



# Retro Commissioning for Ramped Up Performance

**September 19, 2007**

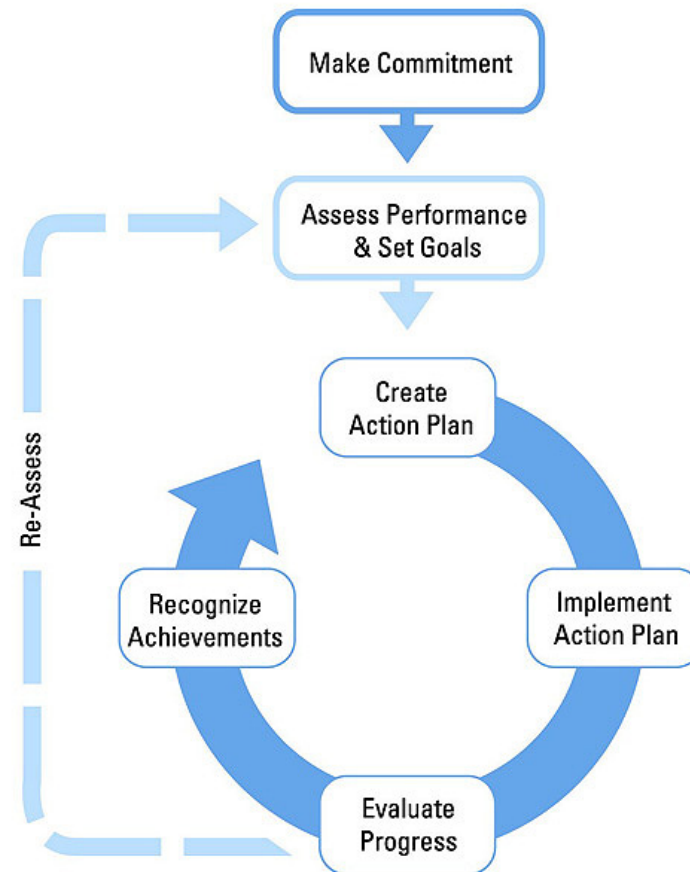
Call-in Number: 1-866-299-3188

Conference Code: 202 343 9965

# About The Web Conferences



- **Monthly**
- **Topics are structured on a strategic approach to energy management**
- **Opportunity to share ideas with others**
- **Slides are a starting point for discussion**
- **Open & Interactive**



# Web Conference Tips



- Mute phone when listening! Improves sound quality for everyone.  
Use \* 6 – to mute and # 6 to un-mute
- Hold & Music – If your phone system has music-on-hold, please don't put the web conference on hold!
- Presentation slides will be sent by email to all participants following the web conference.

# Today's Web Conference



Why Retro Commission?

"If you don't know where you are going, you will wind up somewhere else." – Yogi Berra

Speakers:

- Delbert Reed – Shriner's Hospital
- Thomas A. Pagliuco – Schering-Plough
- Allison Robbins & Dave Moser – PECI
- Announcements



# Retro-commissioning for ramped up performance

**Delbert Reed,**

Director of Engineering/Maintenance  
Shriners Hospital



# Why RCx a new building?



## Common Assumptions (at least by management)

- If it's a new building, it should be fine
- If it was commissioned, it must be OK
- Original design documents are accurate

# Background



## Shriners Hospital for Children Houston, Texas

- Built in 1996
- Re-commissioned in 2002
- Hospital began operations in 1996
- State of the Art Facility
- 247,755 Sq Ft.



