ET Spotlight

"Spotlight on Emerging Technologies"

Webinar

February 24, 2011

ETCC

EMERGING TECHNOLOGIES COORDINATING COUNCIL

Safety Message

ETCC
EMERGING TECHNOLOGIES
COORDINATING COUNCIL

ETCC - Emerging Technologies Coordinating Council

- About the ETCC
  - A collaborative forum where the stakeholder can exchange information on opportunities and results from ET activities.
  - Smoothes the path from the laboratory to the marketplace for cost-effective promising technologies that helps Californians save energy and money.
- Members

Pacific Gas and Electric Company®

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.℠

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SDGE
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California Energy Commission

California Public Utilities Commission

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Agenda

- **1:05 pm Lighting**
  - LED A-Lamp Evaluation – SCE
  - LED Lights and Adura Controls Retrofit – SMUD
  - Advance Lighting Control System / Office of the Future
  - Exterior LED Lighting – SDG&E
- **1:45 pm Residential**
  - Residential Deep Retrofits – SMUD
  - SunCache Solar Collector – SoCal Gas
  - Radronics Hot Water Boiler Controls – SoCal Gas

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Agenda

- **2:10 pm Commercial**
  - Computer Thin Client Assessment - PG&E
  - Data Center Air Flow Management - PG&E
  - NovaTorque Highly Efficient Electric Motor, 3HP - SMU
  - High Efficiency Refrigerated Cases - SCE
- **2:45 pm Industrial**
  - Water Energy Study - PG&E
  - Compressed Air Conversion to Low Pressure Blower - S

Lighting

- LED A-Lamp Evaluation – SCE
- LED Lights and Adura Controls Retrofit – SMUD
- Advance Lighting Control System – SDG&E
- Exterior LED Lighting – SDG&E

Southern California Edison

Spotlight on Technologies

LED A-Lamp Evaluation

February 24, 2011

Presented By:

Paul Delaney

Emerging Technologies Assessments Program Manager

Design & Engineering Services

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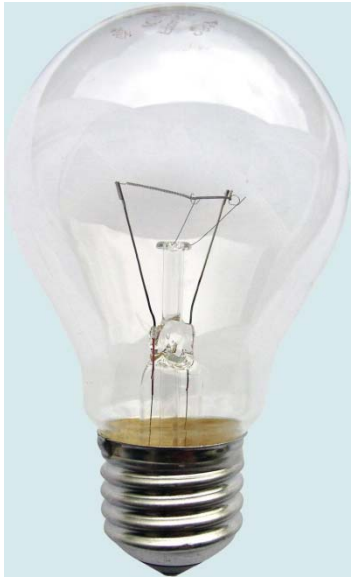
LED A-LAMPS

- Southern California Edison conducted an LED A-Lamp Emerging Technologies Assessment Project to determine the energy savings, performance, availability, and comparison to Energy Star minimum criteria.

INCUMBENT TECHNOLOGY



- The A-19 incandescent lamp is a typical household lamp with a standard Edison screw base
- Used commonly by most people for its omni-directional light characteristic.
- These lamps offer wide range of wattages from 25W up to 150W with efficacy of 12-18 lm/W

RESULTS

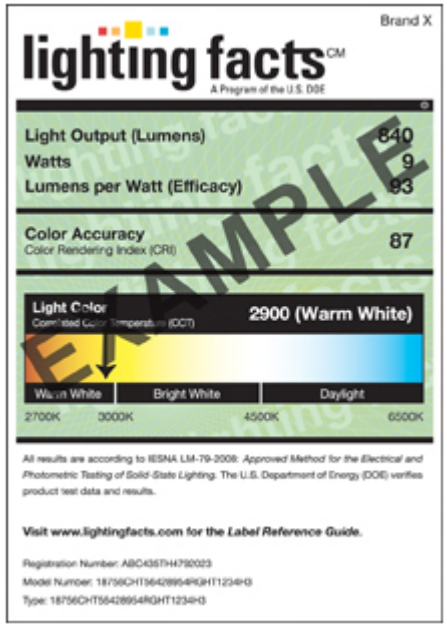
- All LED A-Lamps yield 75% savings or greater
- LED A-Lamps can save anywhere from 16kWh/yr to 746kWh/yr depending on the operating hours
- More than ½ of the lamps tested have CRI of 80 or better and efficacy of at least 50lm/W

CRI	Number of LED A-19 Lamps
Does not Qualify	31
≥80 – Pass	46

Incandescent Wattage (W)	LED Average (W)	Percent Savings (%)
25	6	76
35	7	80
40	8.7	78
60	13	78
100	21.8	78

RECOMMENDATIONS

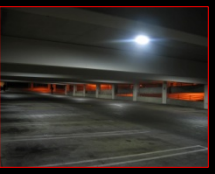
- It is recommended that any EE incentive program be based on meeting Energy Star's minimum requirements
- Requiring a Lighting Facts label guarantees that the product has been independently tested by a certified lab



Questions

Paul Delaney
Emerging Technologies Assessments Program Manager
Design & Engineering Services






Emerging Technology Coordinating Council

ET Spotlight

February 24, 2011

Dave Bisbee, CEM

Project Manager II

Customer Advanced Technologies

SMUD

Technology Spotlight

- CREE LR24 2 X 2 LED fixtures
- CREE LR6 LED recessed downlights
- Adura Technologies wireless lighting controls

Photo credit:
www.creeLED

Photo credit:
www.creeLED

Photo credit:
www.aduratech.com

Technology Spotlight

CREE LR24-38SKA35

- 3800 lumens
- 52 Watts
- Efficacy: 73 LPW
- CRI: 90
- CCT: 3500K
- Rated L70 life: 50,000 hours
- Uses red and unsaturated yellow LEDs to produce warm, high-quality light

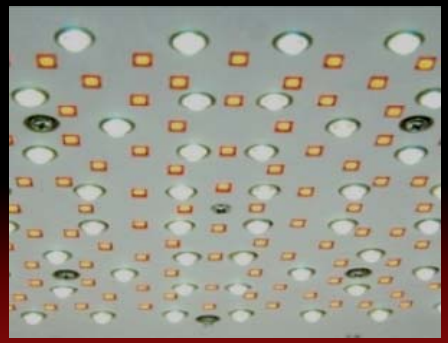


Photo credit:
www.creeLED

Technology Spotlight

CREE LR6

- 650 lumens
- 10.5 Watts
- Efficacy: 62 LPW
- CRI: 90
- CCT: 3500K
- Rated L70 life: 50,000 hours
- Uses red and unsaturated yellow LEDs to produce warm, high-quality light

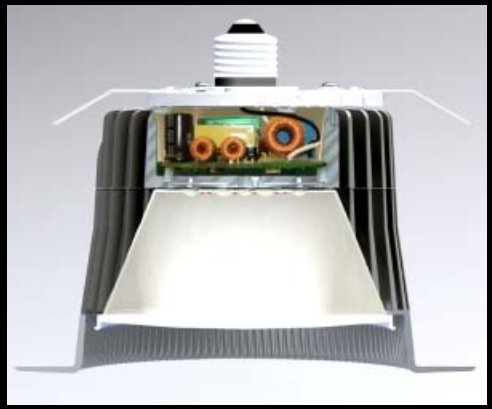


Photo credit:
www.creeLED

Technology Spotlight

Adura Technologies Wireless Controls

- Individually addressable and programmable controllers
- Self healing wireless network (IEEE 802.15.4 and Zigbee)
- User interface software provides tremendous flexibility / limited energy consumption monitoring

Photo credit:
www.aduratech.com

Technology Spotlight

Original System

- Customer contact center
- Existing 1.4 watts / ft^2
- 3-lamp T8 fluorescent fixtures
- Inboard /outboard switching
- Illumination: 41fc/63fc

Photo credit: SMUD

Technology Spotlight

New Lighting System

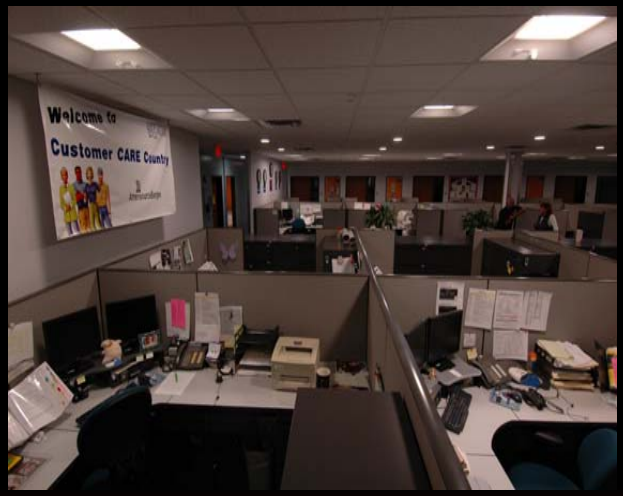
- One CREE LR24 fixture per work station (a.k.a. office cubicle)
- CREE LR6 recessed downlights for file cabinets & egress lighting
- Wattage
  - 100% output = 0.53 watts / ft^2
  - 40% output = 0.31 watts / ft^2

LR24 Fixtures at 40% output
Photo credit: SMUD

Technology Spotlight

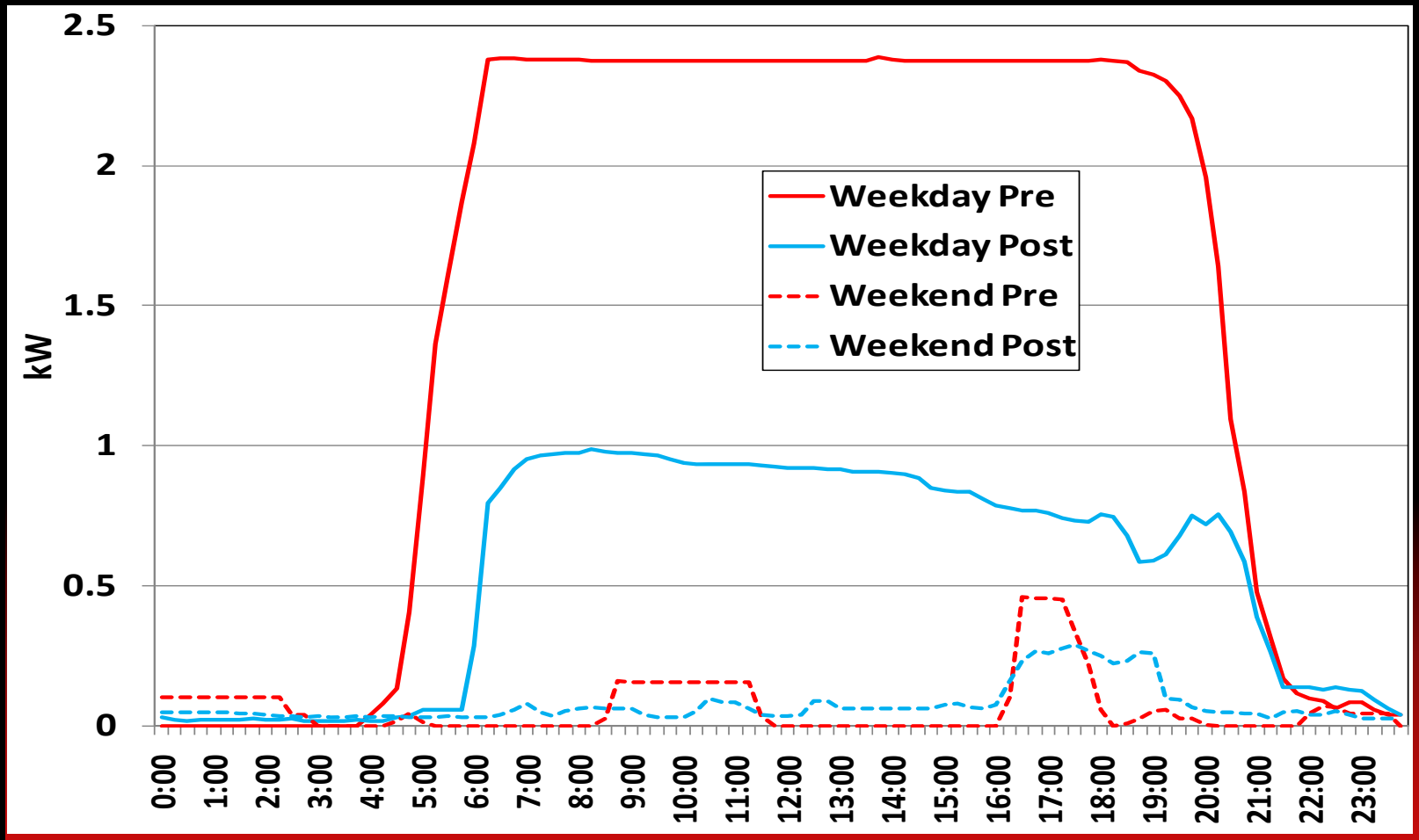
Control Features for 2 x2 Fixtures

- Each fixture is individually addressable and programmable
- Group control via wireless manual wall switch
- Individual fixture control via hand-held remote controls
- Fixtures limited to a maximum of 80% of full output (via software)
- Manual control options include on / off and dimming to 20% output
- Ceiling mounted motion sensors configured to respond only after closing hours



LR24 Fixtures at 40% output
Photo credit: SMUD

Technology Spotlight



Average daily office lighting load profile by day type. Source: ADM Associates Inc.

Technology Spotlight

Project Results

- Illumination levels with the system set to 80% maximum are comparable to original system with 3-lamps operating
- Energy savings: 62.5% (6,033 kWh per year)
- Electrical demand reduction: 66% (2.6 kW)
- Utility bill savings: ~ $700 per year
- Simple payback well over 10 years

Technology Spotlight

Lessons Learned

- Junction boxes too small to house AduraTech controls
- Employees like the ability to turn fixtures completely off - not just dim them
- Excellent illumination on task surfaces yet the office appears darker
- Allow plenty of time to work through the concerns of the customer's Information Technology (IT) department
- Consider pre-programming the control devices at the factory, and deploying wireless gateways before installing the individual control devices

Questions?

Dave Bisbee, CEM

Customer Advanced Technologies

dbisbee@smud.org






ET Spotlight
San Diego Gas & Electric

Nate Taylor

February 24, 2011

Today's Topics

- Advanced Lighting Controls System Assessment
- Office of the Future 25% Solution
- Outdoor Area LED Lighting

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Office of the Future/ALCS

- Office of the Future (Advanced Energy Office)
  - Concept which includes the incorporation of an Advanced Lighting Controls System to maximize the efficiency possible in lighting
    - Interior lighting
    - Interior lighting controls
    - Office plug loads
    - HVAC performance review
    - Demand response
    - Advanced metering

ADVANCED ENERGY OFFICE
EFFICIENCY·PRODUCTIVITY·CONTROL

- Integration of HVAC building management system with lighting controls for LED and high efficiency fluorescent lighting
  - Lighting must be dimmable

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VA Office of the Future

Host Site

- VA Medical Center San Diego
- 1,000,000 square feet total
- 236 beds

Objective

- Technical Assessment of Advanced Energy Office Technical Requirements (New Buildings Institute) and Office of the Future

Methodology

- Staged implementation of recommended technical requirements

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Selected Project Area

- 2800 square feet of office space in Engineering Department
- North facing windows with integrated blinds
- Lighting
  - 44 2X4 fluorescent 3 lamp troffer
    - Original: T12
  - 8 2X2 U tube fluorescent
    - Original: T8
  - Manually switched
  - No occupancy or daylight sensors

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Selected Project Area (cont.)

