

# **APPLYING BEST PRACTICES TO MEET THE CHALLENGE**

## **PARTICIPATION IN THE DOE BETTER BUILDINGS CHALLENGE**

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# DOE's Better Buildings Challenge

**Launched December 2011**

## **Goals:**

- Make commercial, industrial buildings & multifamily housing 20%+ more efficient in 10 years
- Save more than \$80B for US organizations
- Create American jobs; improve energy security
- Mitigate impacts of climate change

## **How:**

- ✓ Leadership
- ✓ Results
- ✓ Transparency
- ✓ Best Practice Models
- ✓ Recognition
- ✓ Catalyzing Action



**Now 200+ Partners**

*Commercial, Industrial, Public, Private*

**Represent:**

3+ Billion Square Feet

\$2 Billion Private Financing

600+ Manufacturing plants

\$2 B Federal Commitment

# Data Center Partnerships

- DOE recently expanded the Better Buildings Challenge to include data centers; also added a new Data Center Accelerator
  - Federal Government, Public, and Private Sector leadership
  - 22 partners, over 90 MW committed to date
  - Unique opportunity– included in many other buildings
  - Small, medium and large data centers
  - Focuses on infrastructure savings; ~50% of energy
  - Highlight innovative and replicable solutions, leaders

## Data Center Partner Roster



# Data Centers Added To The BB Program

Organizations that own and or operate data centers can now partner with DOE to lead by example in one of two ways:

## 1. Better Buildings Challenge

Partners commit to reduce the energy intensity of their portfolio (including data centers) by at least 20% within 10 years and share their results.

## 2. Better Buildings Data Center Accelerator

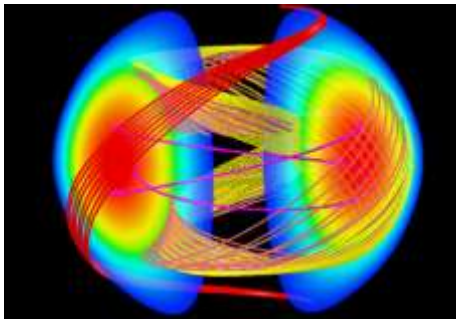
Partners commit to reducing the infrastructure energy use of at least one data center (IT load  $\geq$  100 kW) by at least 25% within 5 years and share their results.

## DOE agrees to:

- Provide technical expertise, communications support, and dedicated account manager
- Create networking opportunities to help Partners share best practices and innovative solutions
- Collaborate with Partners regularly
- Recognize Partners' progress and successes; highlight leadership

# Applying Best Practices, an LBNL Case Study

LBNL operates large systems along with legacy systems



We also research energy efficiency opportunities and work on various deployment programs

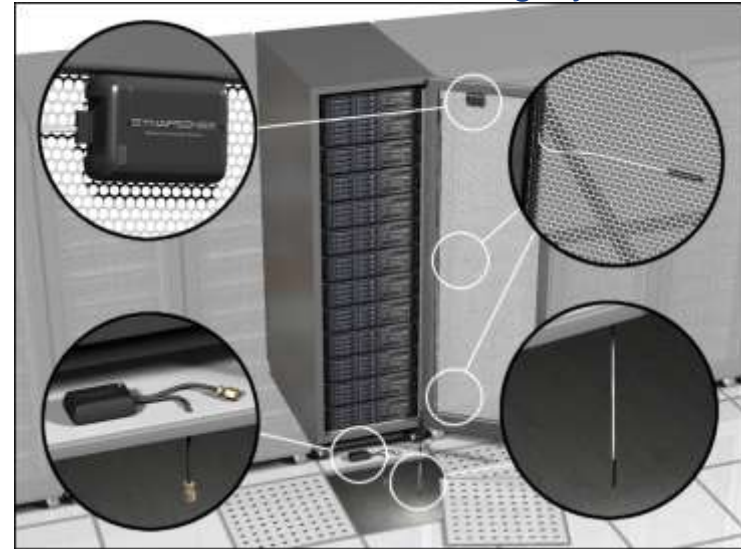
# Applying Best Practices at LBNL

- Partnership between CIO, CS, and energy efficiency researchers, facilities
- Existing data centers relatively efficient
  - NERSC: PUE = 1.3 (1.4), takes advantage of central plant
  - 50B-1275: PUE = 1.45 (1.65), tower cooled CRACs
- Increased efficiency frees up needed “capacity”
- New data centers much better (PUE = 1.1)
- Leveraging data centers as test beds to create an impact beyond Berkeley Lab
- Working with vendors to develop new products and strategies

