On-Going Commissioning

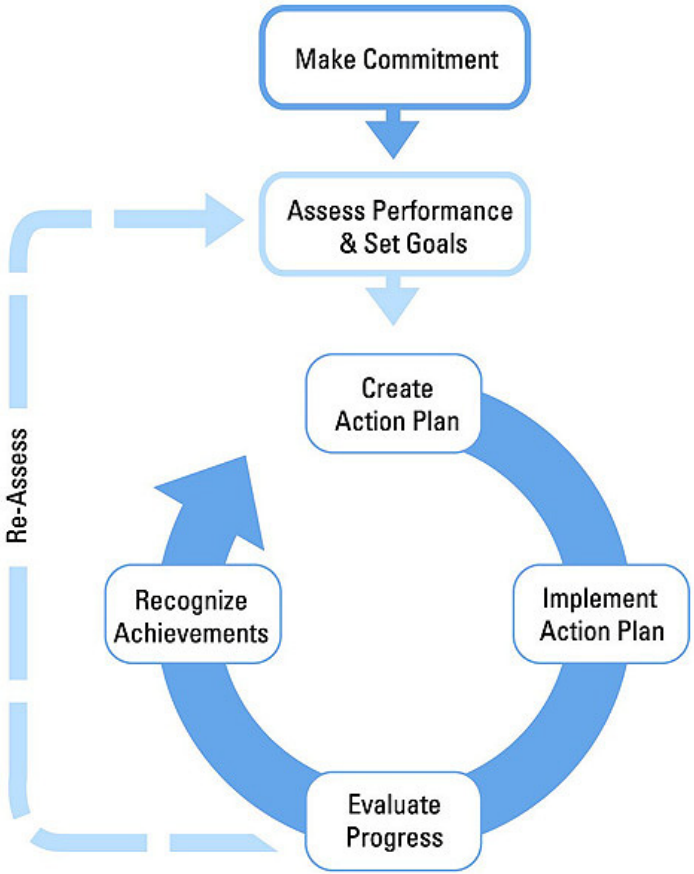
Monthly Partner Web Conference
August 18, 2010

Call-in number: 866 299 3188
Access code: 202 343 9965

Host: Walt Tunnessen

About The Web Conferences

- Monthly
- Topics are structured on a strategic approach to energy management
- Help you continually improve energy performance
- Opportunity to share ideas with others
- Slides are a starting point for discussion



Web Conference Logistics

- Phones will be Muted

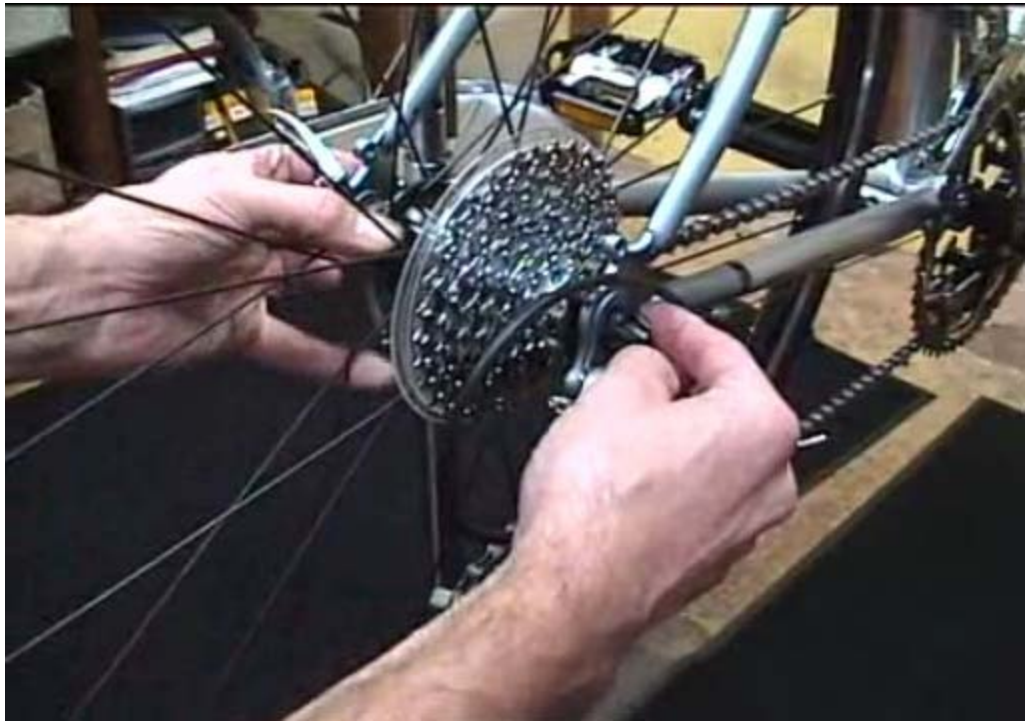
  To ask a question use # 6 to un-mute

  and * 6 – to mute

- Questions – use the chat window or ask question during the Q & A period.