- Office configuration
  - Three individual private offices
  - 15 individual soft wall or “cubicle” office work spaces
  - Open area conference and plan “room”
- HVAC controlled by JCI Metasys
- Operating hours
  - Average 10.5 hours per weekday

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Staged Implementation Approach

- Stage 1
  - Lighting
    - Replaced ballast with Advance addressable dimming ballast
    - Replaced lamps with Philips 25W lamps
    - Tuned all fixtures to 35 ft candles as per IESNA recommended light levels for medium task lighting
  - Lighting control system
    - Exergy Controls
      - ✓ Due to IT requirements used wired version
      - ✓ Daisy chain of ballast and sensors
        - RJ45 connection on ballast and sensors for easy installation
      - ✓ Replaced traditional wall switches with multiple level or “scene” switches
      - ✓ Installed by VA contract electrician

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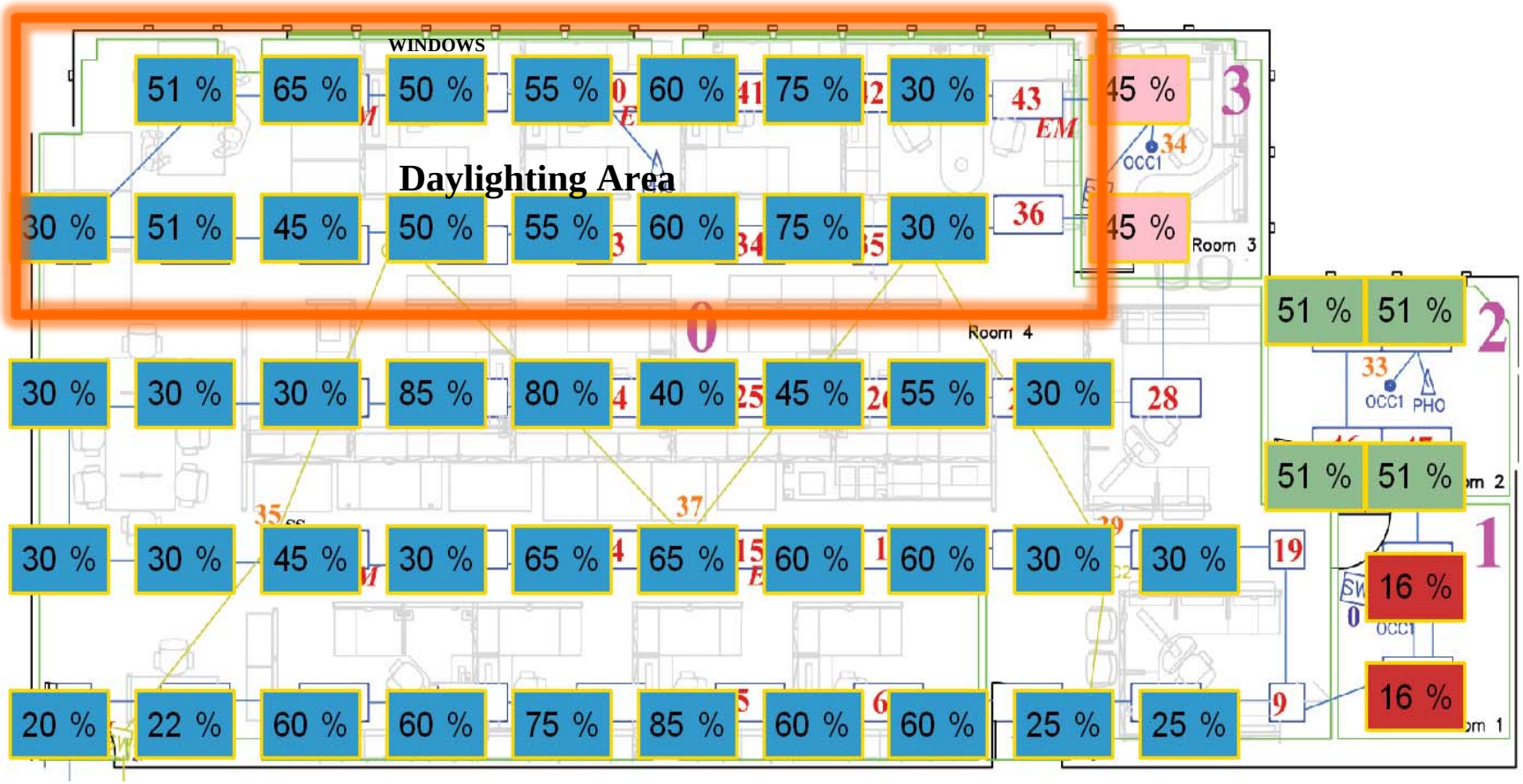
Light Output Results

Light output tuned to IESNA recommended 35 foot candles
(shown as percentage of full brightness)



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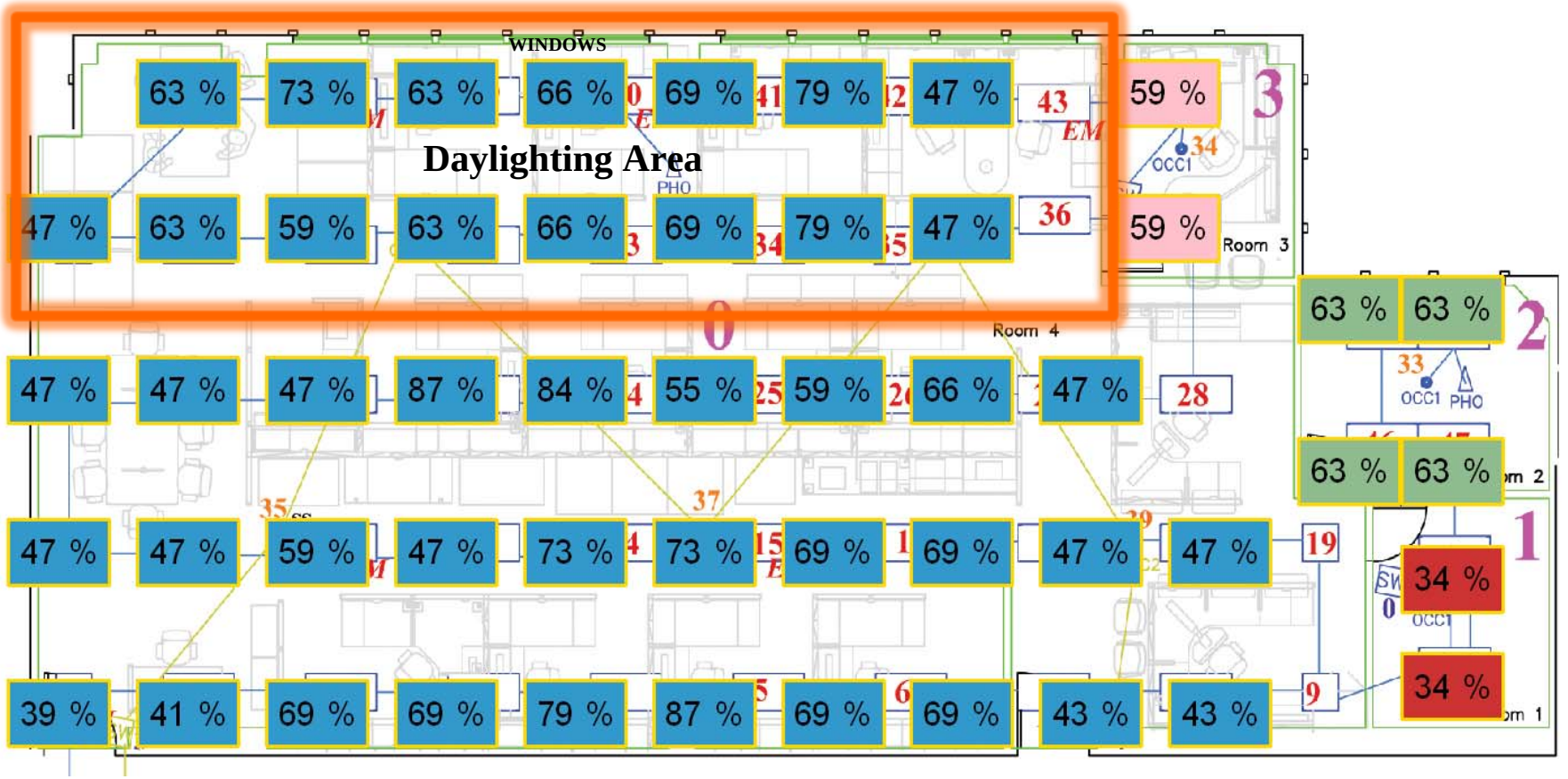
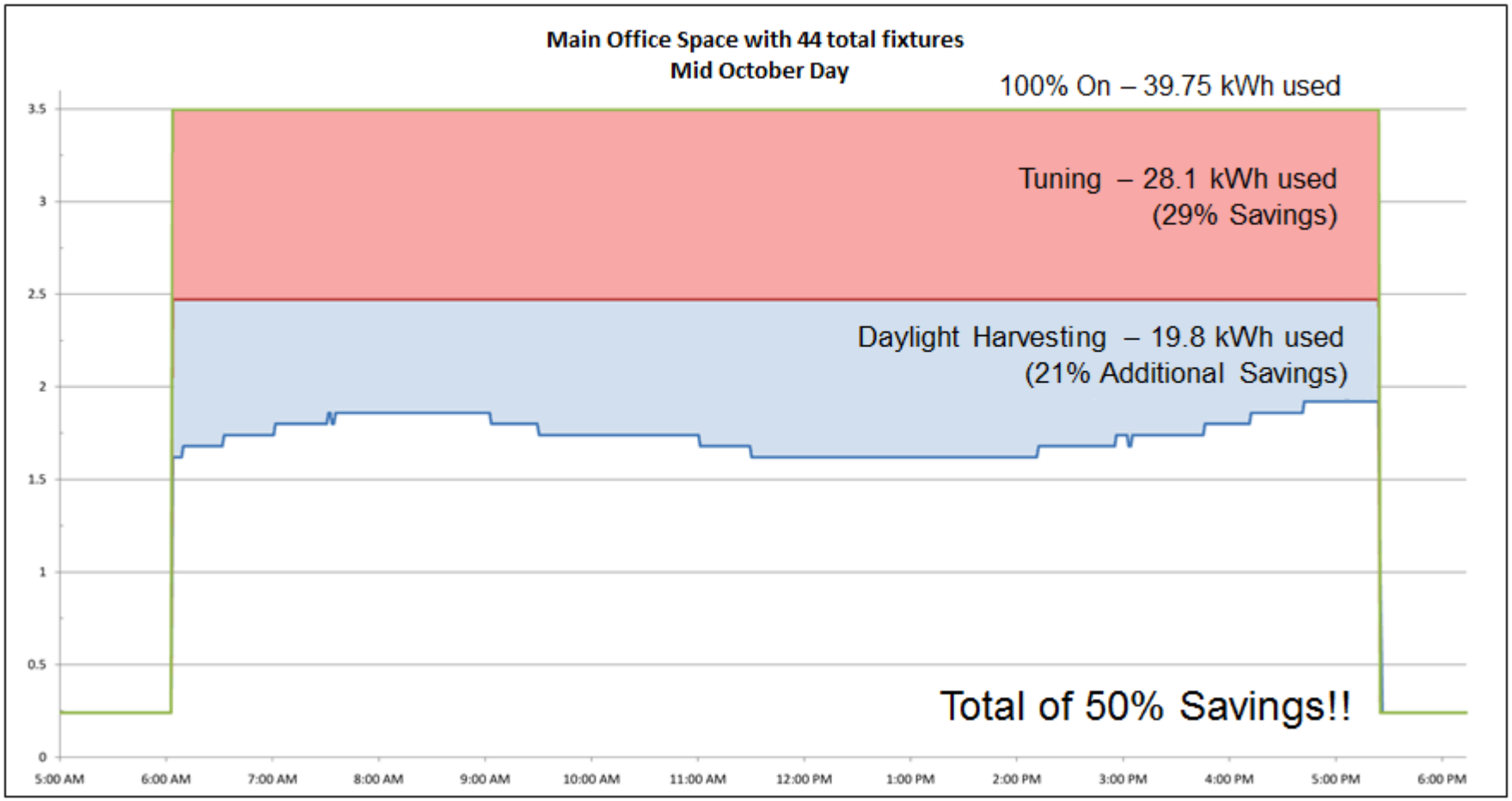
Power Reduction Results

Power when tuned to IESNA recommended 35 foot candles
(shown as a percentage of full power)



Overall Results

Energy Savings from both TUNING and DAYLIGHT HARVESTING



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Lessons Learned

- In lieu of doing a one-for-one direct retrofit or upgrade of lamp and ballast, complete lighting redesign of space is recommended

- The advanced lighting control system should be installed by a CALCTP certified contractor
  - This project took 4 call backs to get system properly working
    - Incorrect wiring
    - Incorrect tombstone installation
    - Sensors incorrectly installed for each space

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What's Next

Continue the staged implementation approach to quantify energy and power savings attributed to each stage

- Stage 2
  - Office plug load
    - LED task light with integrated occupancy sensor
      - ✓ Philips Color Kinetics
    - Smart power strip on accessories
  - Expected results
    - Additional 5-10% energy savings based upon ENERGY STAR estimates

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What's Next (cont.)

- Stage 3
  - HVAC performance review
    - Expected results
      - ✓ Additional 7% energy and demand savings based upon ENERGY STAR estimates
- Stage 4
  - Demand response
- Stage 5
  - Advanced metering

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Outdoor Area LED Lighting Assessment

Objectives

- Examine the electrical, lighting, and economic performance of LED lighting technology in a parking lot and entrance roadway, as compared to the traditional light sources of metal halide (MH) and high pressure sodium (HPS)
- Improve the quality of the lighting, including uniformity
- Utilize the visual attributes of LED lighting to enhance security camera recording and visitor's perception of security

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Outdoor Area LED Lighting Assessment

Host Site

- Sharp Chula Vista Medical Center
- Parking lot lit by 20 400W HPS (nominal)
- Emergency entrance roadway lit by 4 100W HPS (nominal)
- Operate 4165 hours annually (only at night)

Methodology

- Replaced traditional HPS fixture with LED luminaire and motion sensor in parking lot

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Project Results

Energy Cost Savings per Assessment Area

Application	# of Units	Power (W)	Energy (kWh)	Annual Energy Cost ($)	Annual Energy Cost Savings ($)	Reduction (%)
Parking Lot (4165 operating hours)	20					
400 W HPS		469	39,068	$5,469		
230 W LED						
High Mode 1374 hours (33%)		234	6,430			
Low Mode 2791 Hours (67%)		82	4,577			
LED Total			11,008	$1,541	**$3,928**	**72%**
Entrance Roadway (4165 operating hours)	4					
100 W HPS		117	1,949	$273		
55 W LED		57	950	$133	**$140**	**51%**

Retrofit Simple Payback Based Upon Energy Savings

Application	# of Units	Product Cost ($)	Installation Cost ($)	Total Investment ($)	Annual Energy Cost Savings ($)	Simle Payback (years)
Parking Lot (4165 operating hours)	20					
400 W HPS						
230 W LED		26,900	4,400	31,300	3,928	8.0
Entrance Roadway (4165 operating hours)	4					
100 W HPS			0			
55 W LED		2,300	375	2,675	140	19.1

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Questions

Nate Taylor

February 24, 2011

Residential

- Residential Deep Retrofits – SMUD
- SunCache Solar Collector – SoCal Gas
- Radronics Hot Water Boiler Controls – SoCal Gas

SMUD ENERGY EFFICIENT REMODEL DEMONSTRATION PROGRAM

Presentation to ETCC

February 24, 2011

Mike Keesee
Project Manager
Energy Research & Development
SMUD

Why Deep Energy Retrofits?

- State Strategic Energy Plan - 40% Energy Use Reduction in **ALL** Existing California Homes by 2020
- SMUD Efficiency Goals - 15% Reduction in Energy Use by 2015
- SMUD/SEP ARRA - 4,000 homes by 2012
- Home Owners – The “Magic #”

What is it?