# Using IT to Save Energy in IT

- Operators lack visibility into data center environment
- Provide same level of monitoring and visualization of the physical space as we have for the IT environment
- Measure and track performance
- Spot problems early
- 800 point SynapSense system
  - Temperature, humidity, under-floor pressure, current

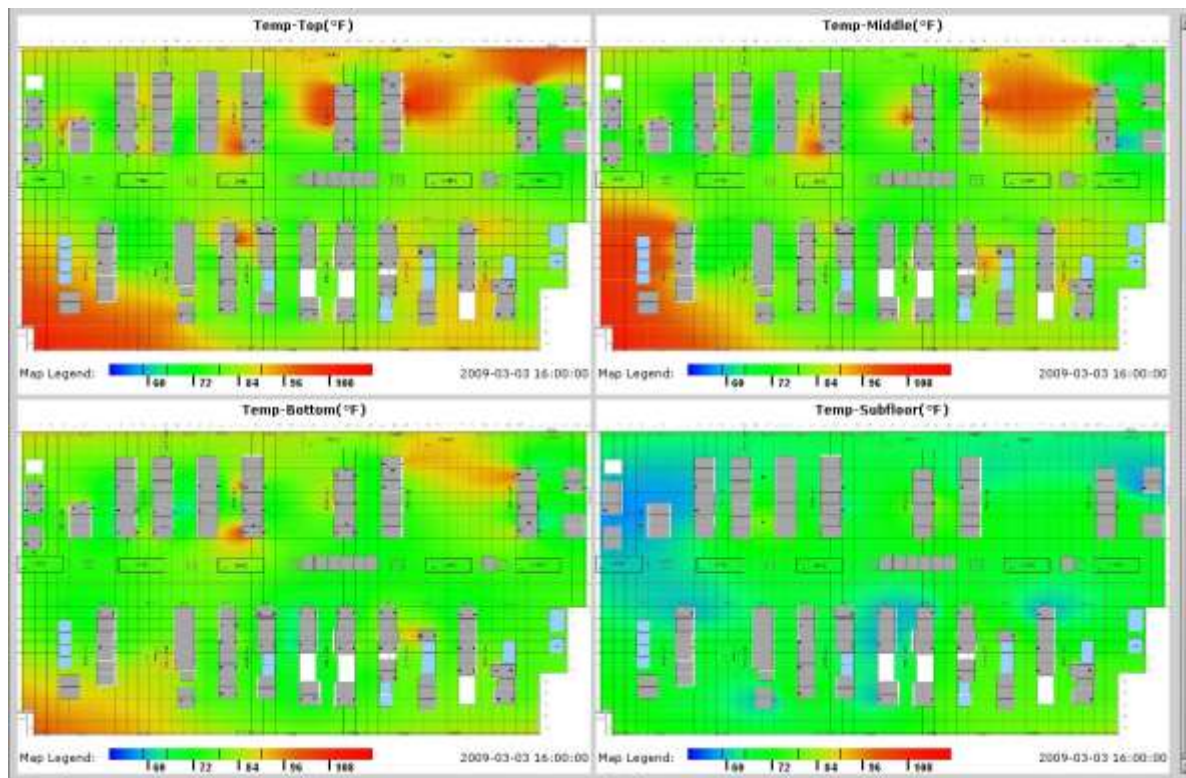
LBLN Wireless Monitoring System



source: SynapSense

