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!

Department of
General Services
BUILDING GREEN · BUYING GREEN · WORKING GREEN

State of California
Franchise Tax Board

FEDERSPIEL
CONTROLS

EMERSON.
Network Power

vte
CLEANROOM & DATA CENTER SPECIALISTS

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:

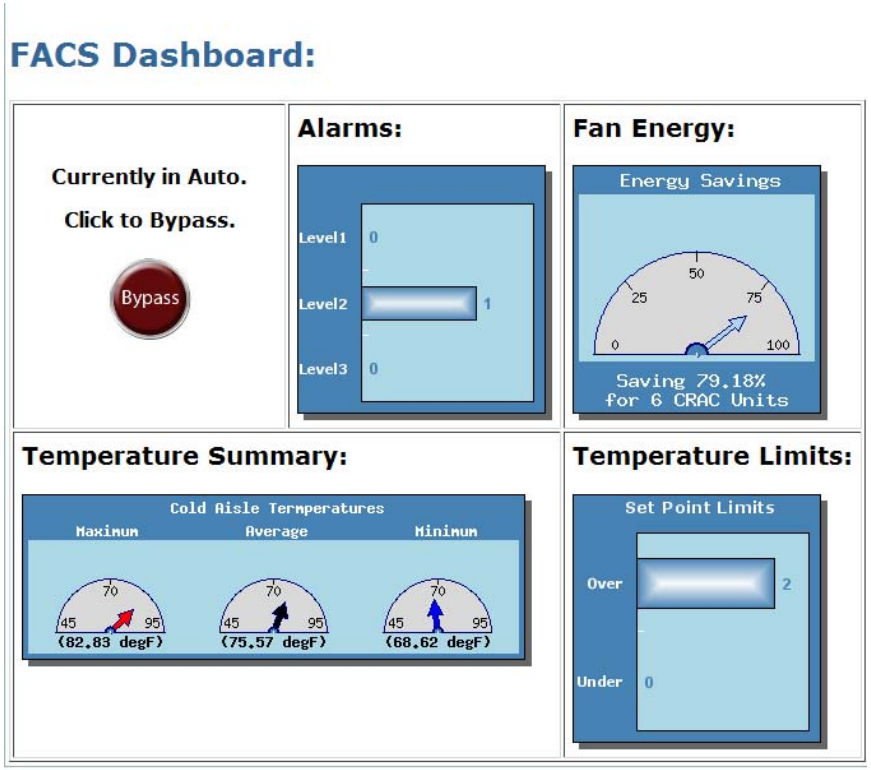
- Intelligent supervisory control software with inlet air sensing