# Something's Not Right



- Signs and Symptoms of problems:
  - OR's – could not control temps/humidity
  - Fifth floor too hot
  - Laundry room too hot
  - Energy bill seems too high
  - Staff complaining of headaches in the morning and late evening
  - Other examples of complaints





# Initial Investigation

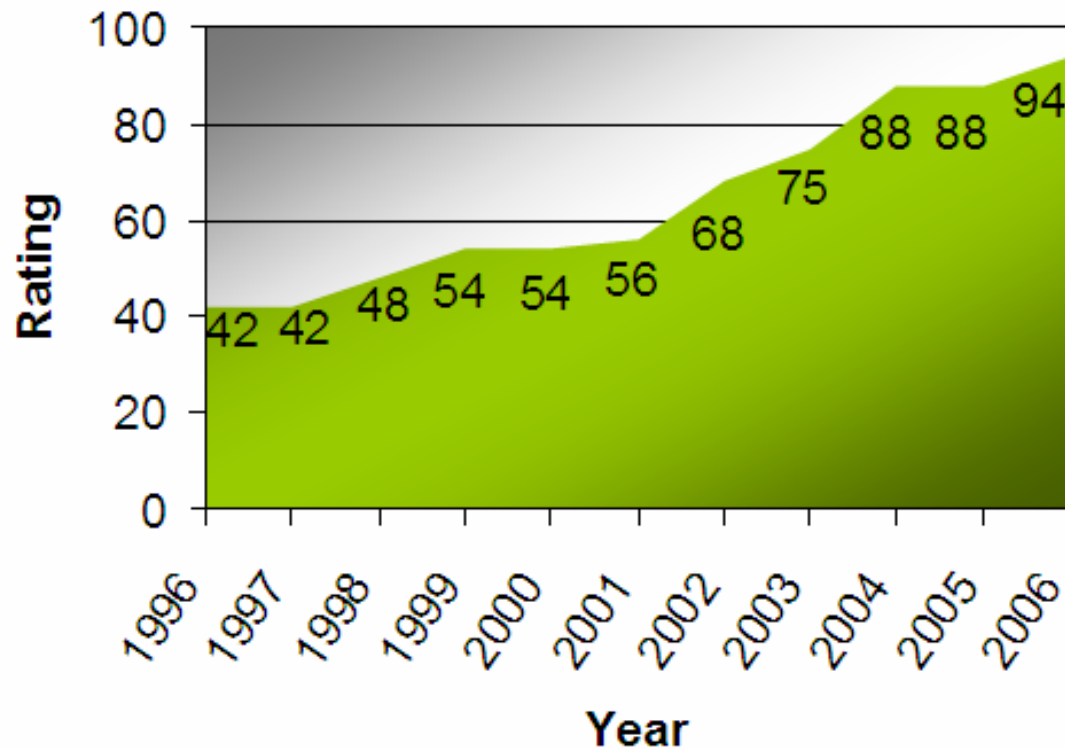


- Who did original commissioning?
  - What kind of reputation do they have...
- What did they do (or not do?)
  - No air balancing? Bad sign!!!
- Did documentation match what was there?
  - No we found...
- Do other design choice make sense?

# Use benchmarking



Benchmarking can be persuasive in getting buy-in for assessments and RCx studies



# What the doctor ordered



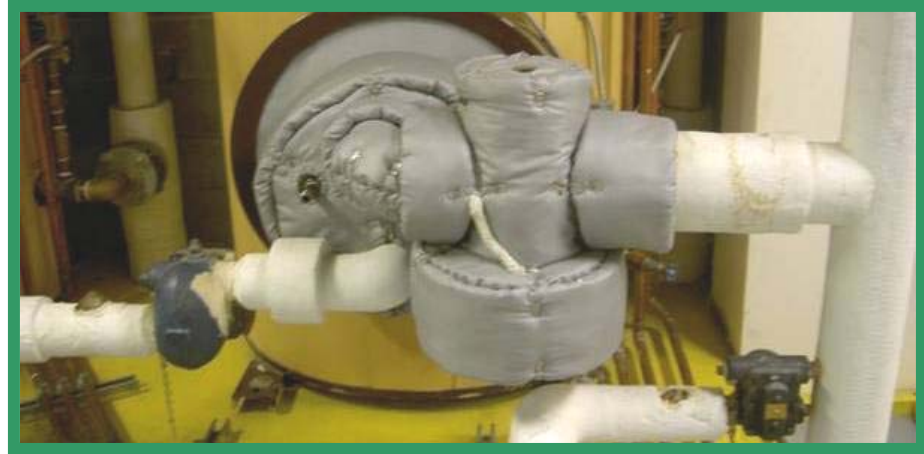
## Building Improvements:

- Lighting
- Occupancy Sensors
- Laundry and Steam Tables
- Thermal blankets on equipment
- Energy efficient motors
- Split-HVAC system
- Continuous maintenance of equipment
- Training

# Laundry and Steam Tables



# Thermal Blankets



# Energy Consumption (1997-2006)



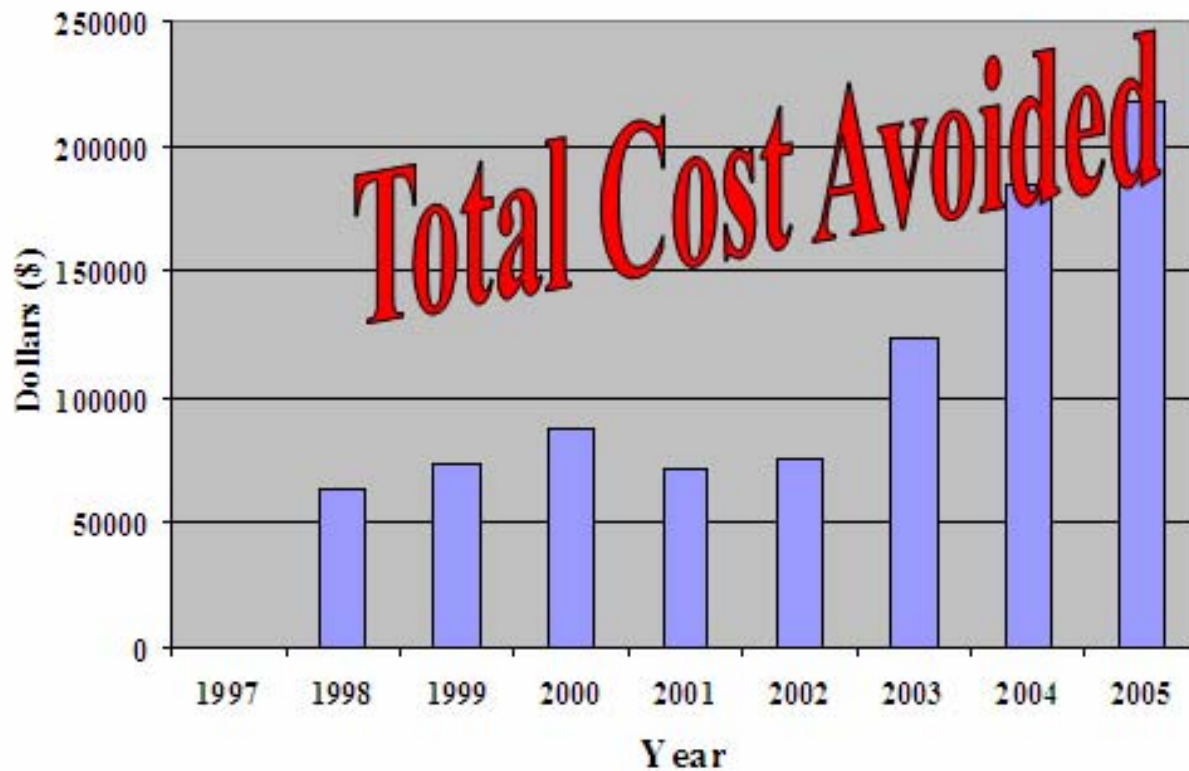
<b>Utility</b>	<b>1997</b>	<b>2006</b>	<b>Difference</b>	<b>% Reduction</b>
Electrical – kWh	3,671,352	2,838,443	832,909	22.7%
Electrical Demand	7,623/12	6,659/12	964	12.7%
Ch-water – K-th	2,100.77	1,428.10	672.67	32.1%
Ch- Demand TH/Day	75.74/12	52.80/12	22.94	30.3%
Steam – K-lb	10,949.45	6,274.49	4,674.96	42.7%
Steam Demand LB/day	400.58/12	228.81/12	171.77	42.8%