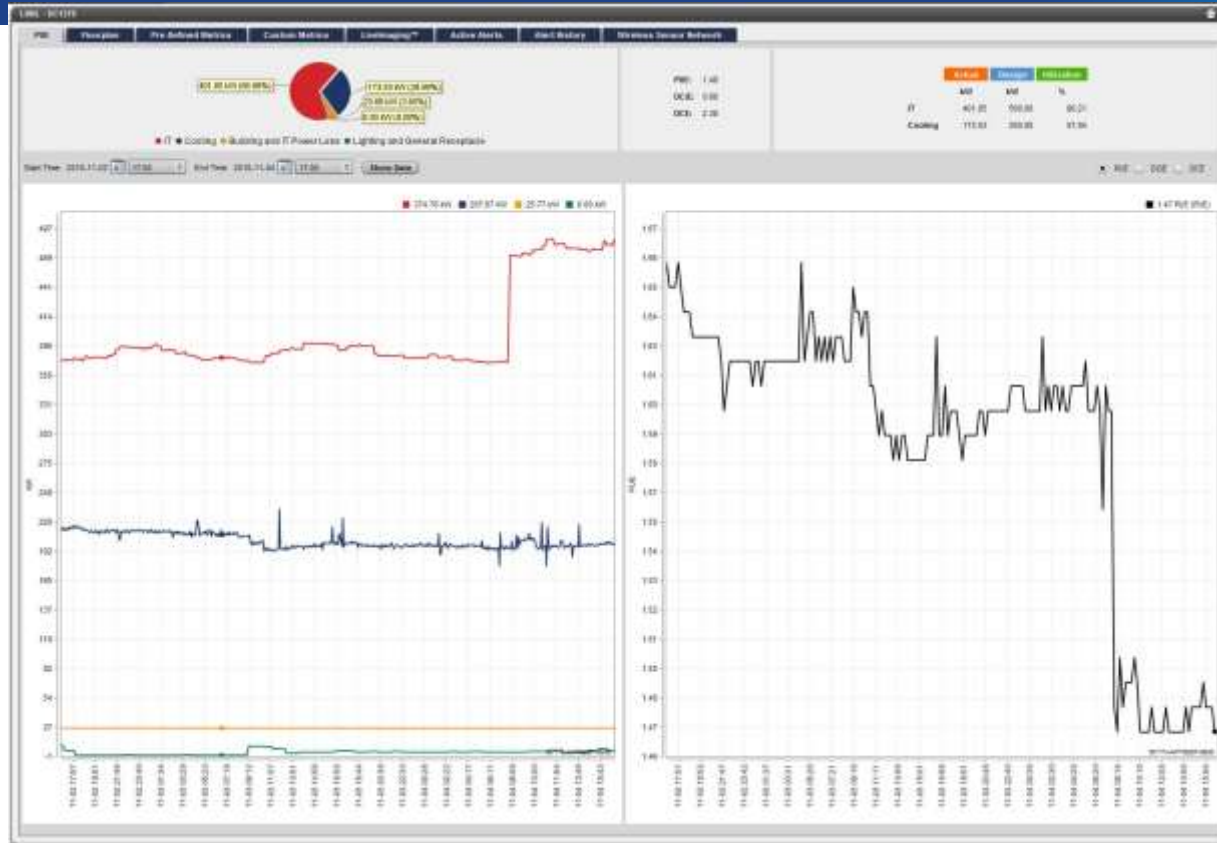


# Visualization getting much better





# Real-time PUE Display



# Air Management: The Early Days

It was cold but hot spots were everywhere



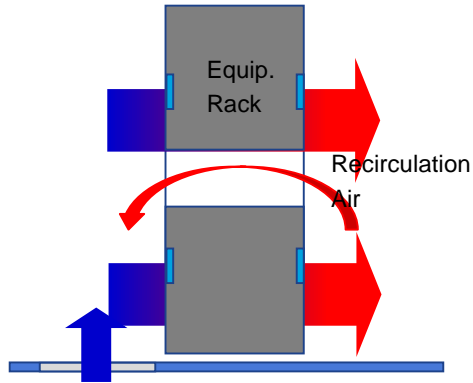
Fans were used to redirect air

High flow tiles reduced air pressure



# Results: Blanking Panels

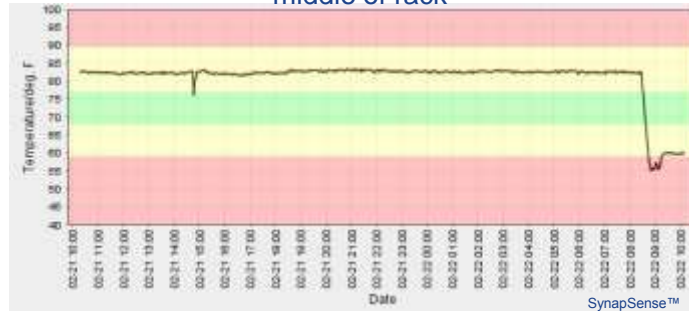
One 12 inch blanking panel  
reduced temperature  $\sim 20^{\circ}\text{F}$