- Presentation slides will be sent by email to all participants following the web conference.

Staying in tune



Buildings are like bikes, they get out of tune.

Tune up remedies

- Cx - Commissioning
- RCx – Retro-commissioning

- OCx - On-going / Constant/ Continuous Commissioning©

•Continuous Commissioning© is copyrighted by the Texas A&M Energy Lab

Today's Web Conference

Speakers:

- Dave Moser – PECI
- Dan Cassidy – Johnson & Johnson
- Questions & Discussion
- ENERGY STAR Resources
- Announcements

Performance Tracking: A Key Part of Ongoing Commissioning

Dave Moser, PE
Senior Engineer
Portland Energy Conservation, Inc.

Presentation Overview

- What is ongoing commissioning?
- What is performance tracking?
- What are the different types of performance tracking tools?
- What are other people doing?

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- What is ongoing commissioning?
- What is performance tracking?
- What are the different types of performance tracking tools?
- What are other people doing?

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RCx & OCx

Retrocommissioning ('RCx')

- An event in the life of a building that:
  - Documents current operating requirements
  - Improves how building systems function together
  - Ensures that building staff have sufficient knowledge and documentation for operating their building

Ongoing commissioning ('OCx')

- An ongoing process that:
  - Tracks and maintains benefits from RCx
  - Keeps building documentation up to date
  - Keeps staff adequately trained
  - Identifies new opportunities

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The Need for Ongoing Commissioning

- Protect the investment in RCx
- Energy savings from RCx reduced by 25% after about 4 years
  - Study by Texas A&M Energy Systems Lab for the US DOE and IEA. (IEA Annex 47 Subtask C Final Report, 2009)
- 22 of 96 (23%) measures failed since installation 3-4 years ago
  - SBW, Final Report 2006-08 CA RCx Impact Evaluation, 2010

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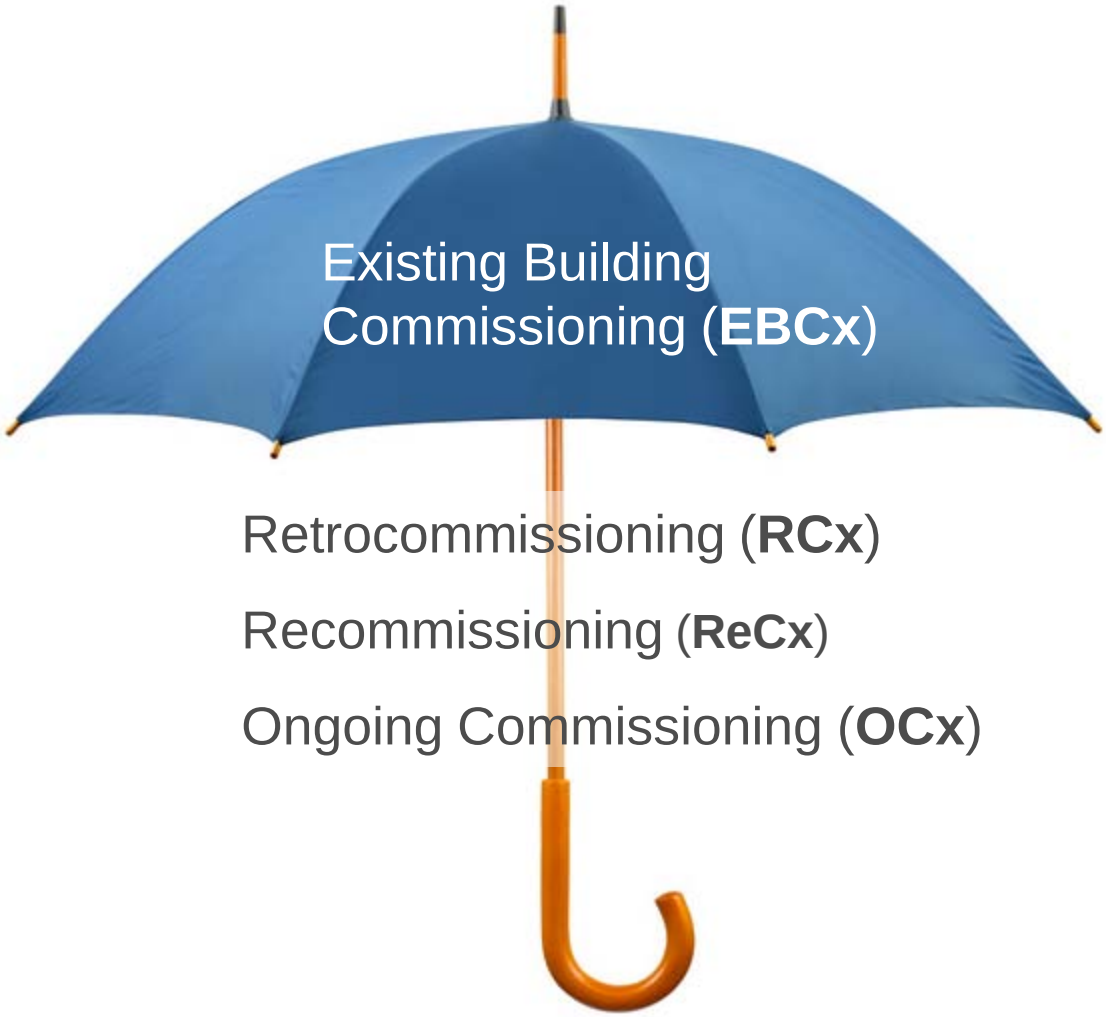
EBCx is the Umbrella Term