# Energy Savings (1998-2006)



### Shriners Total Energy Savings



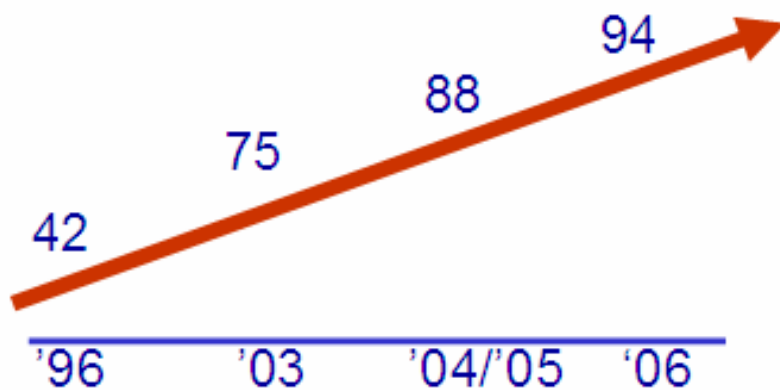
**Total Cost Avoided = \$900,000**

Adjusted for Inflation (2006 Dollars)

# Shriners Hospital for Children Houston, Texas



- Key Equipment Upgrades
- Continuous Improvement
- Commitment





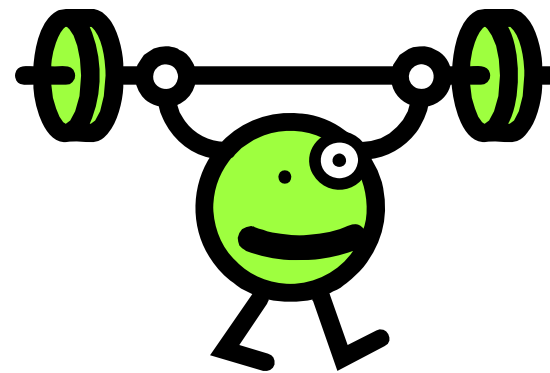
# Final Words



*“You’d be amazed at how many energy saving opportunities you walk by in a day”*



Questions?





**Delbert Reed**  
**Shriners Hospital**  
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# **Retro-Commissioning for Ramped-up performance**

## ***Some Lessons Learned***

Thomas A. Pagliuco  
Director, Energy  
Schering-Plough





# Outline

- Retro Commissioning Overview & Theory
- Why Retro-Cx?
- Finding a target for Pilot
- Retro-Commissioning Process
- Lessons Learned



# Retro-Cx Overview & Theory

- Retro-commissioning is the process of systematically evaluating existing buildings and systems (that were never commissioned) to ensure:
  - Original Design Intent
  - Current Operational Needs
  - Energy Conservation Opportunities (ECO)
- Retro-Cx focuses on the following:
  - Instrument Calibration
  - HVAC & Lighting Control Sequences
  - Mechanical Systems & Components
- You are a candidate for Retro-Cx if:
  - Unexplained increases in bldg energy cost & usage
  - A significant rise in occupant comfort complaints
  - Undocumented changes to building systems & structure
  - Maintenance staff overwhelmed with emergency calls.





# Why do Retro-Commissioning?

- Energy savings & Greenhouse Gas emissions reduction
- Fits a No Cost – Low Cost model
  - Expense vs capital fixes
    - Quicker & easier to implement (or so I thought!)
- Remediation of indoor air quality complaints (Temp, %RH, Pressurization, Filtration)
- Improved System performance, capacity & reliability
- Puts the focus on efficient operation and maintenance
- Wanted to see if it was a viable option for Schering-Plough
  - Establish Retro-Cx as a S-P Energy Best Practice





# Target for Pilot Study

- Potential for big impact
  - Laboratory Building
    - once through air
    - high number of air changes
    - fume hoods
- Drug Discovery Building – Kenilworth, NJ
  - Big area
  - Many fume hoods
  - High energy cost
  - Moderately inefficient
  - High cost of energy electric in NJ

