3 influence after curtains

CRAH-03
Effect on cold aisle temperatures:

- Floor tile changes
- VFDs
- Control software
- Hot aisle isolation
- Rack blanks

- Lower limit of ASHRAE recommended range
- Upper limit of ASHRAE recommended range
DASH™ software started

BEFORE

AFTER

Main breaker, kW

date/time

Environmental Energy Technologies Division
CRAH Power reduction:

![Graph showing CRAH power reduction across different time intervals and factors like floor tile changes, VFDs, control software, hot aisle isolation, and rack blanks.]
Cost-Benefit analysis:

• Total project cost-benefit
  • Cost: $134,057
  • Savings: $42,772
  • Payback: 3.1 years

• DASH cost-benefit (sensors and software)
  • Cost: $56,824
  • Savings: $30,564
  • Payback: 1.9 years
Lessons learned:

• Controls and software eliminated 59.6% of fan energy and 13.6% of chilled-water use from baseline.

• Re-arranging floor tiles reduced chilled water use and made cold-aisle temperatures more uniform.

• VFDs reduced CRAH electrical energy use and further reduced chilled water use.

• Isolation enabled higher return air temperatures, increasing CRAH capacity.

• Wireless reliability was 99.999% (only 81 packets lost out of nearly 10 million sent).
Closing Remarks:
Suggested next steps…

- **Continue** optimization of control and sensor installations.
- **Scrubtizne** floor tile re-arrangement benefits.
- **Evaluate** higher chilled-water temperature to save energy.
- **Consider** introducing outside air to cool data centers.
- **Turn Off Lights** in your data center!
Real improvements; No waiting; Let’s do it!

✓ Readily available…
✓ Applicable throughout California…
✓ Short payback periods; 3 to 5 years…
✓ Creates jobs…
✓ Saves energy and the environment…
Questions?
For More Information

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