Retrofit/Upgrade home to reduce total household annual source (electric/gas) energy use

50%

Typical Residential Energy Efficiency Measures

- R-40 Attic Insulation with Radiant Barrier
- R-19+ Walls
- Air Sealing, Tight Envelope, 3ACH50
- SEER 16+ AC
- AFUE 90% furnace w/ variable speed van
- Tight, tested R-6 ducts
- Hi-Efficiency Water Heater
- Energy Star CFL fixtures and Appliances

R&D

- Systems Approach
- New Wall Insulation Methods
- Home Automation
- Min-Split Heat Pumps
- Heat Pump Water Heaters (all electric)
- Air Sealing Techniques

GreenBuilt Construction
8901 Quail Hill Way, Fair Oaks

Market Rate Flip

- 47% Source Energy Savings
- $42k (No Solar)
- 182 to 78 HERS score
- R-40 Attic Insulation with Radiant Barrier
- High Efficiency Windows
- Air Sealing, 3.6 ACH50, 2.1 SLA
- SEER 16/ HSPF 9.0 Heat Pump w/ tight, tested R-6 ducts
- Heat Pump Water Heater w/ Solar Pre-Heat
- Energy Star CFL fixtures and Appliances
- Solar Electric PV

Housing Group Fund
5832 Mascot Ave., Sacramento

Rehabbed Abandoned Home/ Affordable Housing

- 55% Source Energy Savings
- 241 to 86 HERS Score
- R-40 Attic Insulation with Radiant Barrier
- High Efficiency Windows
- Air Sealing, 2.8 ACH50, 1.4 SLA
- SEER 16/ 80% AFUE
- Tight, Tested R-6 ducts
- Condensing Tankless
- Energy Star CFL fixtures and Appliances

32nd Avenue

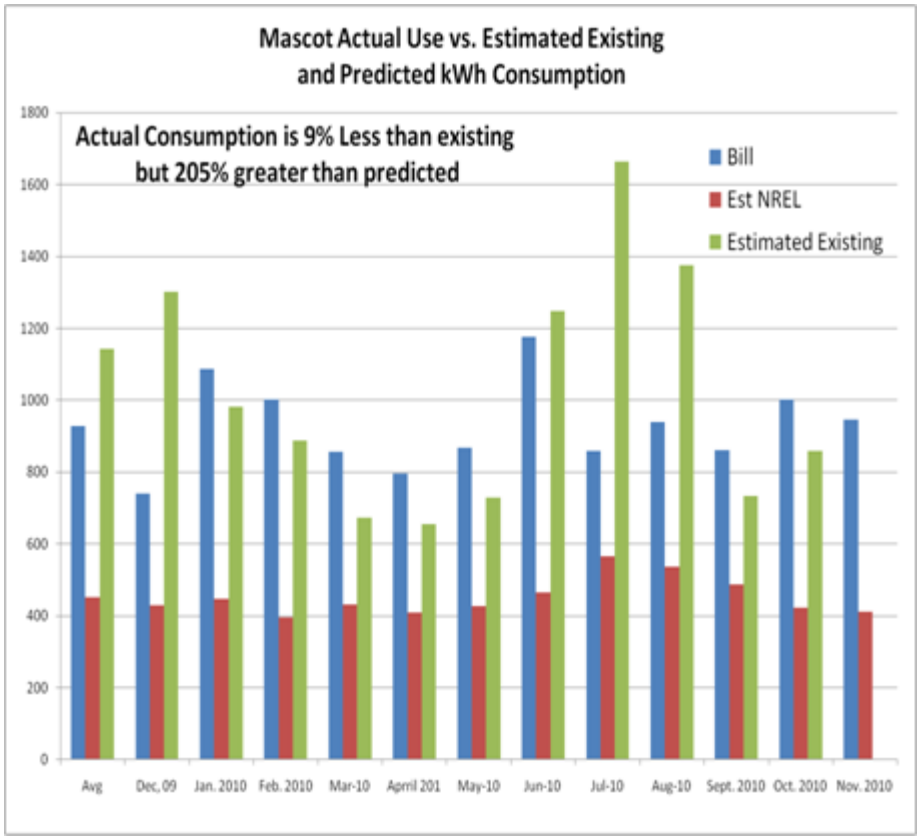
Rehabbed
Abandoned
Home/ Affordable
Housing
$30k

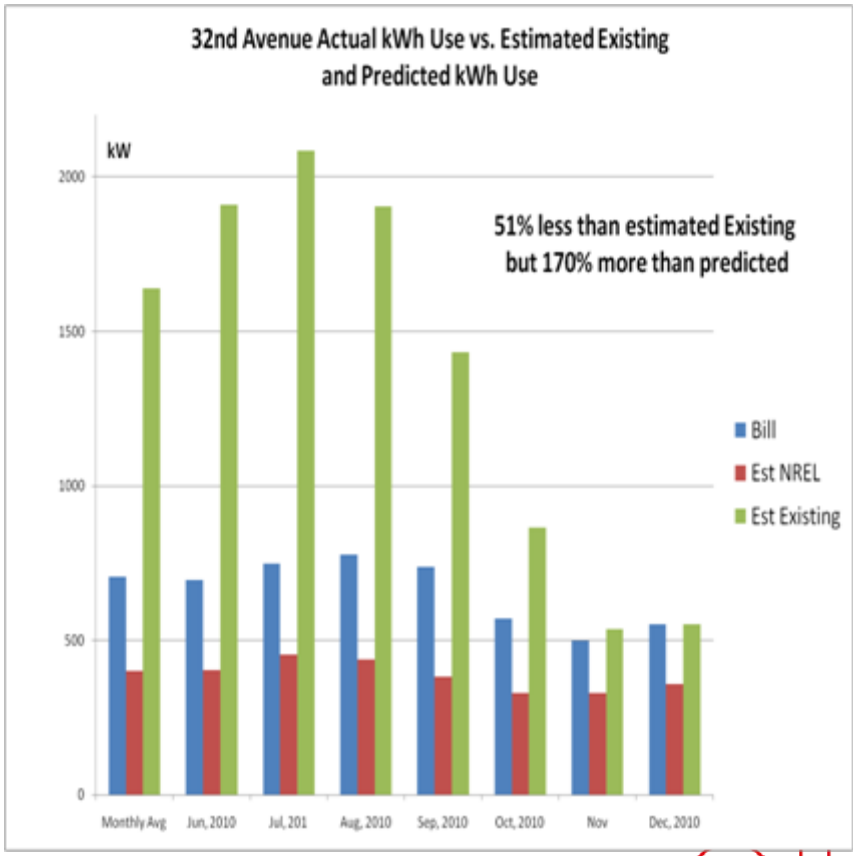
66% Source Energy Savings
R-40 Attic Insulation
R-19 Wall
High Efficiency Windows
Air Sealing 2.9 ACH50, 1.5 SLA
SEER 14/.95 AFUE
Ducts in Conditioned Space
.62 EF Water Heater
Energy Star CFL fixtures and
Appliances

Results to Date

9% less than existing
> 2x predicted electricity use

57% less than existing 1.5x predicted electricity use





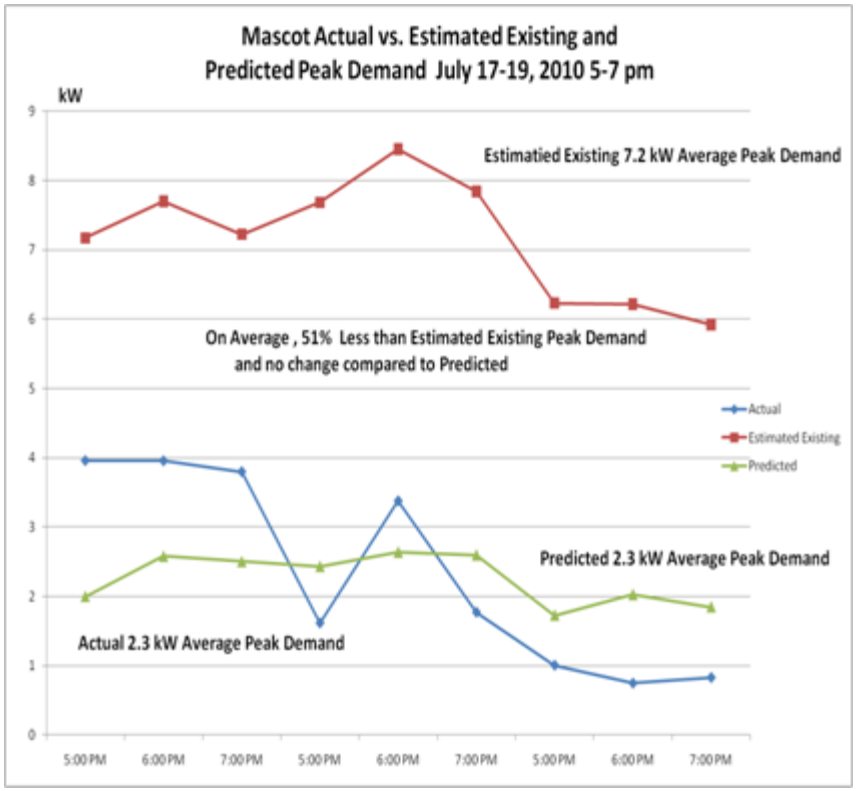
Results to Date

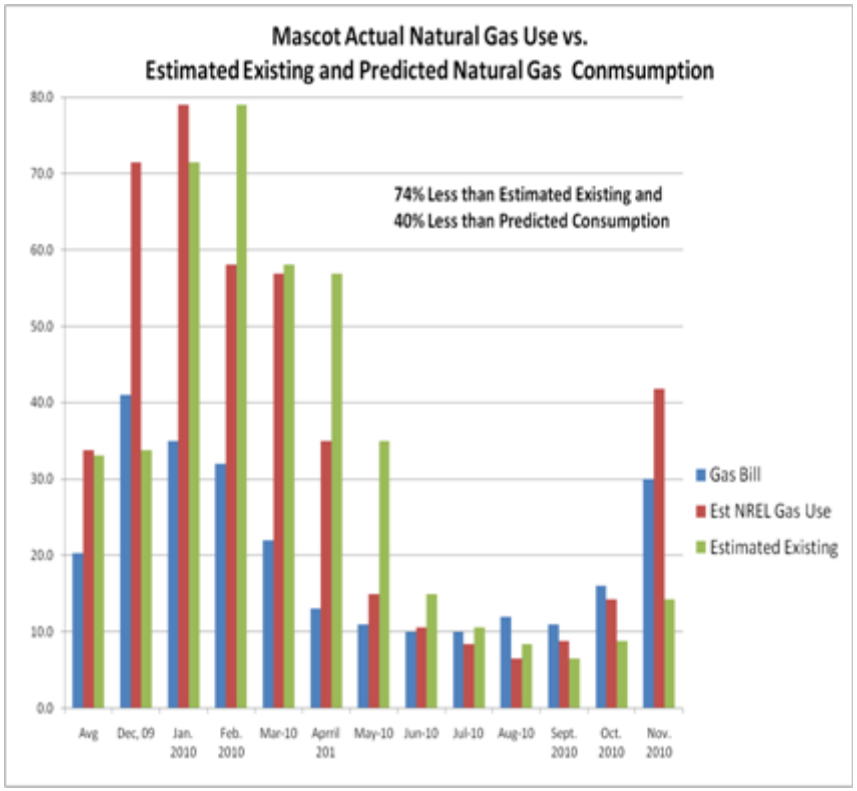
51% less than existing

Same as predicted

74% less than existing

40% less than predicted gas consumption





Pre 80s - 60% Savings Package

- HERS Testing/Inspections
- Air Seal to 5 ACH50
- R-38 Attic Insulation (Radiant Barrier w/ Reroof)
- SEER 14.5 AC/92 AFUE Furnace w/ Tight Ducts (< 6% leakage)
- Energy Star Windows
- .62 EF+ Gas Water Heater or HPWH
- Energy Star Hard Wired CFL Fixtures

Markets

- All Electric Homes
- Foreclosures
- Re-Sale
- Remodeling/Additions
- Older Homes <1978

R&D Issues and Big Winners

- T-24/HERS Modeling
- Home Automation
- Air Sealing
- Mini-Splits
- Plug Loads

- Systems Approach
- Air Sealing
- HPWH
- QuadLock

Summary

- 50% + Energy (and big kW) Savings Possible but Costly
- DER Packages
- Right Targets
- Watch out for Plug Loads

More Information

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www.smud.org/en/residential/EERD/Pages/default.aspx

Research is supported by the U.S. Department of Energy Building America Program.

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SoCalGas ETP Spotlight Webinar

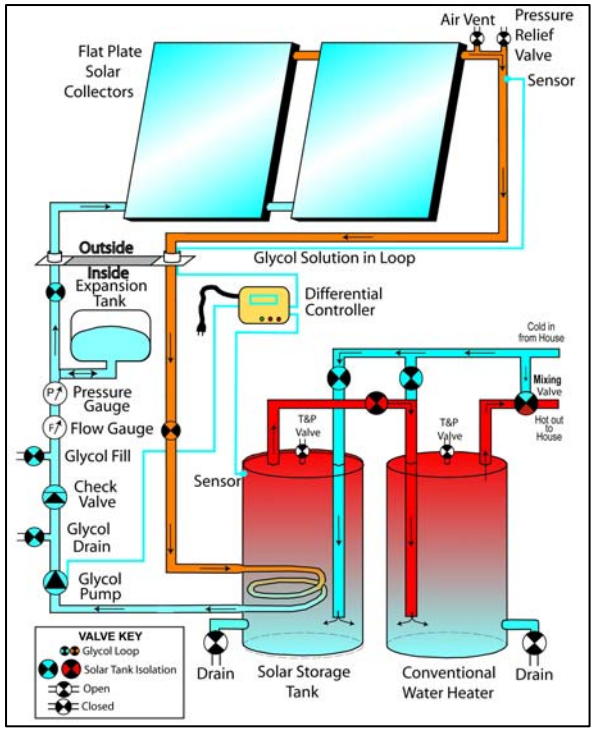
Steven Q. Ly

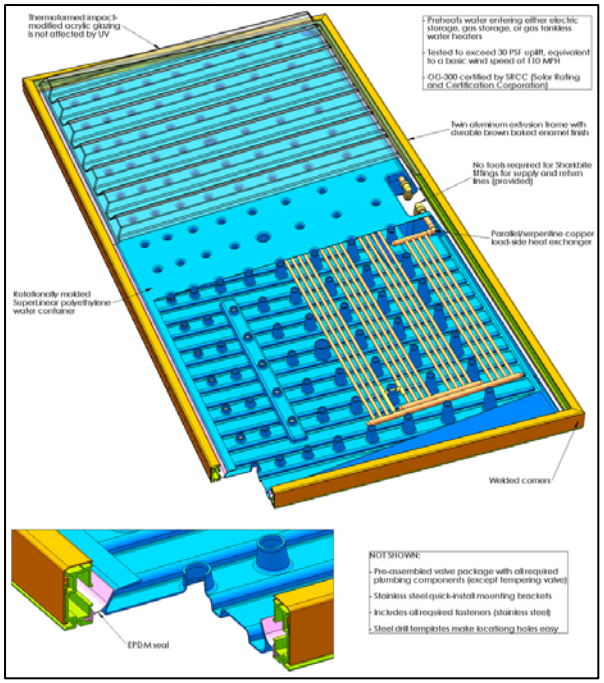
Emerging Technologies Program

February 24th, 2011

SunCache

- **Main Project Lead – California Air Resource Board**
- **What is System?**
- Low-cost, all-in-one, passive solar water heating
- Use polymer materials in construction to reduce cost and weight
- The SunCache System is an early production low cost solar hot water system alternative:
  - Combining solar collector and storage tank as 1 unit
  - No Pumps
  - No Controls
  - No Parasitic Losses
- System Components include:
  - Water Containment Panel
  - Heat Exchanger
  - Glazing
  - Frame
  - Valve Package
  - Installation Hardware