Retrocommissioning (**RCx**)

Recommissioning (**ReCx**)

Ongoing Commissioning (**OCx**)

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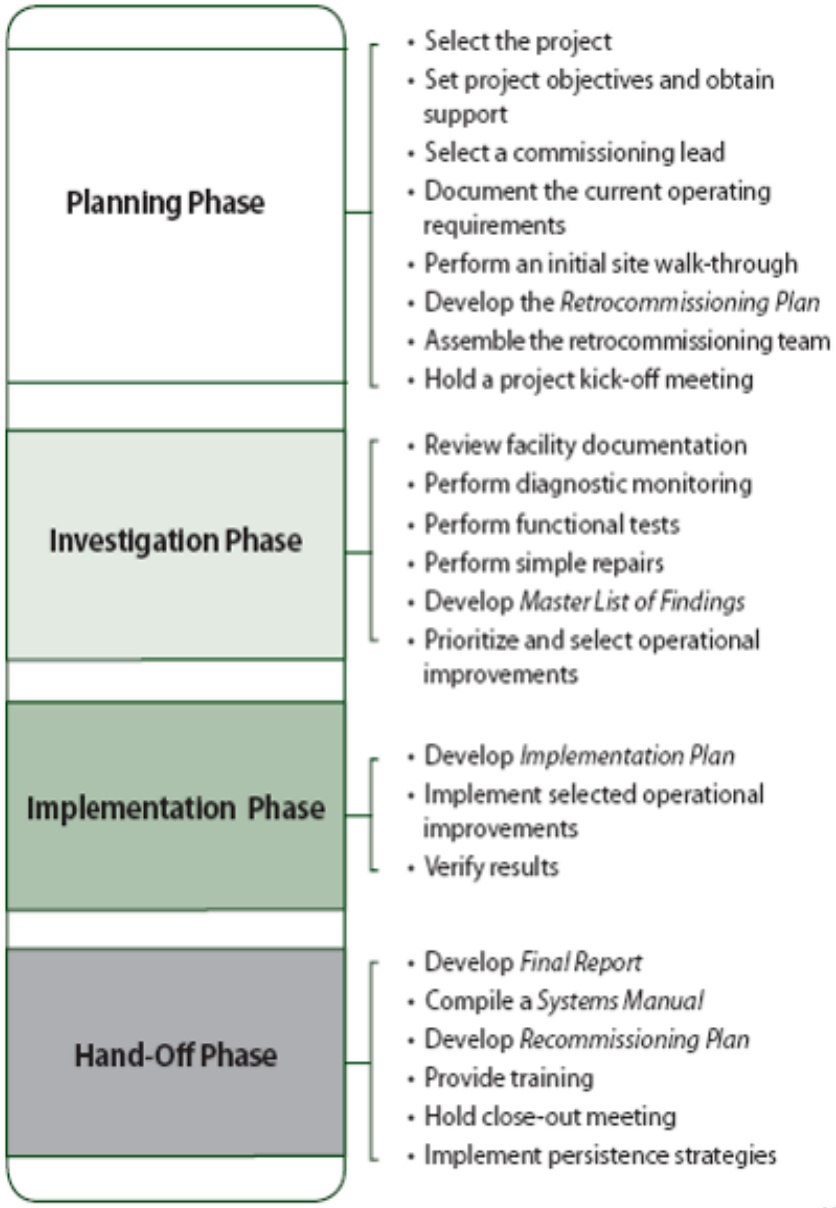
RCx first, then OCx