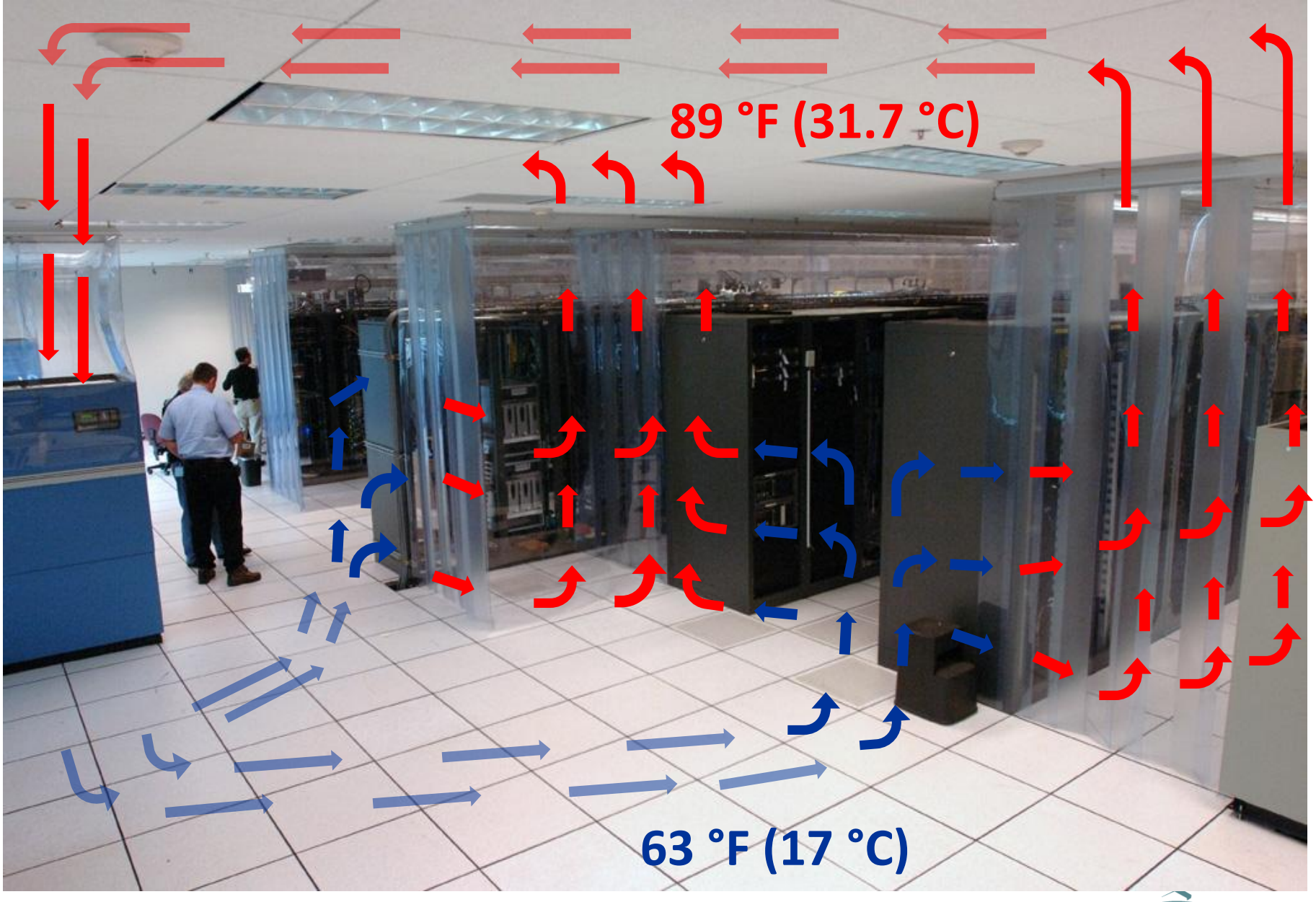
Project Tasks:

- 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

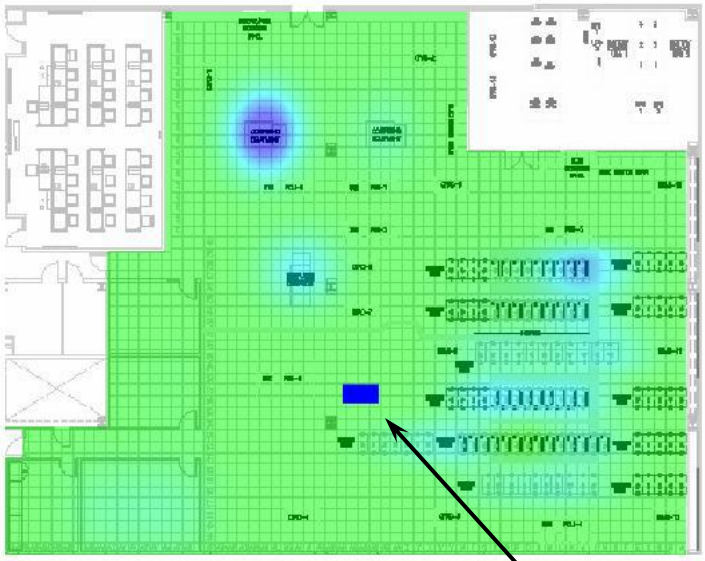




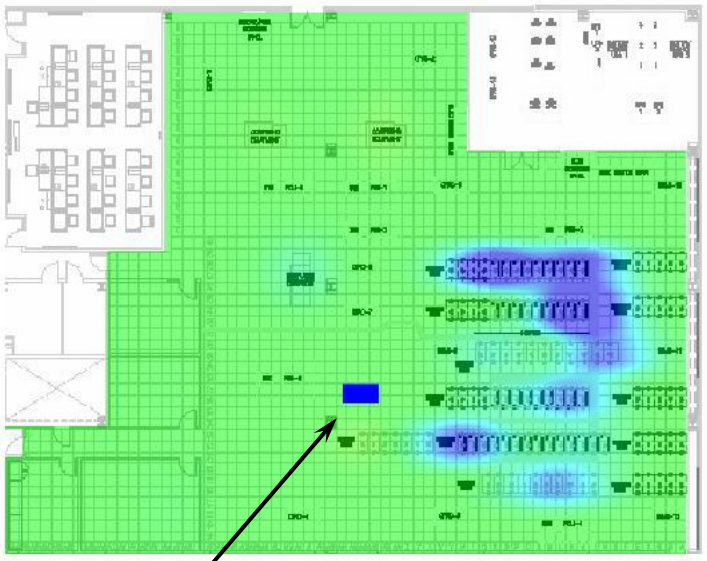
Airflow Solution

Smart software: learns about curtains

CRAH 3 influence at start