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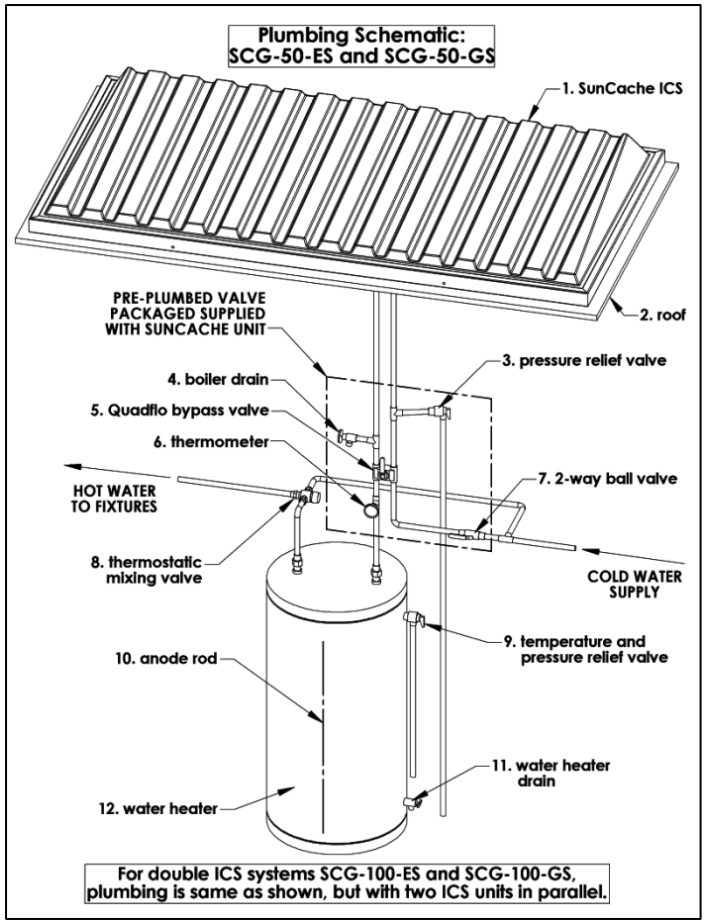
SunCache

- **How does it work, i.e. application**
  - The SunCache System is designed to collect solar energy from Sunlight and transfer it into the domestic Hot Water Supply
  - As a Result – Natural Gas or Electricity will be offset resulting in a reduction Greenhouse Gas Emissions
  - The Application, i.e. Type of Facility - The system is designed for single family and multi-family residential facilities



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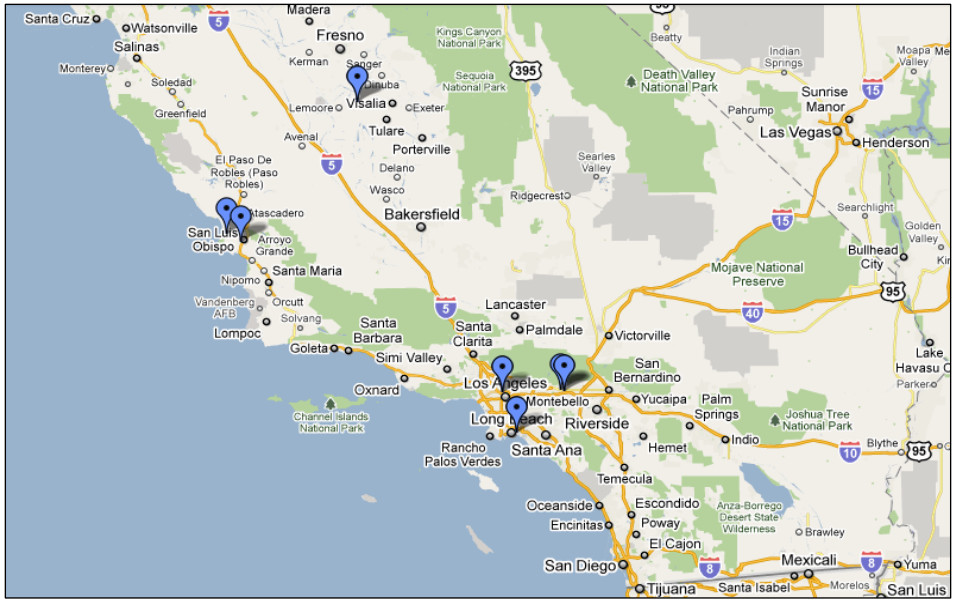
SunCache

- **Installation site – Why They Were Chosen**
  - Climate Zone was the Primary Driver - The system was to be tested in a variety of climate zones to test the effectiveness under different conditions
  - Combination of Single Family and Multi-Family Residents
  - Map of Locations is shown below
  - Note: 2 multi-family Hanford sites represented by 1 marker



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SunCache

- **M&V Protocol for SunCache System**
- The M& V protocol consisted of two types – Detailed Protocol or Streamlined Protocol
  - Streamlined Monitoring Points:
  - Btu Meter on Solar Array
  - Supply & Return Water Temperatures Solar Array
  - Water Flow Solar Array
  - OSA Temp Sensor
  - Solar Isolation
- Detailed Monitoring Points
  - All Above Points
  - Btu Meter on Back-Up Water Heater
  - Supply & Return Water Temperatures on Back-Up Water Heater
  - Water Flow on Back-Up Water Heater
  - Natural Gas Meter (multi-family only)

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SunCache

- **Potential Savings**
  - Displayed in the Table Below are the Results of the Systems through 8 Months

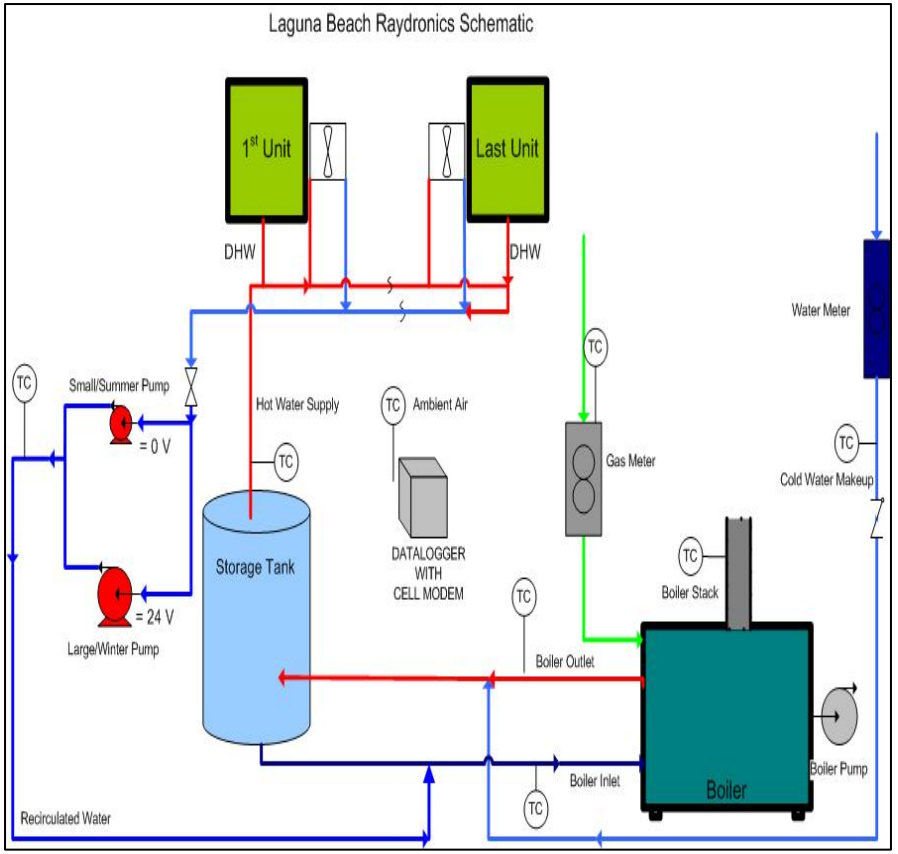
Site	Avg. Monthly Natural Gas Offset
Detailed Multi-Family Site (Hanford)	39.4 therms
Streamlined Multi-Family Site (Hanford)	76.4 therms
Detailed Single-Family Site (Claremont)	1.7 therms
Streamlined Single-Family Site (Los Osos)	2.8 therms
Streamlined Single-Family Site (San Luis Obispo)	1.4 therms
Streamlined Single-Family Site (Long Beach)	3.4 therms
Streamlined Single-Family Site (Los Angeles)	3.3 therms
Streamlined Single-Family Site (Claremont)	No Data

SunCache

- Detail of the study will be presented at ARB facility and Webcast on March 9, 2011
- Web-Link broad cast: http://www.arb.ca.gov/research/seminars/lee2/lee2.htm

Raydronics System

- **What is System?**
  - The Radronics System is a Control Panel and series of Sensors designed to optimize the boiler/water heater by staging and supplying a more precise water temperature
  - System Components include:
    - A Control Panel
    - Associated Electronic Boards
    - Sensors
  - The System performs functions such as:
    - Temperatures Set-Point
    - Temperature Differential
    - Desired throttling range
  - Functions are reset or readjusted when heating demand is increased with colder ambient temperatures



Southern California Gas Company
A Sempra Energy utility

Raydronics System

- **How does it work, i.e. application**
  - The Control Panel is designed for a combined DHW / HHW System that uses the DHW in a fan coil; Raypak's *"Raydronics"*
  - How It Works - During mild weather days the water temperature is at a minimum set-point temperature, when the ambient air temperature decreases the water temperature increases thus supplying hotter water to the building, Temperature reset is based upon OSA
  - The Application, i.e. Type of Facility - The system is mostly used in apartment buildings and motels

Raydronics System

- **Installation site – Why They Were Chosen**
  - Climate Zone was the Primary Driver - The system was to be tested in a variety of climate zones to test the effectiveness under different conditions
  - Needed Multiple Similar-Sized Boilers – To allow for an Apples-to-Apples comparison between Baseline & Optimized
  - Existing Infrastructure – To provide a Cost-Effective Test Existing Individual Gas Meters was an important driver

Raydronics System

- **M&V Protocol for various systems**

- The M& V protocol consisted essentially of a comparison between the *Baseline*, i.e. non-optimized Boiler and a Boiler with a Controller to optimize performance.
  - Performance was verified by quantifying the natural gas used over a period of time
  - As mentioned boilers were similar sized between Baseline & Optimized Boiler
  - Similar Heating Load between Baseline & Optimized Boiler (# of Apartments)
  - Boiler Supply & Return water temperature monitored to confirm modulation or steady-state depending on Boiler
- Goal: Apples-to-Apples Comparison for a Easily Repeatable test

Raydronics System

- **Preliminary Results**

ENERGX RAYDRONICS CONTROL SYSTEM PILOT - GAS CONSUMPTION TRACKING				
Site Name	City	TYPE	Avg. Therms Cons per Living Unit	
Huntington Creek	Huntington Beach	BASELINE	45	10.16%
Huntington Creek	Huntington Beach	OPTIMIZED	41	
Highland Meadows	Moreno Valley	BASELINE	36	13.21%
Highland Meadows	Moreno Valley	OPTIMIZED	31	
Sycamore Springs	Rancho Cucamonga	BASELINE	72	46.27%
Sycamore Springs	Rancho Cucamonga	OPTIMIZED	39	
Woodland Village	Costa Mesa	BASELINE	26	-11.54%
Woodland Village	Costa Mesa	OPTIMIZED	29	
Parkwood Village	Anaheim	BASELINE	40	20.00%
Parkwood Village	Anaheim	OPTIMIZED	32	
The Crest	Pomona	BASELINE	23	22.18%
The Crest	Pomona	OPTIMIZED	18	

Southern California Gas Company

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SoCalGas ETP Spotlight Webinar

- QUESTIONS

Southern California Gas Company
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Commercial

- Computer Thin Client Assessment - PG&E
- Data Center Air Flow Management - PG&E
- NovaTorque Highly Efficient Electric Motor - SMUD
- High Efficiency Refrigerated Cases - SCE

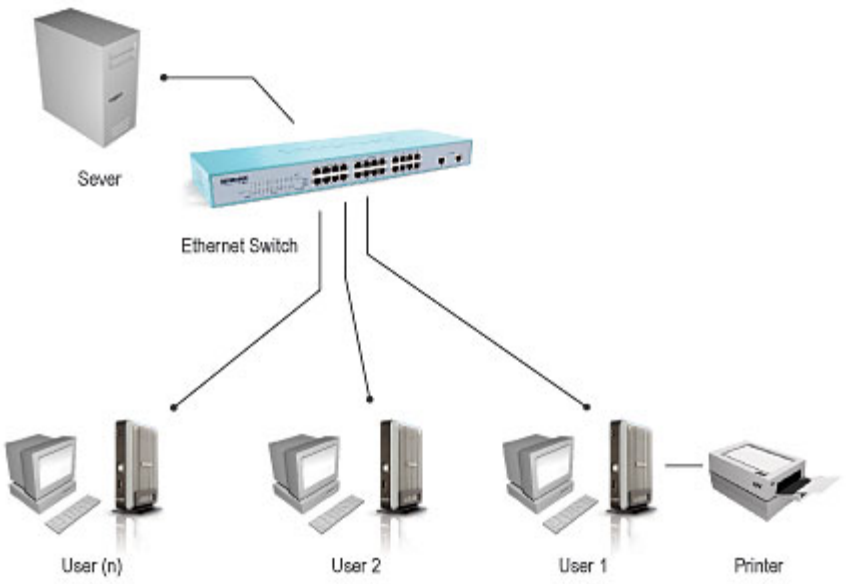
Thin Client Assessment

Lee Cooper
ET Spotlight Webinar
February 24, 2011

Thin Client Opportunity

Current state: 70 watt (or more) desktop

Thin client: 5-15 watt thin client plus 200 watt server w/ 25 thin clients per server