The retrocommissioning process

- Provides a good basis for ongoing commissioning



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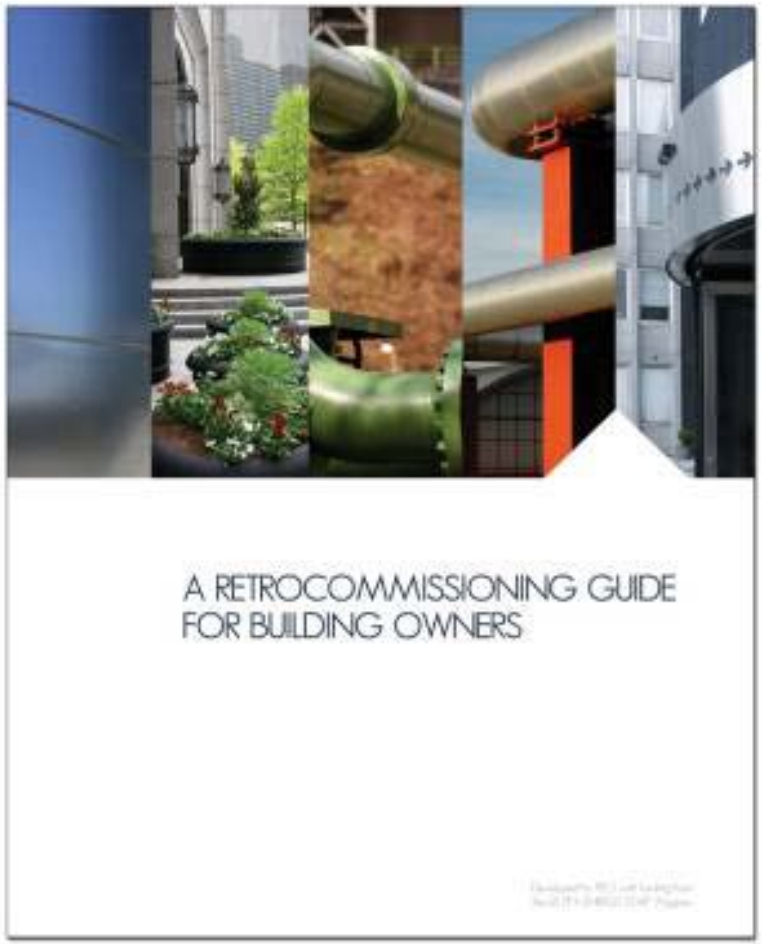
A Great Resource

EPA Guide

- For owners, with input from owners
- Lots for engineers, too!
- Gives details on the RCx process



