CRAH Retrofit and Energy Savings Project
Danny Johnson Director, Technical Operations
Silicon Valley Leadership Group - Data Center Efficiency Summit
October 24, 2012
2260 E. El Segundo Boulevard - A Digital Realty Datacenter
Project Scope

- Upgrade CRAH fans for variable speed operation
- Transition from manual to automated/dynamic environment
  - Motor speeds change to meet IT equipment inlet air set points
  - Create cooling buffer and unlock stranded cooling capacity
  - Optimize operational capacity to increase capacity of existing data center infrastructure
- Rack wireless temperature sensors monitor IT equipment inlet air conditions
- Humidity sensors in each Colo room. Power sensors on each CRAH
- Data collection of 1,274 monitored points
- Reduce capacity requirements from over extended grid
- Project Team: Digital Realty, Lawrence Berkley National Labs, So Cal Edison, Vigilent
Project Objectives

1. Reduce the part load mechanical demand profile and improve PUE

2. Maximize cooling capacity utilizing existing CRAH units

3. Delivery graphic demonstration of real-time heat profile

4. Develop and implement improved rack management practices with existing customers

5. Improve ROI through use of grant award funding (Lawrence Berkeley National Laboratory) and public utility rebate program (Southern California Edison)
## Project Timeline

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Source: Vigilent
Plug Fan with EC Motor

Plug Fan Installed

Plug Fan Upside Down on Pallet

Note: Impeller under the floor for better air flow
CRAH Power Reduction Due to Fan Type Change

Fan Type Change: CRAH Power Reduction
(includes associated infrastructure power)

Power (kW)

497

Fan Type Change
CRAH Power Reduction 47%

264

Original AC Scroll Type
No Controls (estimate Baseline)

New ECM and AC Plug Type
No Controls (Baseline)

Source: Lawrence Berkeley National Laboratory High-Tech and Industrial Systems Group
Vigilant Control Addition CRAH Power Reduction
(includes associated infrastructure power)

CRAH Fan Speed Control
37% Power Reduction

Power (kW)

264

167

New ECM and AC Plug Type
No Controls (Baseline)

Vigilent Speed Control Active (Auto Mode)

Source: Lawrence Berkeley National Laboratory High-Tech and Industrial Systems Group
CRAH Fan Improvement Program Total Infrastructure Power Reduction

- Original AC Scroll Type No Controls (estimate Baseline) - 497 kW
- New ECM and AC Plug Type No Controls (Baseline) - 264 kW
- Vigilant Speed Control Active (Auto Mode) - 167 kW

Fan Improvement Program: 66% Power Reduction
- Fan Type Upgrade: 47% Reduction
- Fan Controls Added: 37% Reduction

Source: Lawrence Berkeley National Laboratory High-Tech and Industrial Systems Group
Total CRAH Power per Colo Room During Baseline and Auto Mode Test Periods

Baseline Total: 233 kW
Auto Mode Total: 147 kW
Reduction: 37%

Source: Lawrence Berkeley National Laboratory High-Tech and Industrial Systems Group
Colo 3 Controls Response (Baseline vs. Auto)

Source: Lawrence Berkeley National Laboratory High-Tech and Industrial Systems Group
<table>
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<tr>
<th>Colo Control Group</th>
<th>CRAH Type</th>
<th># of CRAHs On/Total</th>
<th>Average Fan Speed</th>
<th>% Energy Savings</th>
<th>Setpoints to meet Customer SLAs (ASHRAE 64.4 – 80.6)</th>
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<td><strong>38%</strong></td>
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Source: Vigilent
CRAH Fan Improvement Program Total Site Savings Estimate

- Original AC Scroll Type No Controls (estimate Baseline) 4.13
- New ECM and AC Plug Type No Controls (Baseline) 3.89
- New ECM and AC Plug Type Controls Added (Auto) 3.79

CRAH Fan Program Total Site Power Reduction 8.0%

Fan Type Upgrade (5.7% Reduction)
CRAH Fan Speed Controls Added (Additional 2.5% Reduction)

Source: Lawrence Berkeley National Laboratory High-Tech and Industrial Systems Group
Conclusion

- Plug Fans with VFD’s and the Plug Fans with Electrically Commented motors actually saved approximately 230 kW of demand
- Vigilent Controls running in Automatic control saved 85+ kW of demand for a total of to 290 kW of demand reduction on the mechanical load with no reduction of the IT load
- Pier Grant and Utility rebate resulted in a return on the investment period of less than 12 months
- Colo 1 & 2 customers now adding blanking plates to racks – which when complete will provide additional energy savings. electric loads gained and cooling capacity buffer gained
- Ability to see heat profiles room to room and in different areas of the room in real time exceeded expectations
- Digital Realty saving 2.9 M kWh per year since the completion of this project, providing an annual greenhouse gas emission reduction of 1.9 million pounds of carbon dioxide (CO₂).