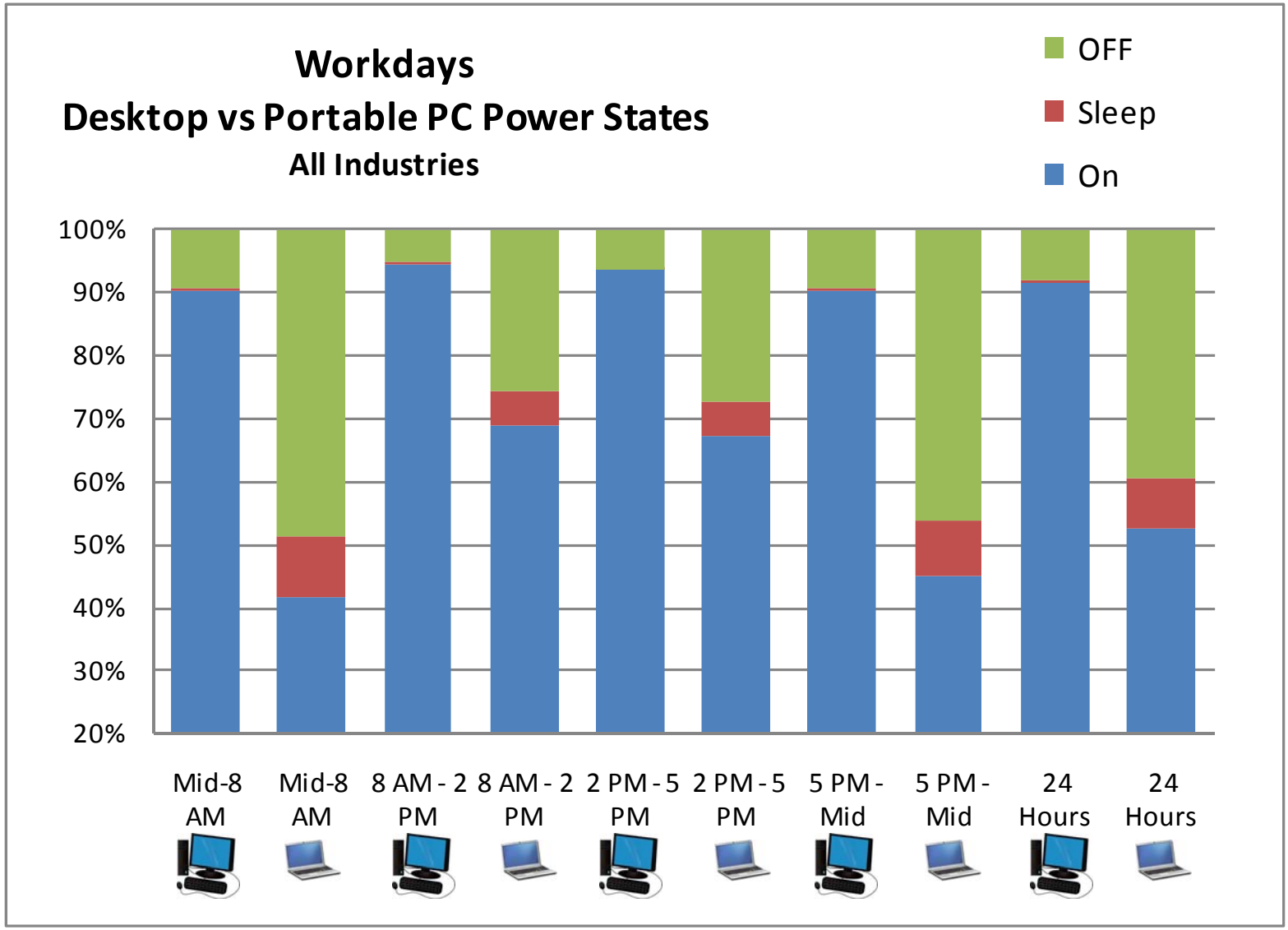
ET Assessment

Gather baseline data on computer energy use

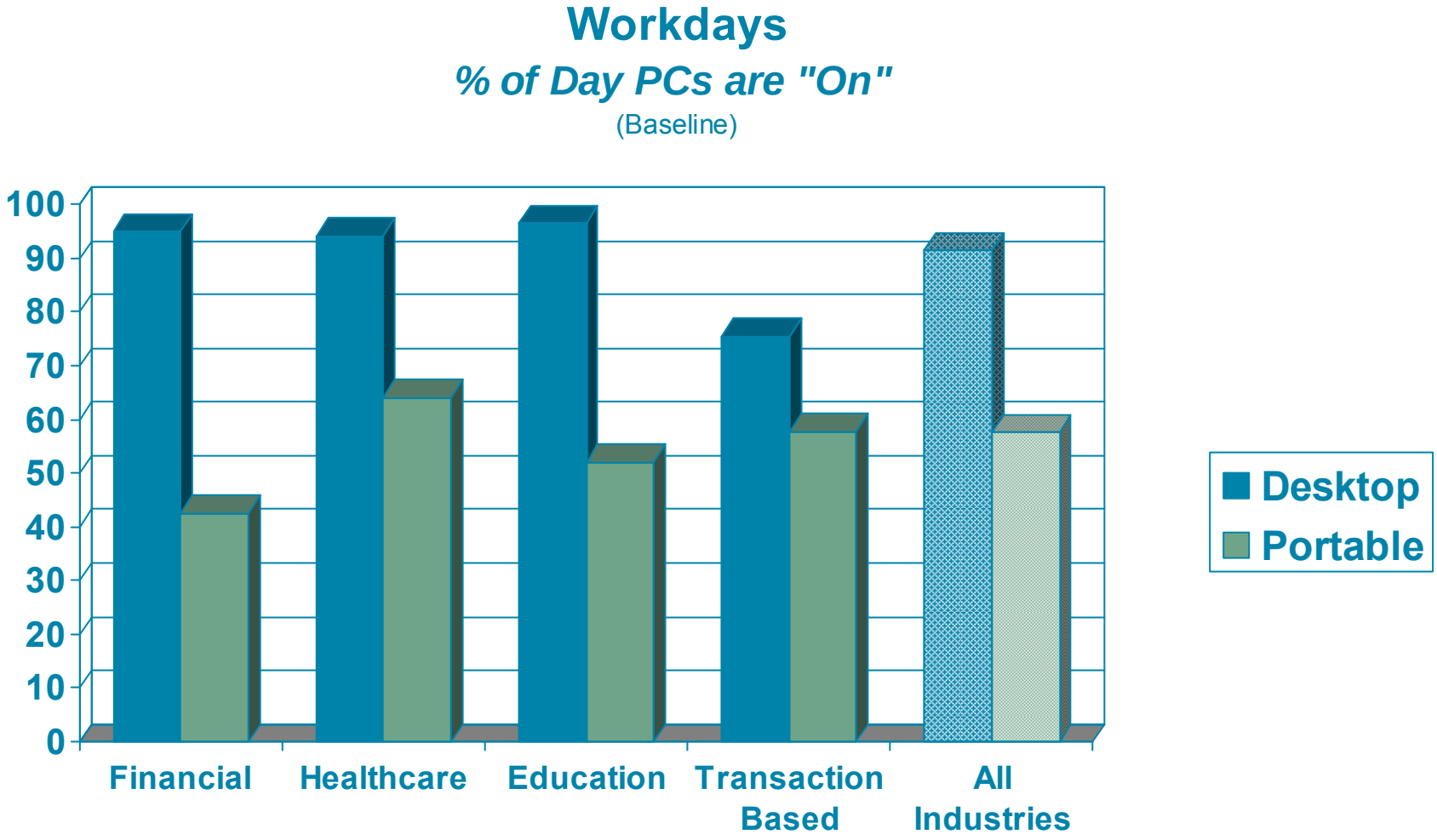
Used PC network management software to monitor 110,000 PCs over a two week period

Hourly power usage data to refine energy savings calculation methodology

PC Power States: Workdays vs. Weekends



PC Power States by Industry Vertical



Summary

Thin client hardware is not a new concept

Virtual Desktop Infrastructure (VDI) used today in thin client rollouts. (Some VDI rollouts happen without thin clients)

Thin client-to-server ratio varies widely

Financial incentives can tip the balance toward adoption

Questions

Lee Cooper
ET Spotlight Webinar
February 24, 2011

Numerical Simulation of Data Center Airflow Improvements

François Rongere

ET Spotlight Webinar

February 24, 2011

Context and Objectives

Improper mixing of supply and return air is a major cause of energy waste in data centers through:

- Excess of CRAH fan air flow
- Over cooled air supply

The objective of the project was to quantify the impact of different air containment strategies recommended in the DC-PRO tool to reduce mixing and improve efficiency, focusing on:

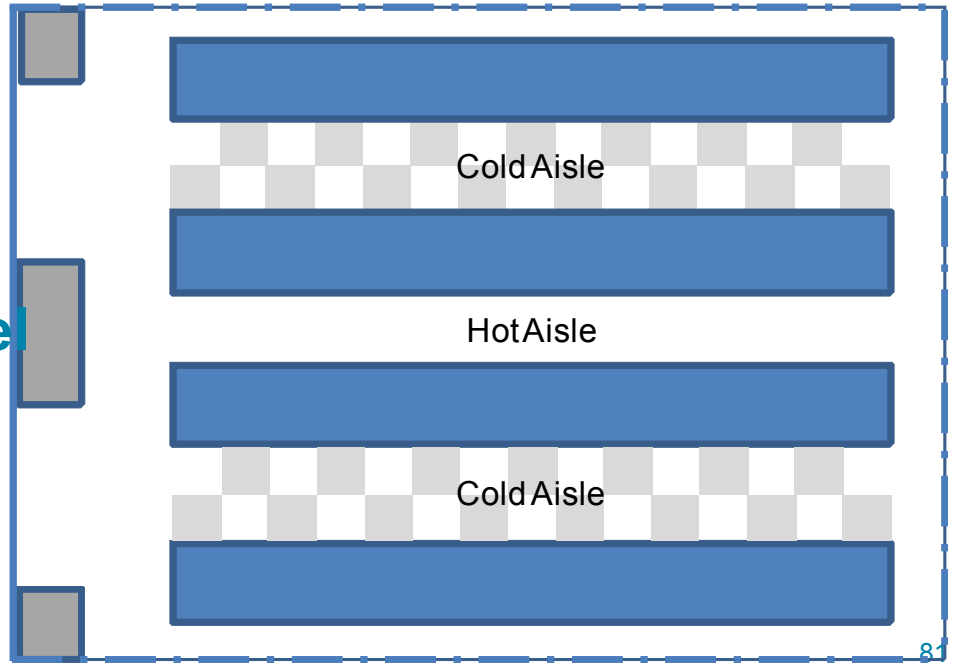
- Aisle containment
- Blanking panels
- Floor sealing
- Perforated tile placement

Contractor: ANCIS

Test Configuration

- 4 rows arranged with cold and hot aisles
- 1 AHU feeds two server rows
- Server density: 80 W/sqft
- Area: 39’ x 27’4”
- Height under ceiling: 11’
- Raised floor: 2’
- Server ΔT: 27ºF

- CFD simulation
- 1 million cells
- k~εturbulence model



Parametric study

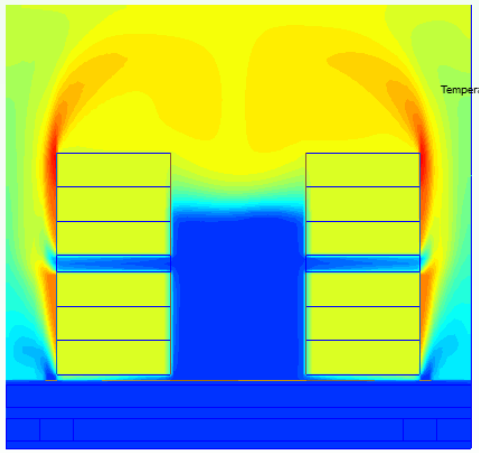
Measure	Low Quality (1)	Mid Quality (2)	High Quality (3)
1. Aisle containment	No containment	Doors to cold aisles (2" gaps)	Full containment of cold aisles (1" gaps)
2. Blanking panels	No panels (20% of front rack area open)	Some panels (8% of front rack area open)	All panels (2% of front rack area open)
3. Floor sealing	No floor sealing (50% of total flow rate)	Some floor sealing (25% of total flow rate)	Good floor sealing (10% of total flow rate)
4. Tile placement	Many (20%) tiles outside cold aisles	Some (10%) tiles outside cold aisles	No tiles outside cold aisles

Results

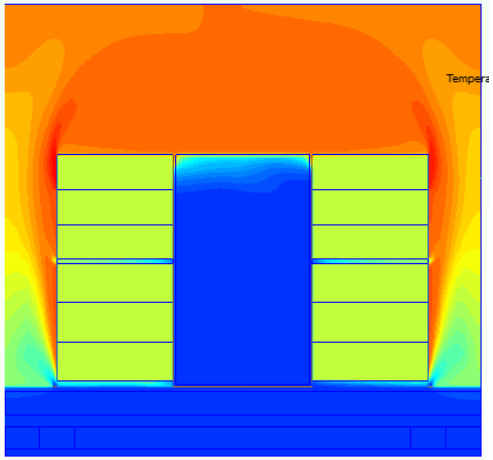
Adjustment of AHU air-flow to keep in-let temperature in acceptable range (measured with Rack Cooling Index RCI =95%)

Measure	Configurations				
	#6 (Base)	#7	#8	#10	#11
1.Containment	1	2	2	2	3
2.Blanking panels	2	2	2	3	3
3.Floor leakage	2	2	2	3	3
4.Tile placement	2	2	3	3	3
Supply Air Temperature	71	71	72	74	74
CRAC/Server flow rate ratio this study	186%	170%	172%	145%	120%
CRAC/Server flow rate ratio DC-PRO Tool	163%	150%	130%	123%	120%

Conclusion



Case # 6



Case # 11

Confirmation of observed air flow excess and potential savings

Basis for recommendations for specific measures in DC-PRO tool

Definition of a realistic target for air-flow improvement to 120% of server air-flow

Understanding of lack of containment impact

Thank you!

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Emerging Technology Coordinating Council

ET Spotlight

February 24, 2011

Dave Bisbee, CEM

Project Manager II

Customer Advanced Technologies

SMUD

Technology Spotlight

NovaTorque Brushless Permanent Magnet Motor

Photo credit: Novatorque Inc.

Technology Spotlight

What is it?

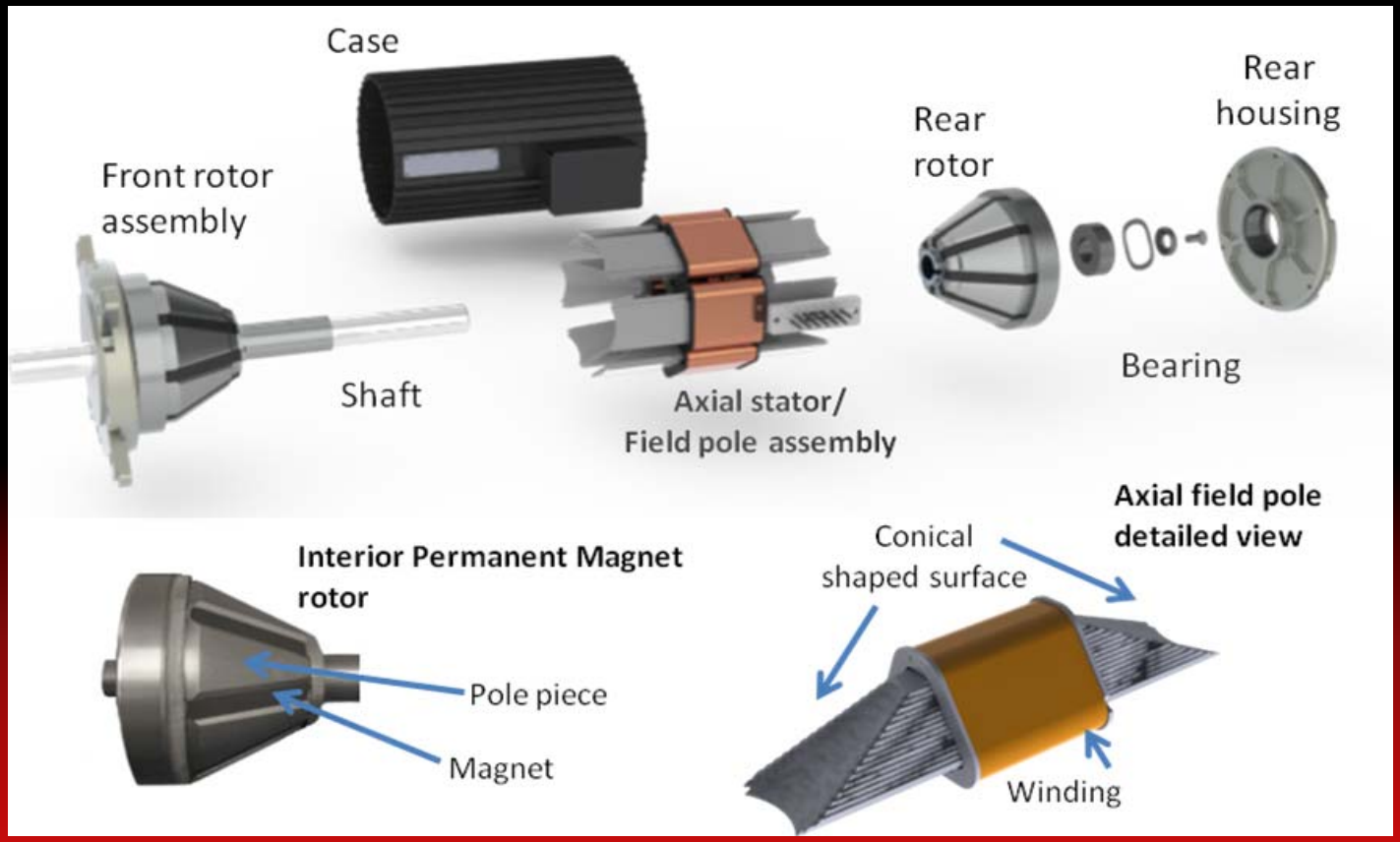


Photo credit: Novatorque Inc.