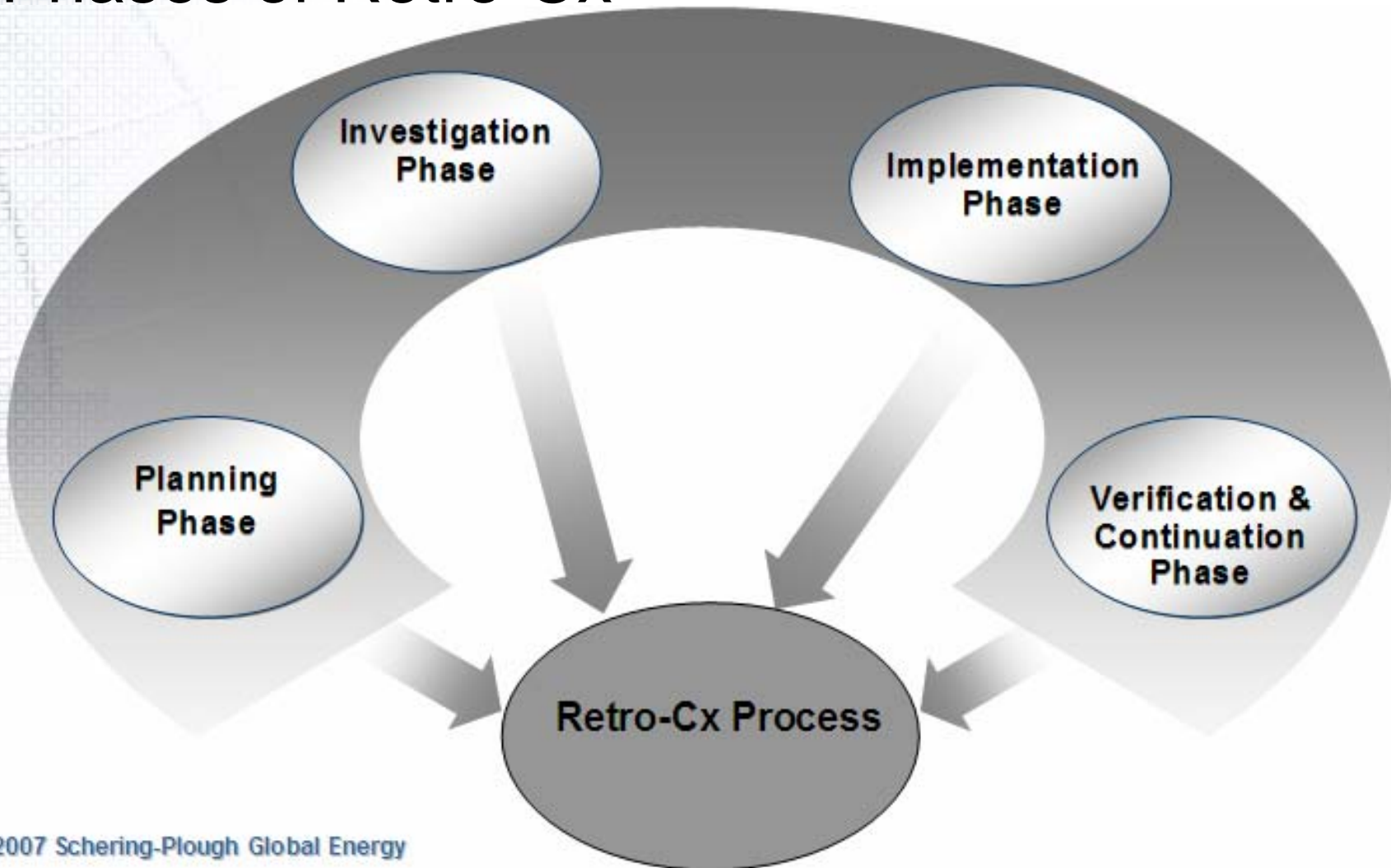






# Retro-Cx Process

## Phases of Retro-Cx





# Pilot Study Results

*Scoping study projected savings from annual cost*

- “Traditional” RCx findings
  - calibration
  - Time of Day schedules
  - Maintenance items
- Lab hoods (exp & cap)
  - exhaust and supply flow sensors
- Capital opportunities
  - chiller plant