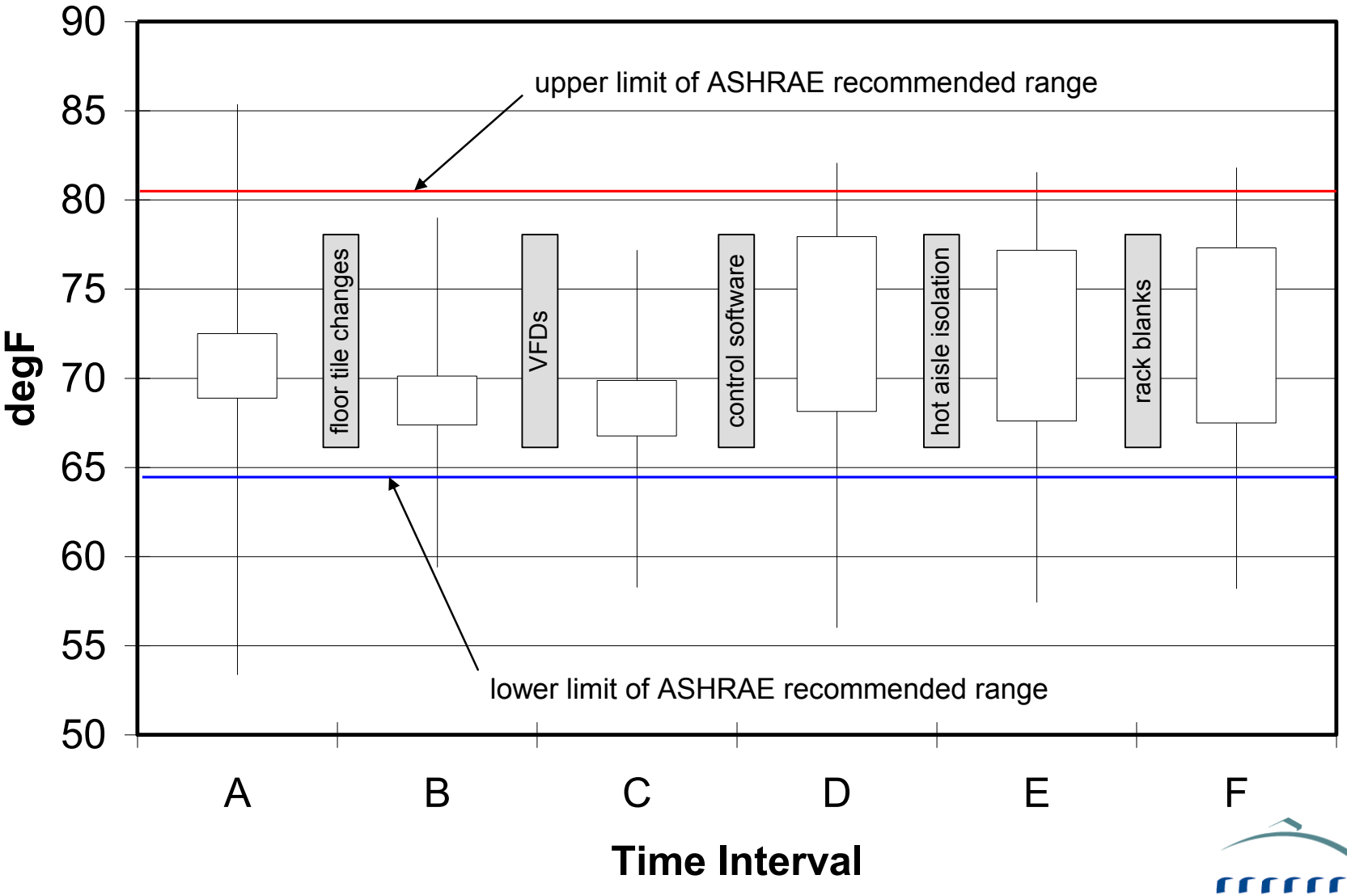


CRAH 3 influence after curtains

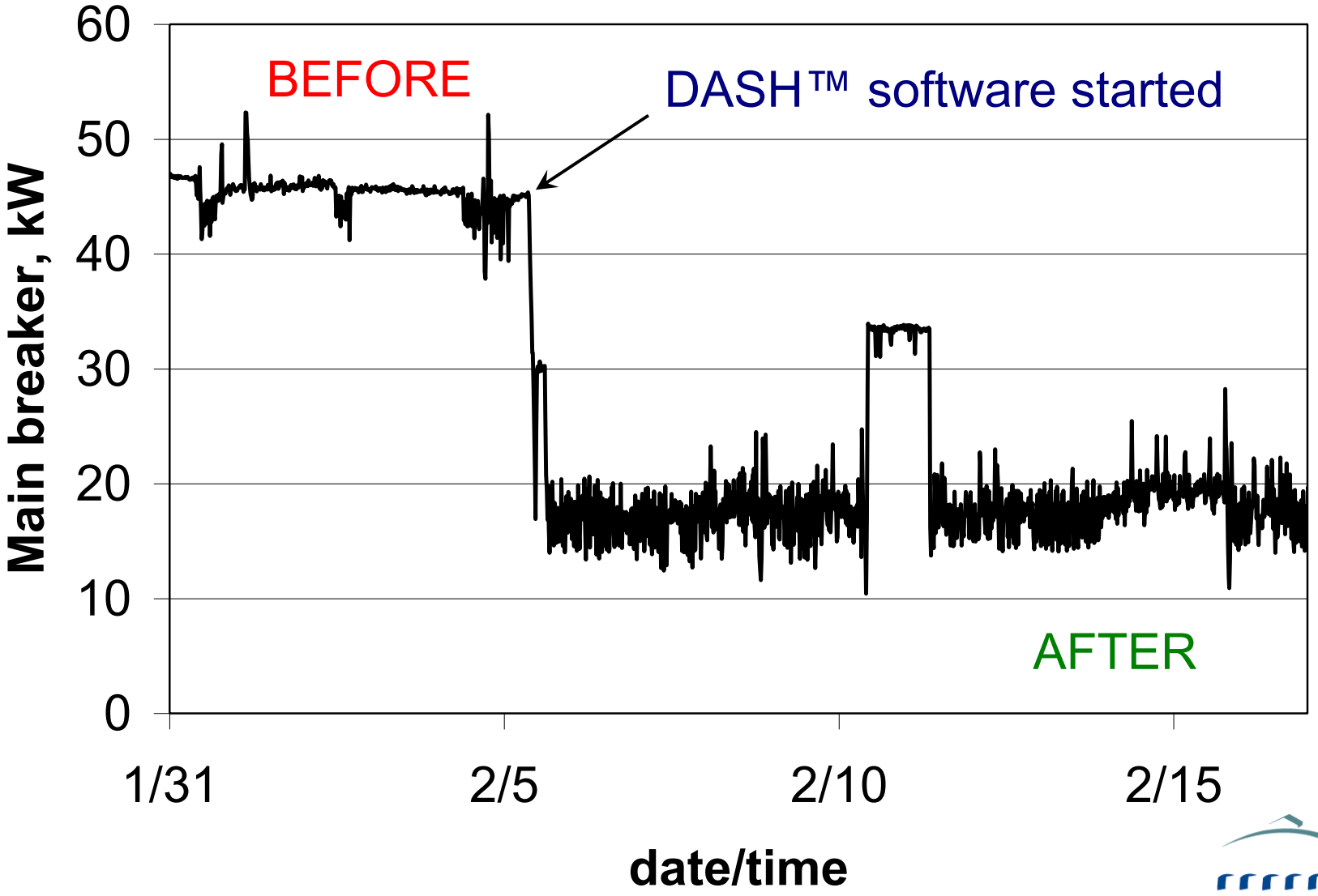


CRAH-03

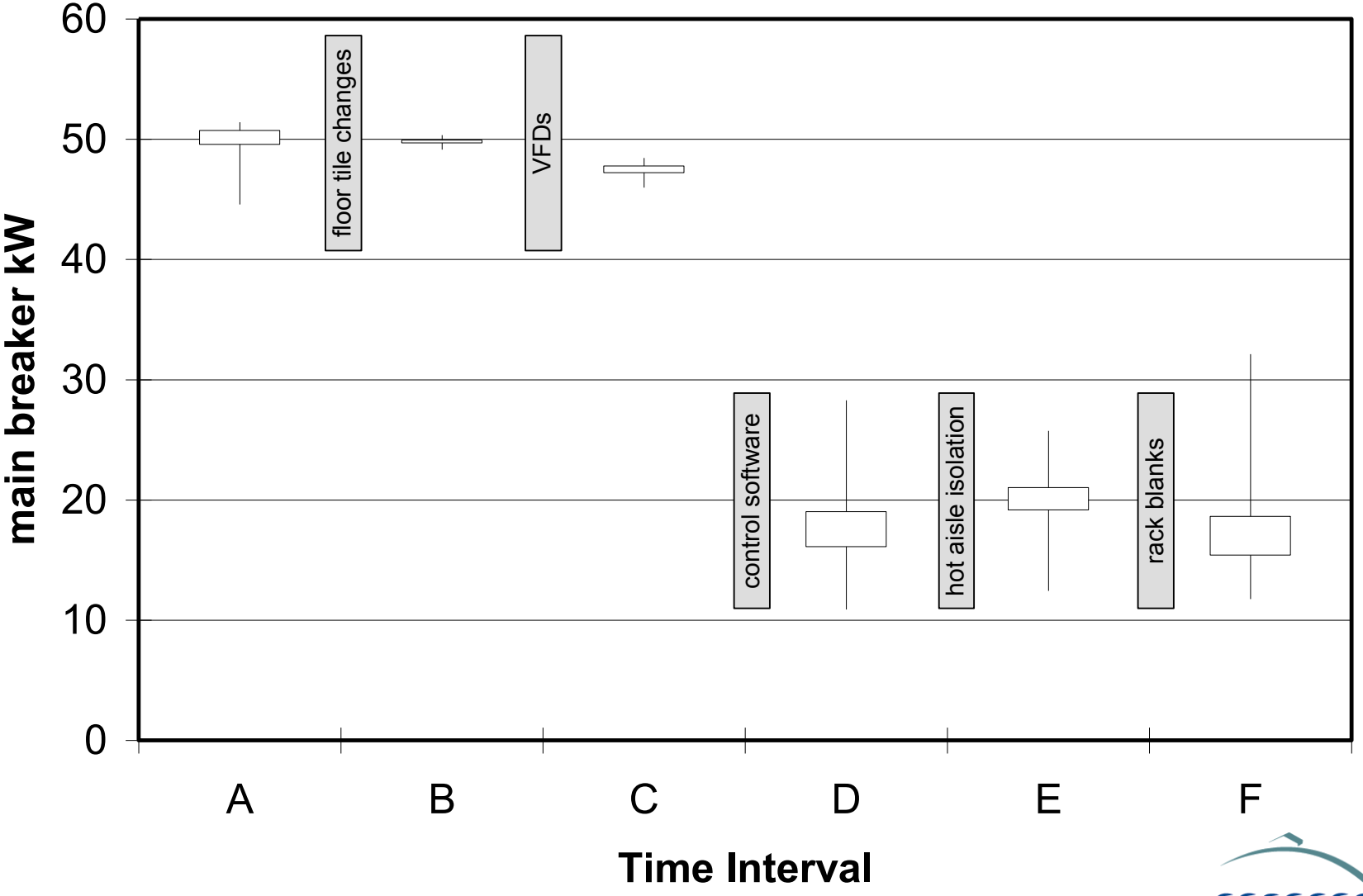
Effect on cold aisle temperatures:



DASH = Dramatic Reduction…



CRAH Power reduction:



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.
- **Scrutinize** 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

http://hightech.lbl.gov/datacenters.html

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