top of rack



middle of rack

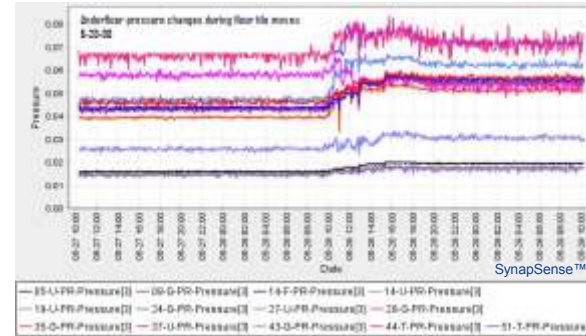


# Results: Tune Floor Tiles



- Too many permeable floor tiles
- If airflow is optimized
  - under-floor pressure ↑
  - rack-top temperatures ↓
  - data center capacity increases
- Measurement and visualization assisted tuning process

under-floor pressures



rack-top temperatures



# Improve Air Management

- Overhead plenum converted to hot-air return
- Return registers placed over hot aisle
- CRAC intakes extended to overhead



Before



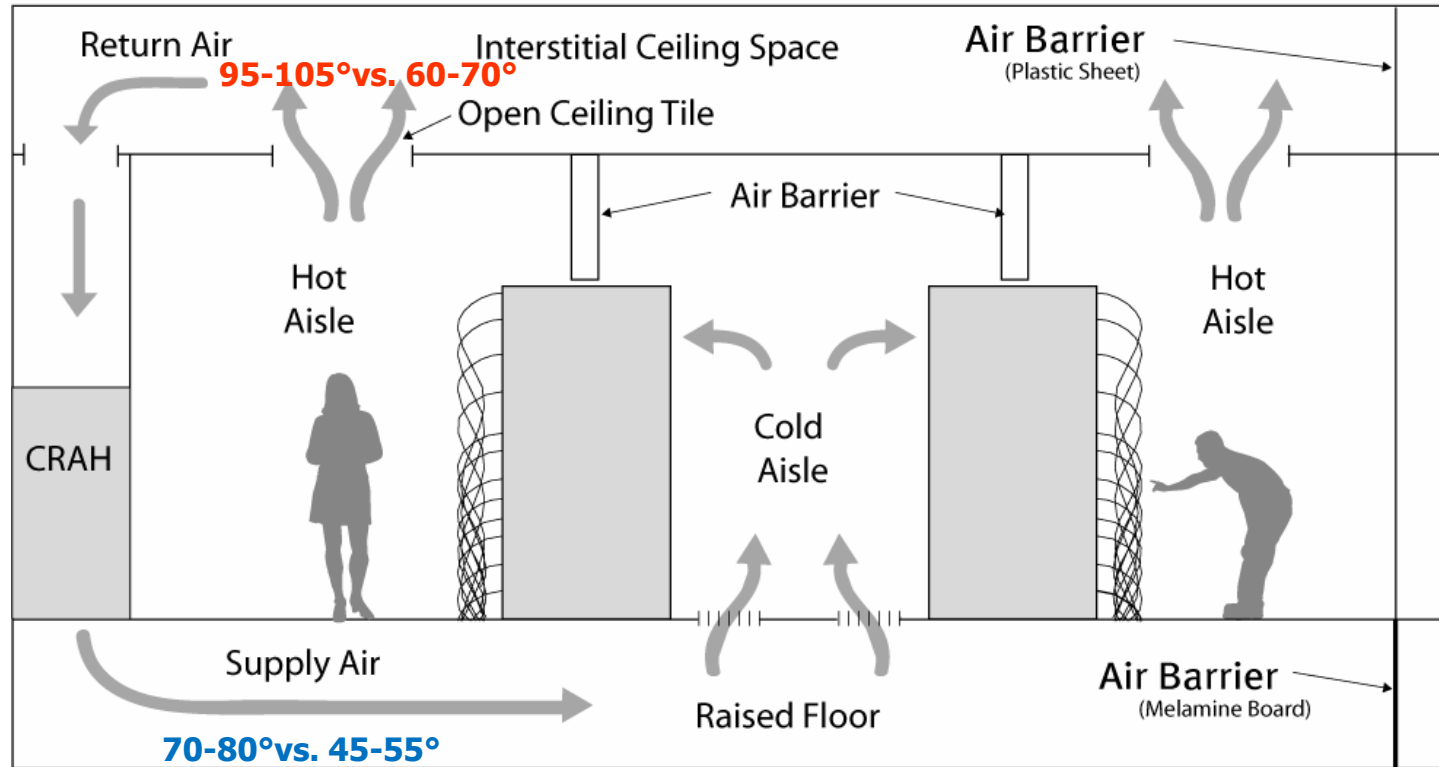
After



# Adding Air Curtains for Hot/Cold Isolation



# Isolate Cold and Hot Aisles





# Use Free Cooling

## Cooling without Compressors

- Water-side Economizers
- Outside-Air Economizers



➤ Let's get rid of chillers in data centers

# LBNL Example: Rear Door Cooling

- Used instead of adding CRAC units
- Cooling with tower-only or chiller assisted
  - Both options significantly more efficient than existing direct expansion (DX) CRAC units.



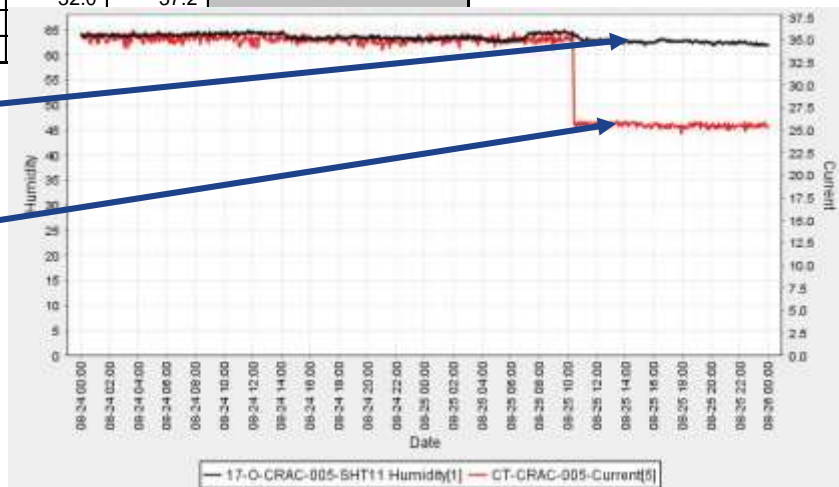
# The Cost of Unnecessary Humidity Controls

	Visalia Probe			CRAC Unit Panel			
	Temp	RH	Tdp	Temp	RH	Tdp	Mode
AC 005	84.0	27.5	47.0	76	32.0	44.1	Cooling