# Barriers Become Lessons Learned

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- Potential to embarrass someone
  - Maintenance? Facilities? etc.
  - the more the savings the more the embarrassment
- Accounting system issues; even for expense work
  - customer needs to see the benefit ASAP
  - Need to budget for costs
- TOD schedules
  - some resistance to change
- Calibrations
  - work order system



# Barriers Become Lessons Learned

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- Lab hoods
  - Safety
    - working in ceiling - heights - scaffold
    - working in operating lab
    - chemicals in duct
    - need safety plan
  - Shutdown lab 2 - 4 days
    - extends schedule – work on weekends, wait for renovations
  - Desire to “make system right” increases cost and time
    - redesign the system – variable volume fume hoods
    - accessible from ground without disturbing scientist



# Lessons Learned

- Do it right the first time = **Commissioning**
- Design for accessibility
  - think about how to maintain systems with building fully occupied and operational
- Establish funding mechanism or at least pre-sell the cost potential
  - try to make the project “self funding”
- Consider safety requirements early
- Involve stakeholders early
- Building owner should be accountable for energy bill



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# Questions?





**Developing a Retrocommissioning Plan:  
Best practices & In-practice**  
Allie Robbins, Program Manager  
Dave Moser, Engineer

# Why Retrocommissioning?

- Building systems are not typically fully functional at initial occupancy
- Owners face increasing numbers of performance problems
- Buildings are more complex
- Current facility use may be dramatically different than original design
- Reduces energy, as well as operation and maintenance costs (improves net operating income)
- Provides a healthy and comfortable working environment for occupants





# RCx's Energy Savings Potential

- Most projects see a 5 - 20% reduction in utility cost as the result of low-cost RCx efforts
- Paybacks of 2 years or less are common

See *Retro-Commissioning's Greatest Hits*, presented at ICEBO 2001 by Tudi Haasl, downloadable from [www.peci.org](http://www.peci.org)



# What Does it Typically Cost?

- ~\$3,000 to scope out a typical project
- \$0.10 to \$1.00 per square foot for the total RCx process depending on:
  - Number of systems
  - System complexity
  - Number of zones
  - Data logger rentals
  - Owner's requirements
  - Subcontractor requirements
  - Implementation involvement
  - Owner involvement



# Best Practices in Retrocommissioning Process

- Planning Phase
- Investigation
- Implementation
- Hand off
- Post-RCx



# Strategies for a Successful RCx Program

- Involve facility staff to save time and money
- Screen for good candidate buildings
  - Benchmark with ENERGY STAR® Portfolio Manager
- Find a trusted RCx Provider
  - Select a provider well-suited to the project
- Designate an in-house champion
- Define Project Deliverables
- Develop a persistence plan to ensure lasting savings



# Common RCx Opportunities

- Scheduling
  - Lighting, equipment
- Controls / Setpoints
  - Recalibrate sensors, revise control sequences, change setpoints
- Economizers
  - Re-enabling “free” cooling



# Lighting Schedules

- **Finding:** most lights were on 24/7 on five floors
  - Occupants did not have access override switches located in locked closet
  - Zone names programmed into the system were unrecognizable by facility operating staff
  - Lighting sweep control system was disabled
- Problem identification
  - 15 minute utility interval data
  - System trend data
  - Walk by building at night!