http://www.peci.org/documents/EPAguide.pdf

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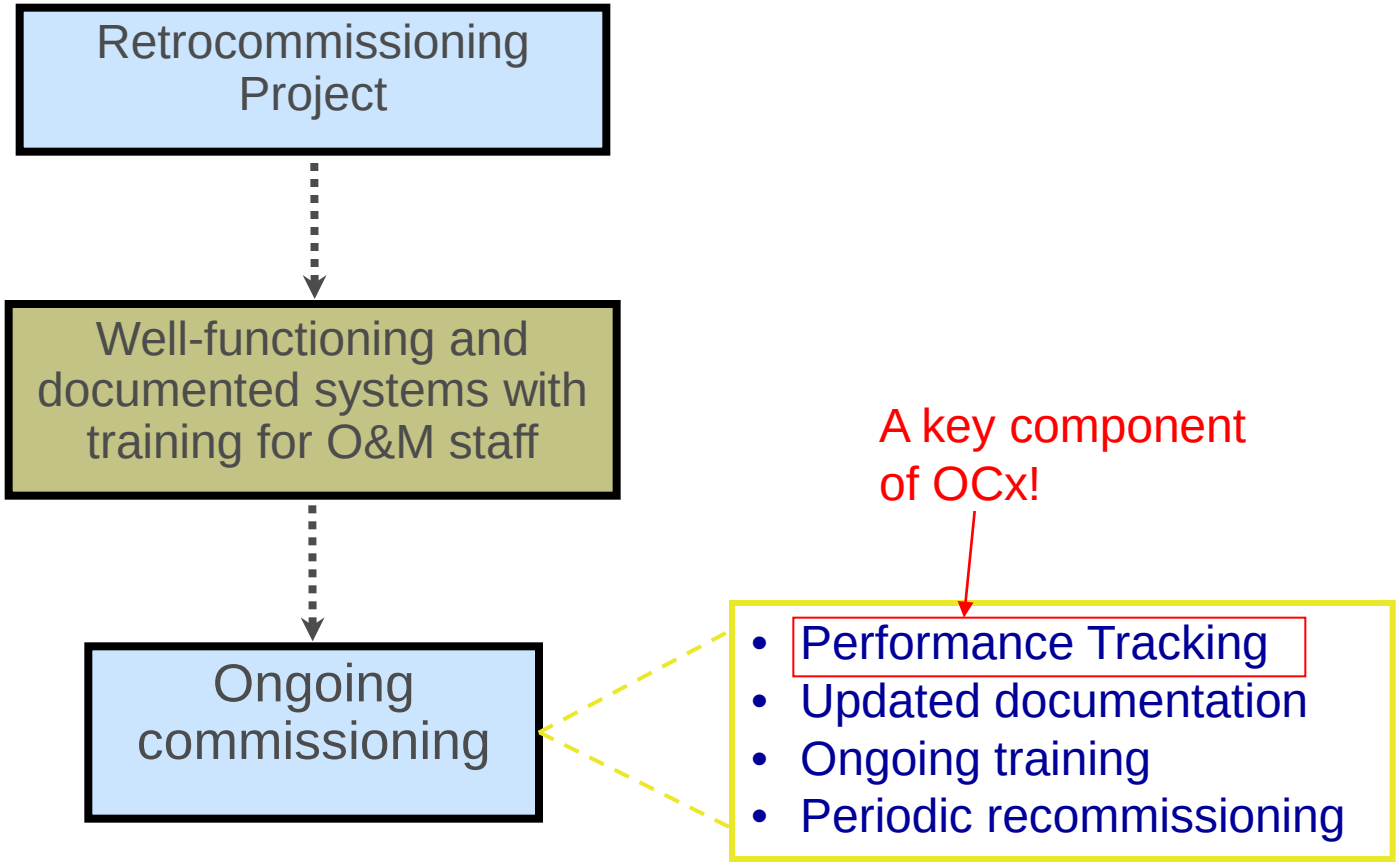
Ongoing Commissioning



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- What is ongoing commissioning?
- What is performance tracking?
- What are the different types of performance tracking tools?
- What are other people doing?

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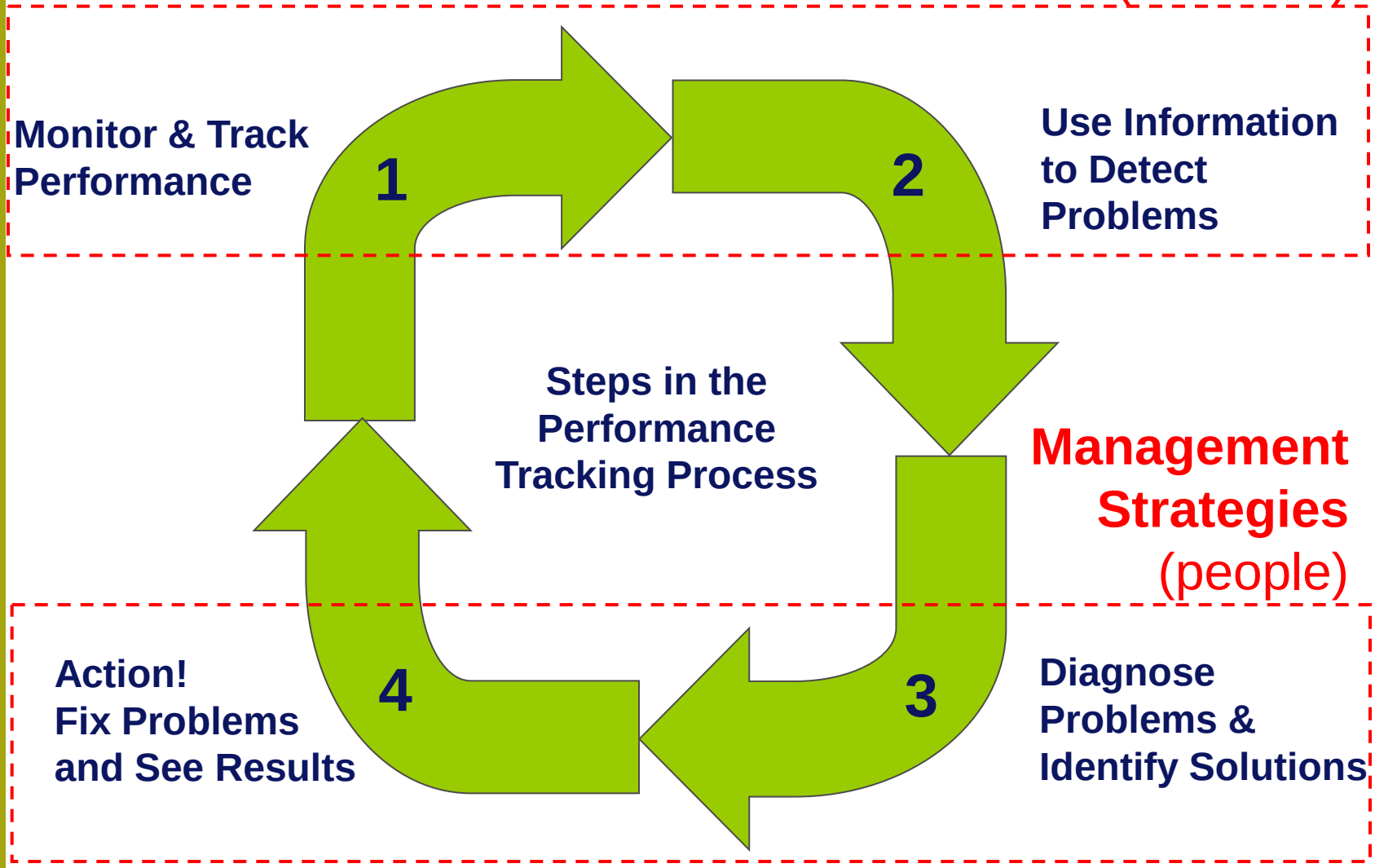
Performance Tracking