AC 006	81.8	28.5	46.1	55	51.0	37.2	Cooling & Dehumidification
AC 007	72.8	38.5	46.1	70	47.0	48.9	Cooling
AC 008	80.0	31.5	47.2	74	43.0	50.2	Cooling & Humidification
AC 010	77.5	32.8	46.1	68	45.0	45.9	Cooling
AC 011	78.9	31.4	46.1	70	43.0	46.6	Cooling & Humidification
Min	72.8	27.5	46.1	55.0	32.0	37.2	
Max	84.0	38.5	47.2	76.0			
Avg	79.2	31.7	46.4	68.8			



Humidity down 3%

CRAC power down 28%



# Results at LBNL's Legacy Data Center

- Increased IT load ~180kW
  - >50% increase with virtually no increase in infrastructure energy use
- Raised room temperature 5°C
- AC unit turned off
  - (1) 15 ton now used as backup
- Decreased PUE from 1.65 to 1.45
  - 30% reduction in infrastructure energy
- More to come!

# Resources to Get Started

## DOE's Data Center Energy Efficiency Center of Expertise:



[Datacenters.lbl.gov](http://Datacenters.lbl.gov)

# Moving Forward Together

- Looking forward to working with you as a Better Buildings Partner
- Highlighting what is possible in data centers
- Voluntary partnership; welcomes feedback and input
- Better Buildings Summit, May 27-29, 2015

<http://www4.eere.energy.gov/challenge/partners/data-centers>

# Speaker Contact Information

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