# Lighting Schedules

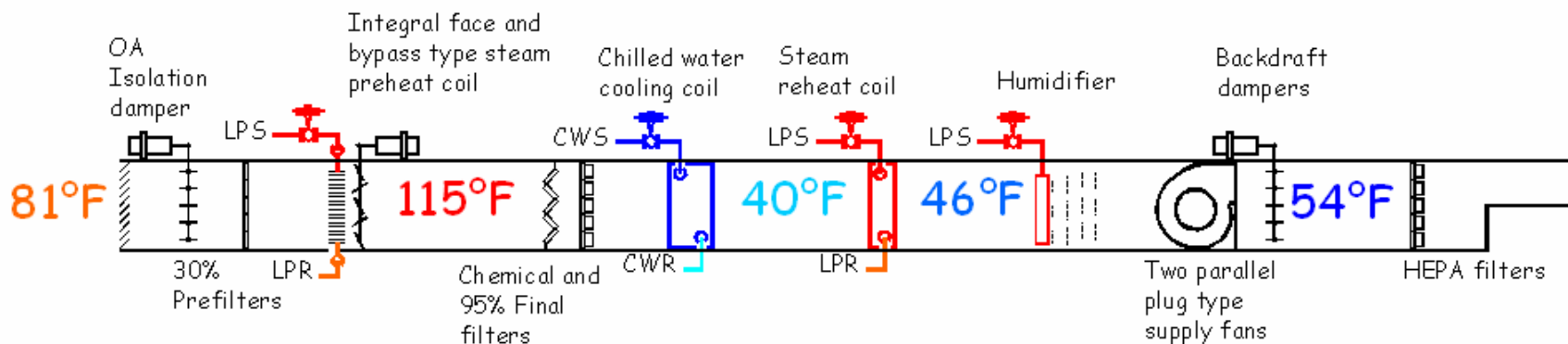
- **Implemented Measure:** move override switches to public areas; give appropriate zone names to lighting circuits
- **Results:**

Estimated annual electric savings	\$14,000	349,000 kWh
Implementation cost	\$9,800	
Simple payback	0.7 years	



# Reduce Simultaneous Heating & Cooling

- **Finding:** a large air-handling unit was adequately maintaining the temperature & humidity requirements, but the AHU's individual heating & cooling components were operating simultaneously.





# Reduce Simultaneous Heating & Cooling

- **Implemented Measure:**

- The preheat coil shutoff valve was integrated with the main control system so that the valve shuts off steam to the coil when it is not needed.
- Temperature sensors that were out of calibration were replaced.
- The control sequence was revised for more stable and efficient operation.

- **Results**

Estimated annual total gas and electric savings	<b>\$84,000</b>
Implementation cost	\$7,000
Simple payback	0.1 years



# Disabled Economizer Control

- **Finding:** Outside air damper was locked at 30% open due to return fan operational issues, causing the system to request chilled water at outside air temperatures as low as 45°F.
- **Implemented Measure:** address the operational issues related to the return fan and return economizer to fully-modulating automatic control.
- **Results:**

Estimated annual electric savings	\$5,465	74,857 kWh
Implementation cost	\$2,800	
Simple payback	0.5 years	



# Retrocommissioning Resources

## General Information

- [www.peci.org](http://www.peci.org)
- [www.cacx.org](http://www.cacx.org)
- [www.bcxa.org](http://www.bcxa.org)

Coming soon....EPA's Retrocommissioning Guide for Building Owners

## Utility Programs

- [www.sce-rcx.com](http://www.sce-rcx.com)
- [www.sandiegorcx.com](http://www.sandiegorcx.com)
- [www.rcx-program.com](http://www.rcx-program.com)





# Questions & Discussion

# Upcoming Meetings



- IEEE Industrial Energy Workshop  
Baltimore MD October 22 – 23  
<http://ieew2007.googlepages.com>

# Upcoming Web Conferences



October 17 – Energy and Greenhouse Gas Management

November 14 – Energy Strategy for the Road Ahead

January 16 – ENERGY STAR Program Update

February 21 – Green Power Strategies

Download past web conference presentations at:  
[www.energystar.gov/index.cfm?c=networking.bus\\_networking](http://www.energystar.gov/index.cfm?c=networking.bus_networking)

Questions or comments? Contact: [tunnessen.walt@epa.gov](mailto:tunnessen.walt@epa.gov)



Thank You!