Tools (software)



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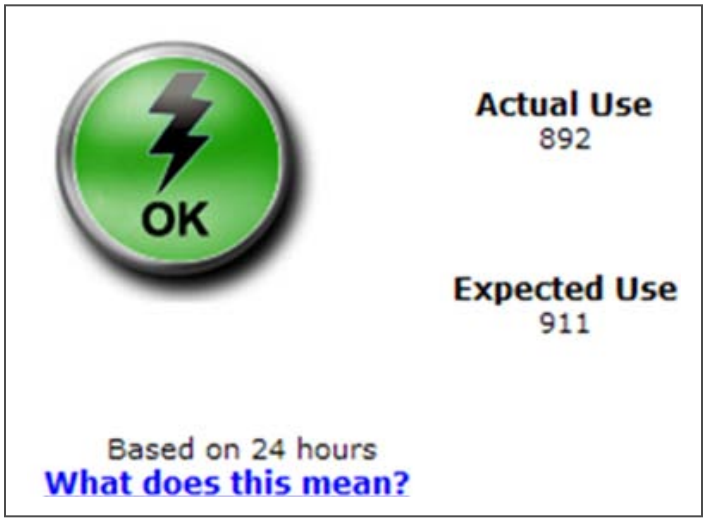
Performance Tracking Tools

- Software to monitor performance
  - Of overall building
  - Of specific systems
  - Of specific equipment
- Customization req'd
  - To suit building
- Automated software
  - Some tools can send automatic alerts when performance is out of expected range



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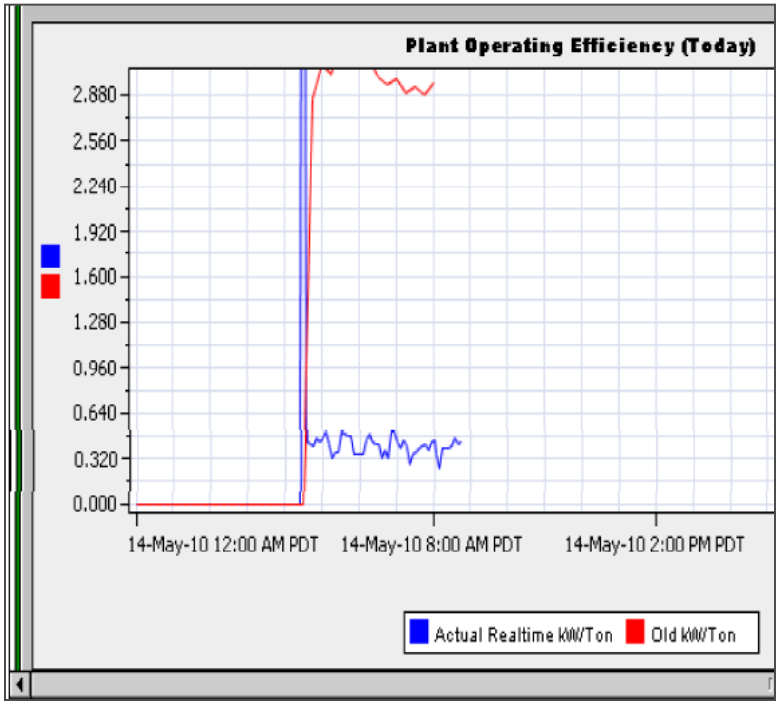
Performance Tracking Tools