Technology Spotlight

What Are the Potential Benefits?

- Maintains higher efficiencies during variable speed operation
- Cost competitive with NEMA premium efficiency motors with variable speed drives
- Generates less heat
- Enhances reliability due to cooler operation
- Smaller package enables the motor to be used in a wide variety of applications

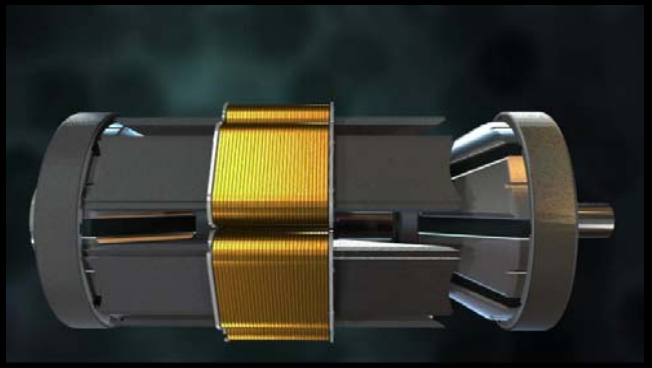


Photo credit: NovaTorque Inc.

Technology Spotlight

What Was Tested?

- 3 HP NovaTorque Premium Plus+™ Motor
- 3 HP NEMA Premium Efficiency Induction Motor (rated efficiency = 89.5%)
- 3 HP NEMA Standard Efficiency Induction Motor (rated efficiency = 87.5%)

Photo credit: ADM Associates Inc.

Technology Spotlight

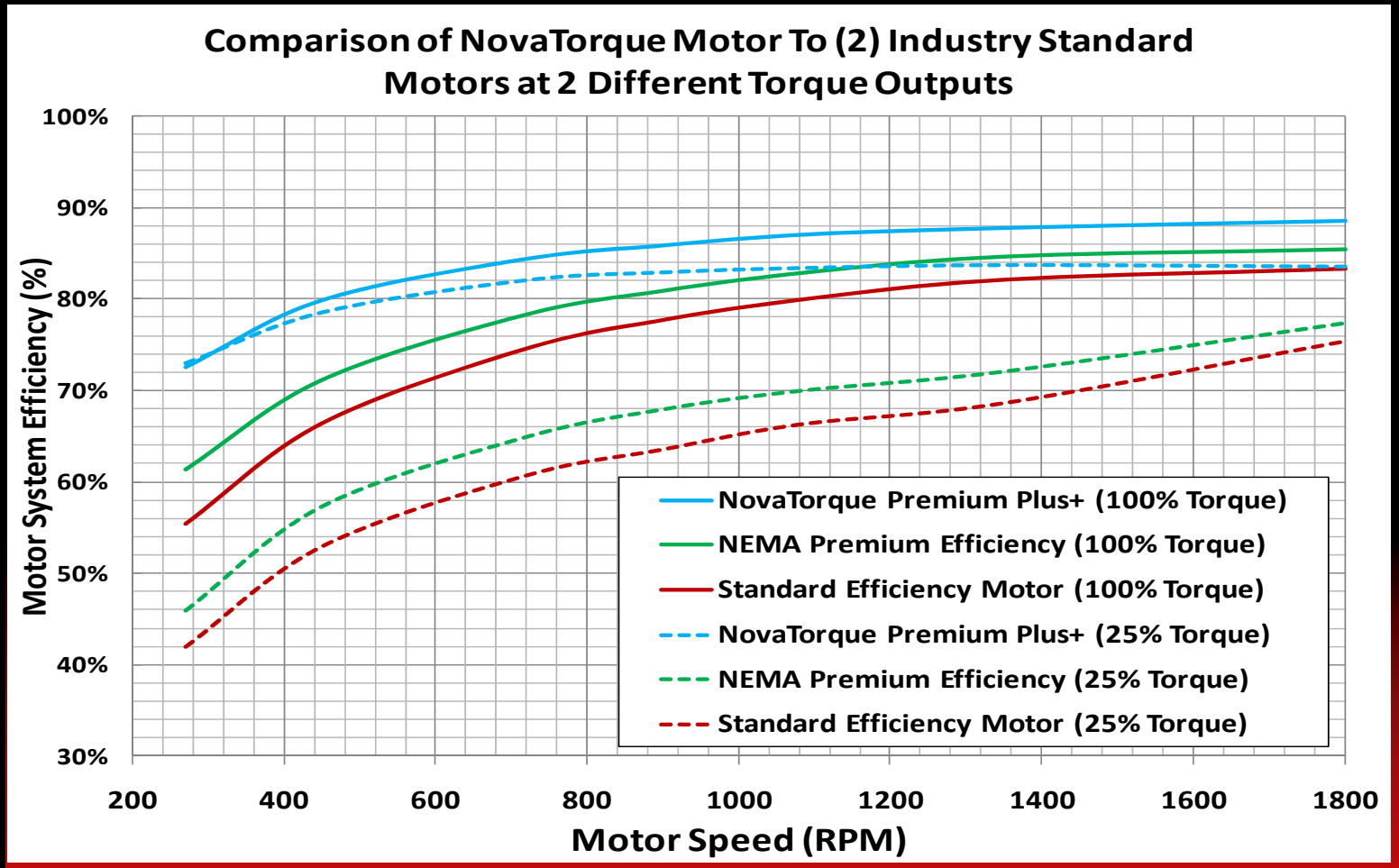
How Was the Test Accomplished?

Dynamometer 5 HP Automated Test System Stand

- Tests motor and system efficiency
- Torque range of 0 to 20 N-m
- Speed range of 0 to 5000 RPM
- Power limit of 3.7 kW
- Magtrol TM308 20 N-m torque head
- Magtrol 3410 torque display
- Magtrol AHB-12 air-cooled hysteresis brake
- Yokogawa WT1600 power meter
- Dell Latitude E6400 notebook computer

Photo credit: ADM Associates Inc.

Technology Spotlight



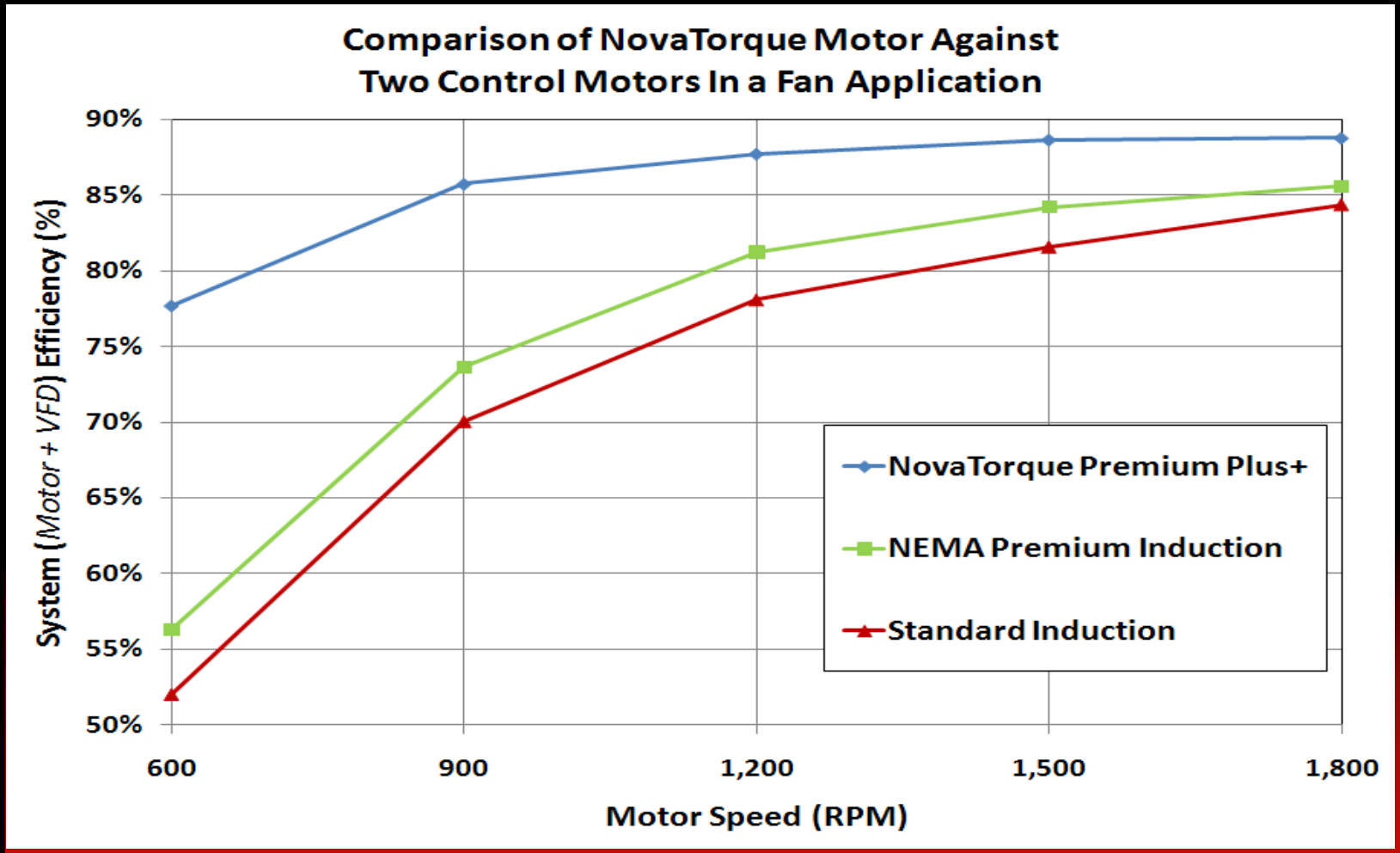
Monitored Motor System Efficiency Vs Speed (RPM) at Two Different Torque Outputs.
Source: ADM Associates Inc.

Technology Spotlight

Next Steps

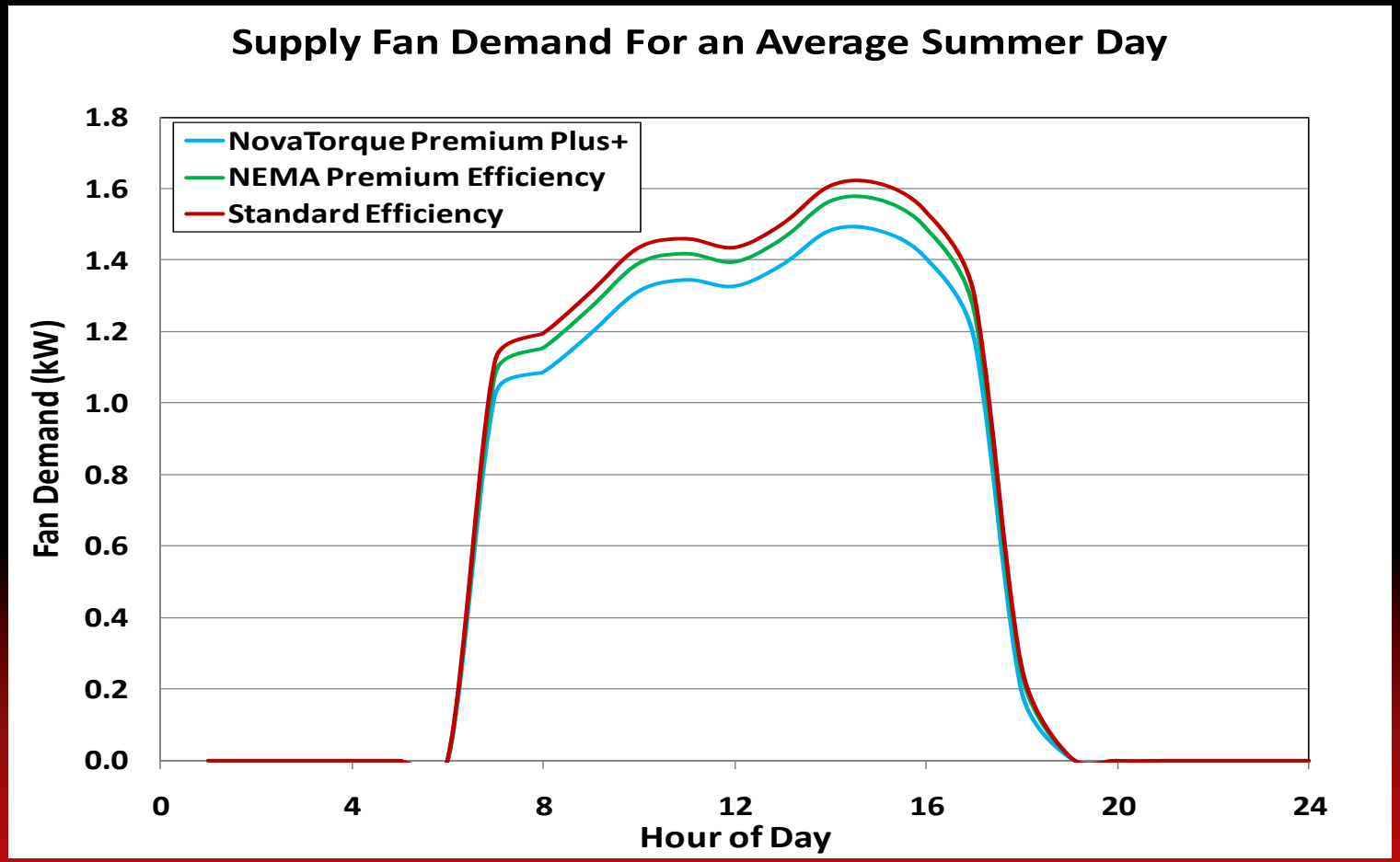
- Test data used to develop performance curves for all three of the tested motors and drive systems
- Performance curves and simulation software used to develop estimates for four typical scenarios:
  1. Variable air volume (VAV) system with a right-sized motor (3 HP)
  2. Variable air volume (VAV) system with an over-sized motor (5 HP)
  3. Variable chilled water pumping system with a right-sized motor
  4. Variable chilled water pumping system with an overt-sized motor

Technology Spotlight



Data points are measured system efficiency values and were selected based on a calculated fan curve. Source: ADM Associates Inc.