Can monitor a variety of metrics. E.g.:

- Energy usage
- kW demand
- Space temperatures
- Equipment efficiencies



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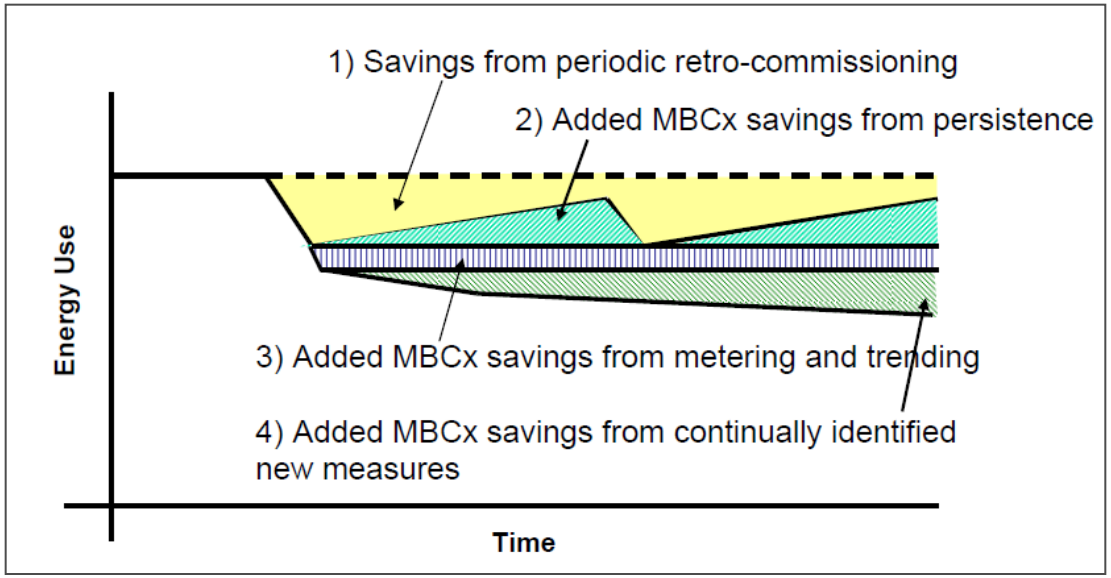
Why track performance?

- Verify benefits from projects
  - E.g., energy savings
- Make sure benefits persist over time
- Identify additional opportunities



MBCx = Monitoring-Based Commissioning. Similar to ongoing commissioning

Graphic from: Brown, Karl. "Monitoring-Based Commissioning: 2008 Update." *Proceedings of the 2008 National Conference on Building Commissioning*, Newport Beach, CA. April 2008.

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- What is ongoing commissioning?
- What is performance tracking?
- What are the different types of performance tracking tools?
- What are other people doing?

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Performance Tracking Tools

Various types of performance tracking tools

- Benchmarking
- Energy information systems (EIS)
- Building automation system (BAS)
- Energy anomaly detection (EAD)
- Automated fault detection and diagnostic (FDD) tools

Simple → Complex

Whole Building → Equipment Level

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Benchmarking

- A simple and effective method of monitoring overall performance
  - A good first step
- Not as ‘automatic’, timely or targeted as the other four methods

ENERGY STAR PORTFOLIO MANAGER

Energy Information Systems

EIS
BAS
EAD
FDD

- EIS Basic Features
  - Monitoring and collection of energy data
  - Often includes data filtering and benchmarking
  - See “Building Energy Information Systems: State of the Technology and User Case Studies”, Granderson, Piette, 2009

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EIS Example: McKinstry EEM Suite