Technology Spotlight



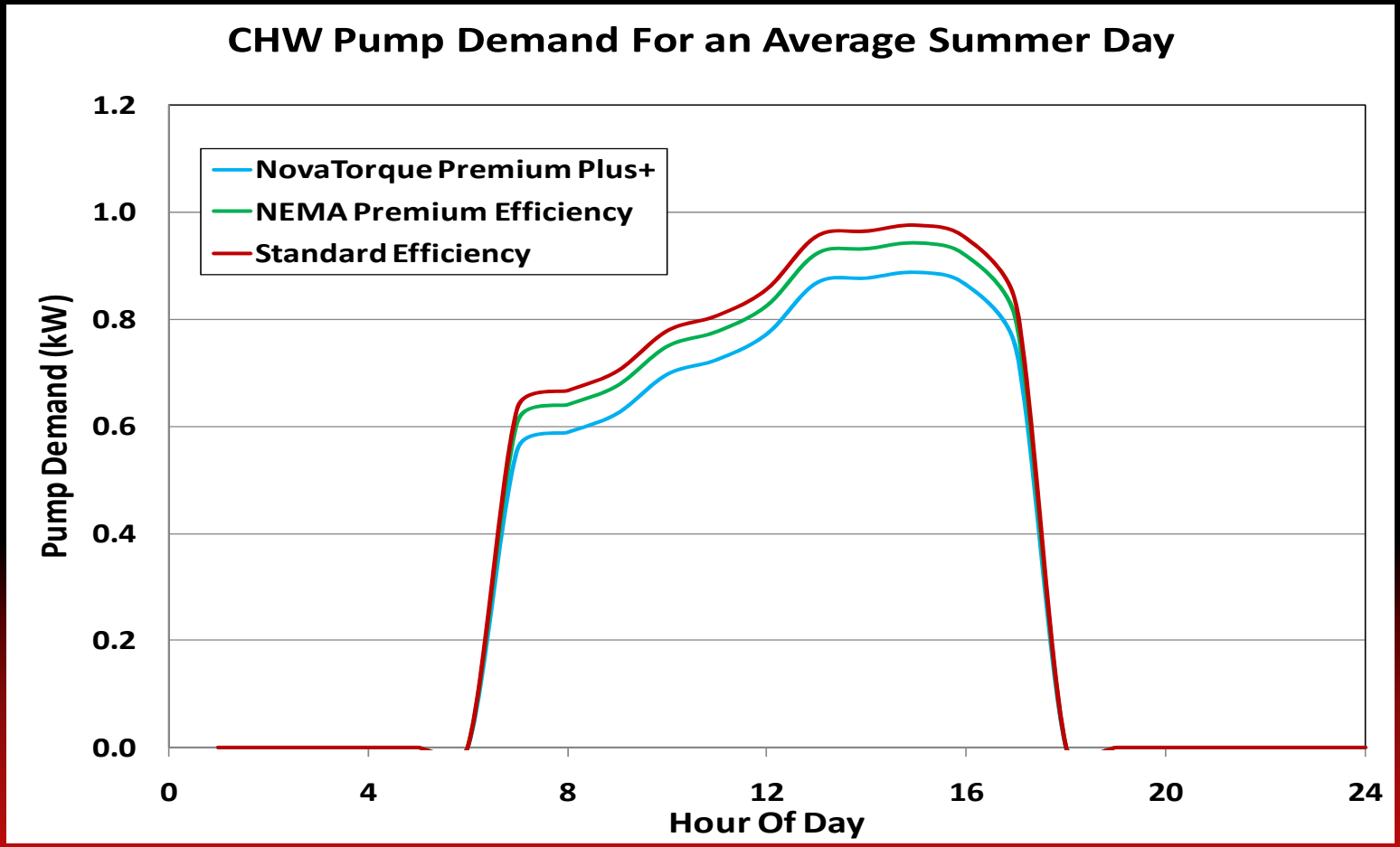
Calculated results for using a 3 HP NovaTorque Premium Plus+™ Motor in a variable air volume (VAV) system application. Source: ADM Associates Inc.

Technology Spotlight

	Right Sized Supply Fan (3 HP)		Oversized Supply Fan (5 HP)	
	Premium Motor	Standard Motor	Premium Motor	Standard Motor
Estimated Savings (kWh/HP)	90	136	137	200
Estimated Savings (%)	7%	10%	10%	14%

Calculated results for using a 3 HP NovaTorque Premium Plus+™ Motor in a variable air volume (VAV) system application. Source: ADM Associates Inc.

Technology Spotlight



Calculated results for using a 3 HP NovaTorque Premium Plus+™ Motor in a variable chilled water pump system application. Source: ADM Associates Inc.

Technology Spotlight

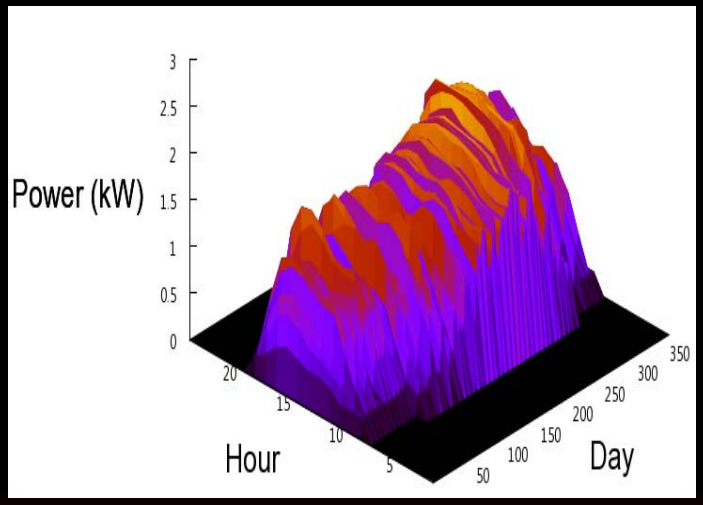
	Right Sized CHW Pump (3 HP)		Oversized CHW Pump (5 HP)	
	Premium Motor	Standard Motor	Premium Motor	Standard Motor
Estimated Savings (kWh/HP)	69	105	116	162
Estimated Savings (%)	8%	11%	12%	16%

Calculated results for using a 3 HP NovaTorque Premium Plus+™ Motor in a variable chilled water pump system application. Source: ADM Associates Inc.

Technology Spotlight

Observations

- Energy savings potential merits further investigation via field tests – especially if initial cost is comparable
- Search for SMUD demonstration site is currently underway



Questions?

Dave Bisbee, CEM

Customer Advanced Technologies

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Southern California Edison

Spotlight on Technologies

High Performance Medium Temperature Refrigerated Display Case Evaluation

February 24, 2011

Presented By:

Paul Delaney

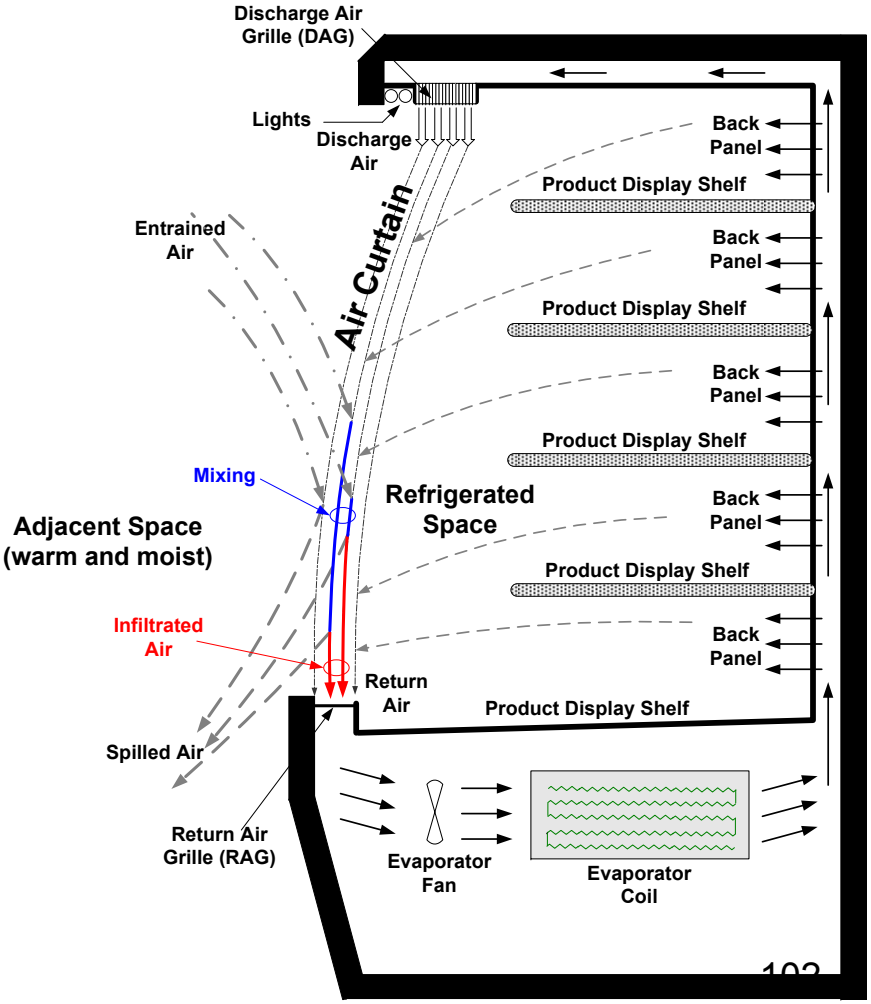
Emerging Technologies Assessments Program Manager

Design & Engineering Services

SOUTHERN CALIFORNIA EDISON®

An EDISON INTERNATIONAL® Company

High Performance Display Cases



Background

- In a typical supermarket, MT compressors serving OVRDCs require about 46 kW and 290,000 kWh/yr
- 2,800 supermarkets (> 1.6M kWh/yr) in SCE's service territory*
  - 128 MW (power demand for MT compressors)
  - 812 GWh/yr (energy usage for MT compressors)
- 6,900 supermarkets (> 1.6M kWh/yr) in CA*
  - 317 MW (power demand for MT compressors)
  - 2,001 GWh/yr (energy usage for MT compressors)

*Source: Itron. "California Commercial End-Use Survey: Consultant Report," CEC-400-2006-005. March 2006.

Background – cont'd

- OVRDCs account for more than 50% of total display cases lineups
- Food and Drug Administration regulates the temperature of perishable food products (core product temp. ≤ 41°F)
- Supermarkets and grocery stores are largest electric energy intensive building groups in commercial sector:
  - Annual energy usage intensity: 43 to 70 kWh/ft^2/year
  - Refrigeration energy: more than 50% of total energy
- New generation of cases can reduce energy consumption over legacy cases

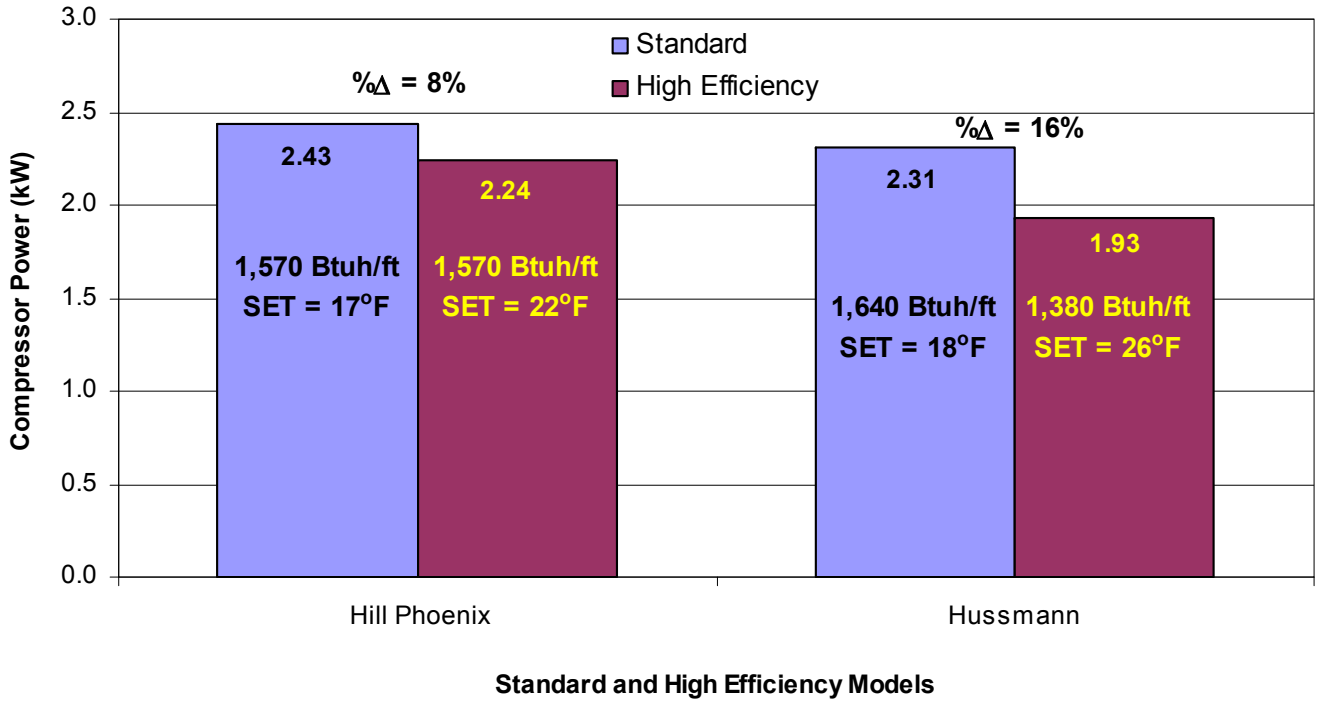
Sample Baseline Specifications

- Open Vertical Refrigerated Display Case, medium temperature - 8-ft:
  - Avg. Discharge air temperature (DAT): 29°F
  - Saturated evaporating temperature (SET): 17°F
  - Avg Rated capacity: 1605 Btu/hr/ft
  - *Avg. Est. compressor power: 2.43 kW*

High Efficiency Display Case Specifications
(based on manufacturers data)

- Hill Phoenix (O5DM), 8-ft:
  - DAT: 30°F
  - SET: 22°F
  - Rated capacity: 1,570 Btu/hr/ft
- Hussmann (M5X-GEP), 8-ft:
  - DAT: 30°F
  - SET: 26°F
  - Rated capacity: 1,380 Btu/hr/ft
- Tyler (N6DHPACLA), 8-ft:
  - DAT: 34.5°F
  - SET: 28°F
  - Rated capacity: 1,059 Btu/hr/ft

Sample Compressor kW Saving Estimates



- Replacing standard cases with high efficiency cases can save up to 16% in compressor power demand

Conclusions

- While maintaining the warmest product temperatures below 41°F, the most efficient case had:
  - Up to 26% lower infiltration load
  - Up to 22% lower total cooling load
  - Up to 14% lower compressor power demand
- Two of the cases did not meet maximum product temperature requirements.
- Anticipated that replacing standard with high efficiency cases can save between 8% to 16% in compressor power demand

Recommendations

- Although there is viable opportunity for EE rebate program, care must be taken to ensure proper temperature/performance is maintained
- Suggested characteristics of high efficiency OVRDCs:
  - Highest saturated evaporating temperature (> 26ºF)
  - Lowest temperature difference between discharge and return air (< 10ºF)
  - Lowest vertical distance between the discharge and return air grille
  - Least amount of daily collected condensate (< 9.5 lbs/ft/day)
  - Lowest infiltration load per refrigerated volume (< 120 Btu/hr/ft^3)
  - Lowest total cooling load per refrigerated volume (< 145 Btu/hr/ft^3)
  - Lowest evaporator fan motor power (< 20 watts/fan motor)
  - Lowest display case lighting power (< 55 watts/canopy row)

Questions

Paul Delaney
Emerging Technologies Assessments Program Manager
Design & Engineering Services

Industrial

- Water Energy Study - PG&E
- Compressed Air Conversion to Low Pressure Blower - SCE

Including Energy Use Information in Water Pumping Station SCADA

François Rongere

ET Spotlight Webinar

February 24, 2011

Context and Objectives

Municipal distribution water pumping represents about 1,000 GWh/yr of electricity use.

Pump station operation have not been driven by energy use information.

When provided with power use information operators may adjust their decision to reduce the electricity bill.

Pilot Concept

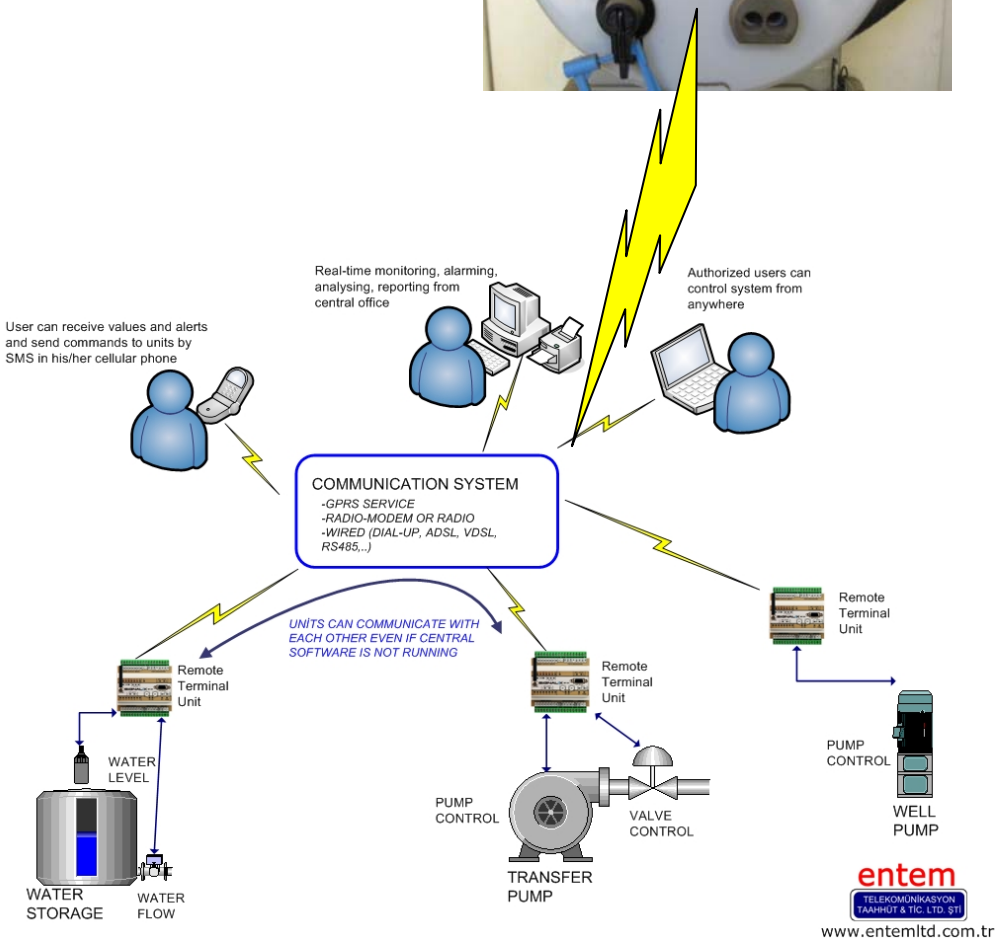
Water utilities monitor at pump stations:

- pressure
- flow
- pump status

Connect PG&E meter into SCADA system:

- energy

Real time efficiency monitoring and control



Pilot Description

San Jose Water Company

- 215,000 customers, 138 Sq miles
- 130 MGD
- Three pump stations with 1 to 4 ground water pumps and 3 booster pumps

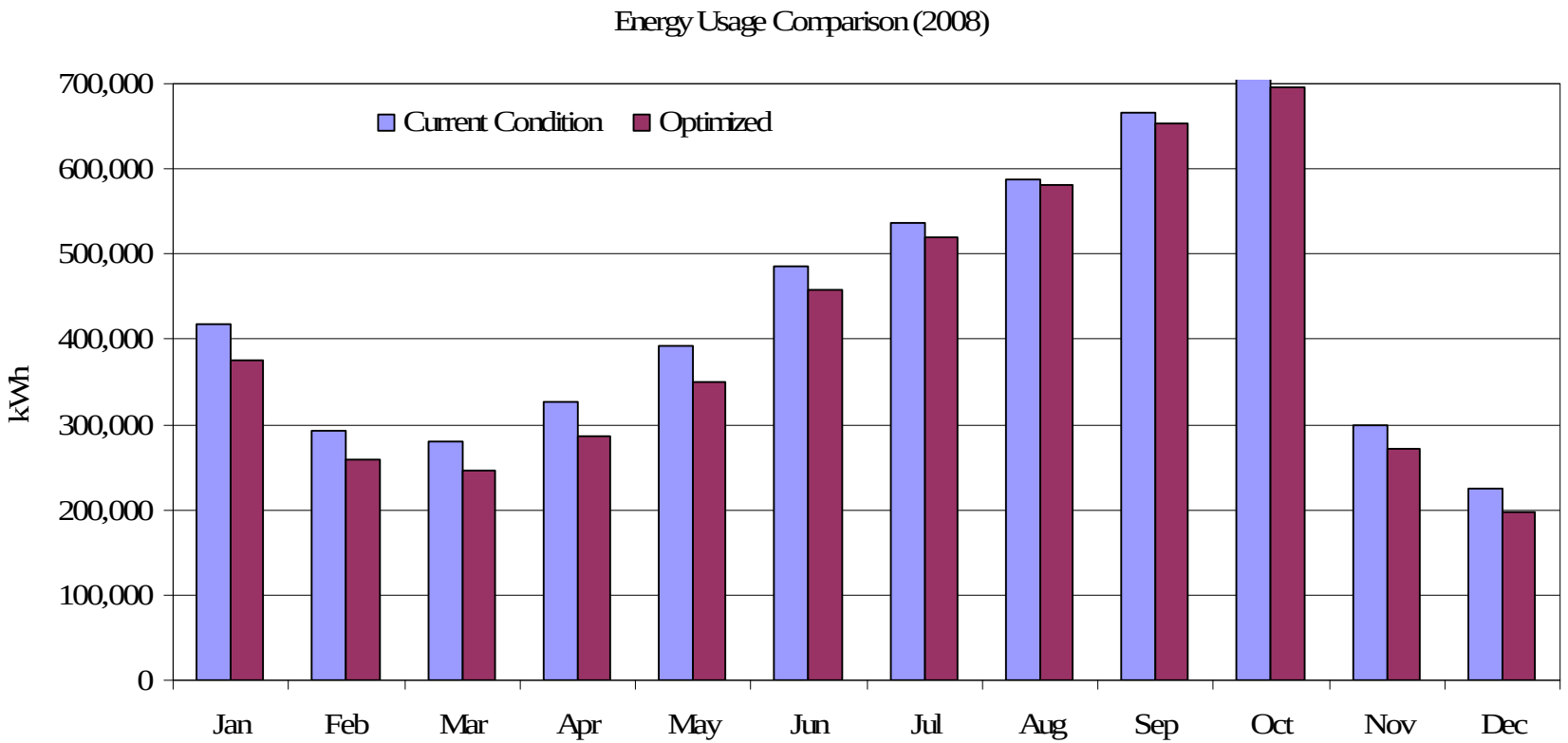
East Bay Municipal Utility District

- 400,000 customers, 325 Sq miles
- 200 MGD
- Four pump stations with 3 to 5 ground water pumps 55 MGD
- Contractor: Global Energy Partners

Pilot Results:
San Jose Water Company

Total savings potential at three pump stations:

- **6% energy savings if optimization algorithm was used**
- **313,000 kWh/yr in savings, or ~$31,000 per year @$0.10/kWh**



Pilot Results:
East Bay Municipal Utility District

Improvements in energy efficiency have not been sustained:

- Energy use is impacted by factors beyond the pump station itself
- Instantaneous optimal values do not lead to long term minimum energy use
- Other events impact water pump operation
- Operators may not have followed optimization rules

Conclusion

- Including energy use in SCADA systems of water agencies is fairly easy
- Savings can be captured by optimizing the use of pumps within a station and across a group of stations
- Modeling of the water distribution system may be needed to actually capture the full optimization potential
- For non-automated distribution system, operator behavior change may take time to include energy efficiency in operation rules

Thank you!

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Southern California Edison

Spotlight on Technologies

Compressed Air to Low Pressure Blower Evaluation

February 24, 2011

Presented By:

Paul Delaney
Emerging Technologies Assessments Program Manager
Design & Engineering Services

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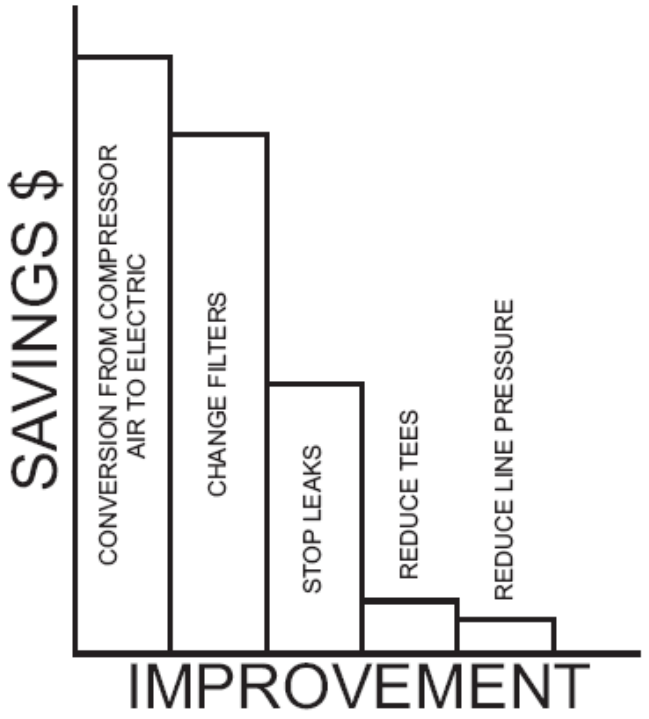
Change Compressed-Air Process to Use Low Pressure Blower Air

Some manufacturing and industrial processes use compressed air for applications that can be done with low pressure blowers instead. The following industrial processes have been identified as potentially inappropriate uses of compressed air:

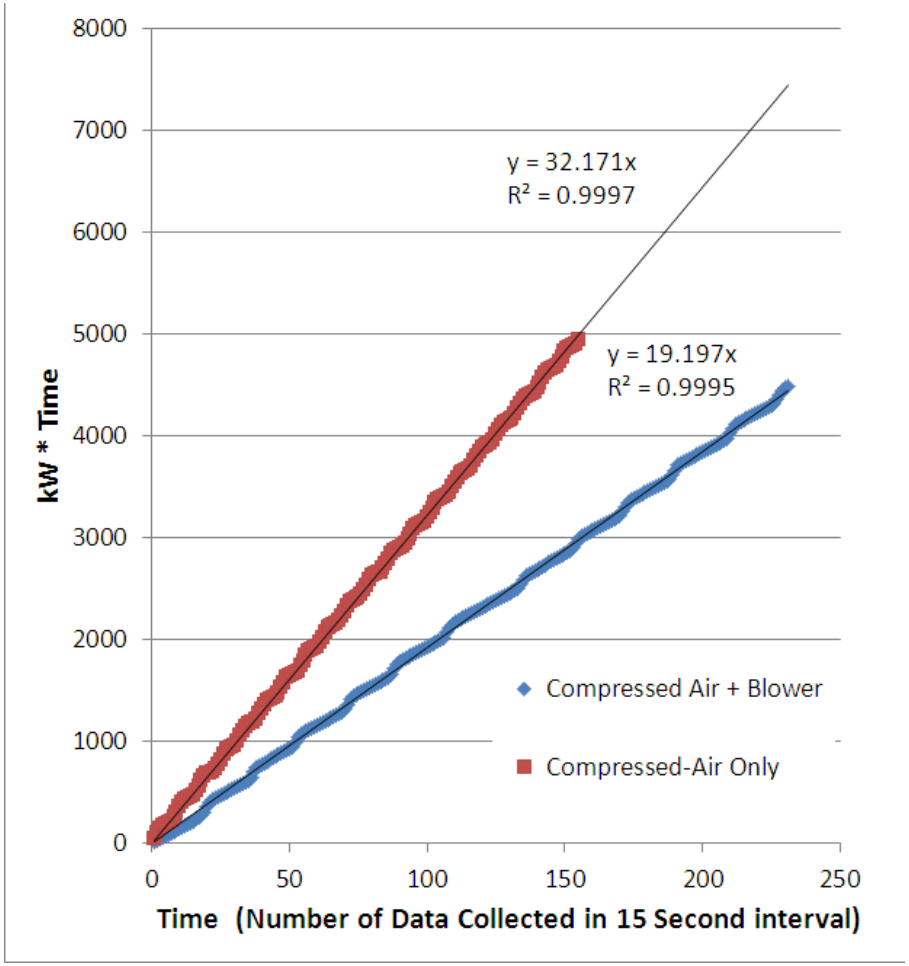
- open blowing
- sparging
- drying
- aspirating
- atomizing
- dilute phase transport
- vacuum generation
- personnel cooling
- diaphragm pumps
- vacuum venturi
- cabinet cooling



Incumbent Technology - Compressors

For open-blowing types of production processes such as removing debris from a plastic extrusion process, this can be done more effectively using air blowers, which also provides 70% to 90% in energy savings when compared to compressed air systems.

Energy and Demand Savings



Case Study: Thermoplastic Extrusion Process.

- Peak Demand Savings = 13 kW
- Annual Savings = 78,000 kWh
- Material Cost = $16,900
- Simple Payback = 1.5 years
- Additional Benefits:
  - Lower noise level (about 10 dB(A) lower)
  - Lower maintenance cost compared to the compressor system

Conclusions

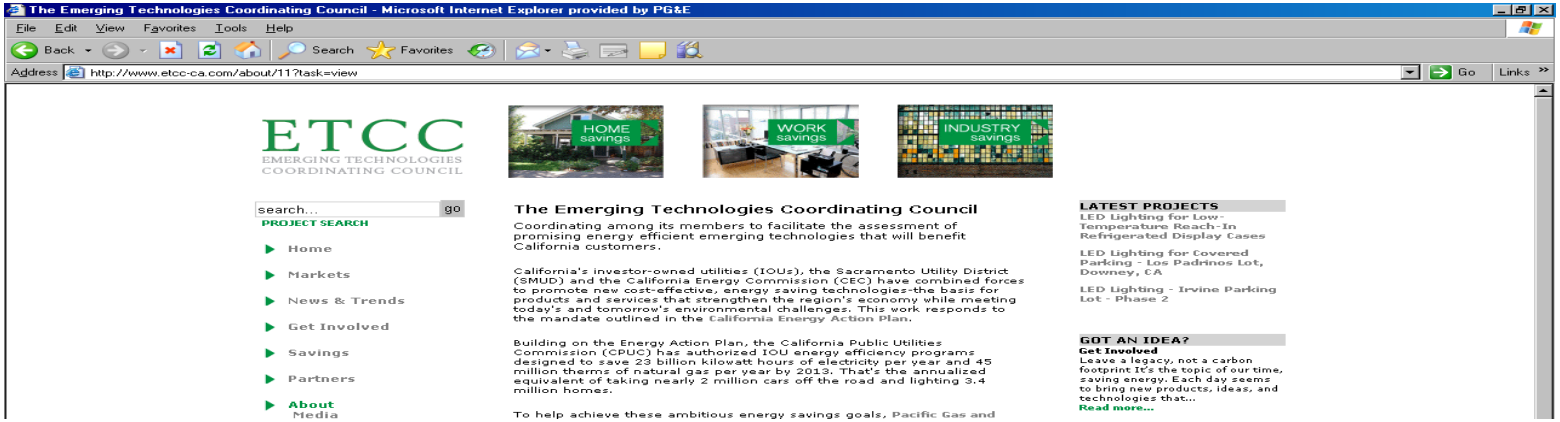
- For “Open Blowing” industrial processes (e.g., cooling, removing debris or water), blowers can save between 70% to 90% in compressor energy uses for the process.
- Blower works well if the industrial process requires air constantly.
- Blower does not work well for:
  - *Pneumatic process*
  - *Humidity restricted applications (e.g., microprocessor fabrications)*
  - *Temperature restricted applications (e.g., some food processing), etc.*

Questions

Paul Delaney
Emerging Technologies Assessments Program Manager
Design & Engineering Services

ETCC - Emerging Technologies Coordinating Council

- Website
  - http://www.etcc-ca.com



- On-Line Survey

Thank You !

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