EIS
BAS
EAD
FDD

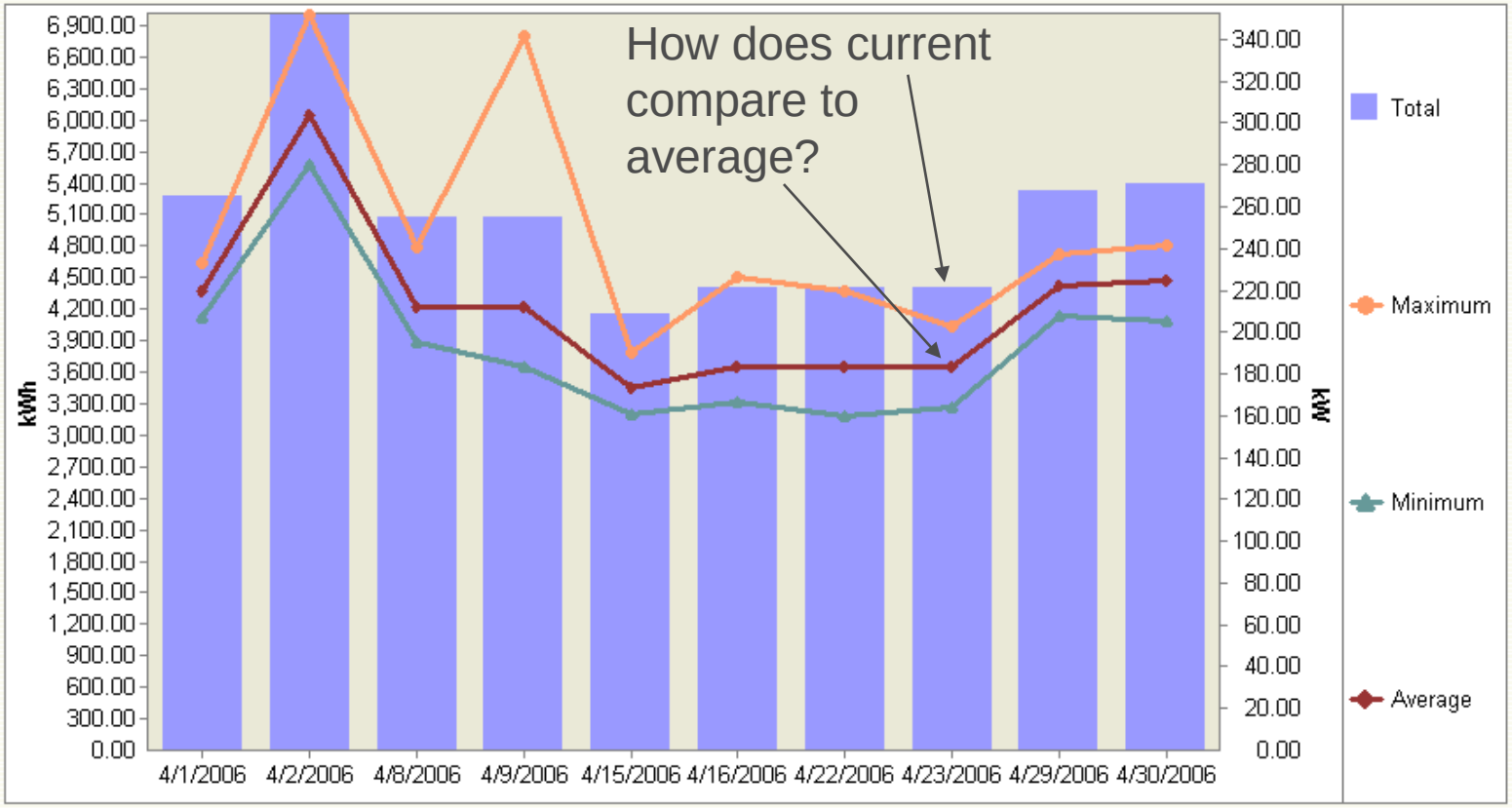
Daily Usage - WEEKEND DAYS

Report date: 5/10/2006 9:27:36 AM

Report span: 4/1/2006 - 4/30/2006

Day of week: Weekends

Total days: 10



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Building Automation Systems

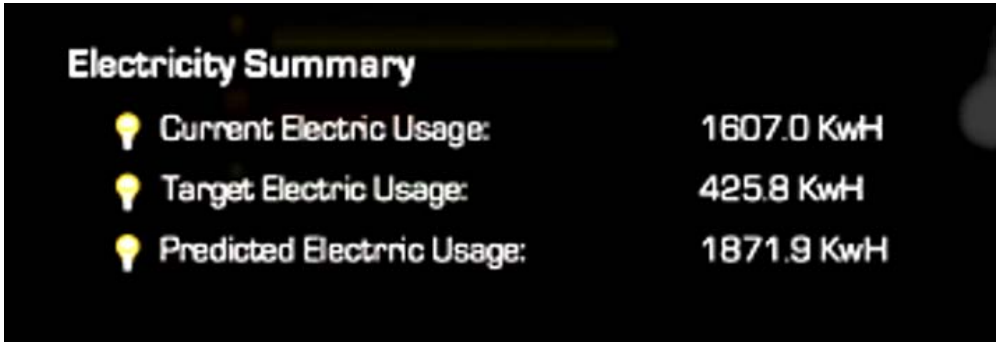
EIS
BAS
EAD
FDD

- Typical BAS don't track energy usage
- Make a tracking tool by adding
  - Energy meter data
  - "Smart alarms" to help detect problems
- BAS vendors starting to offer packaged solutions

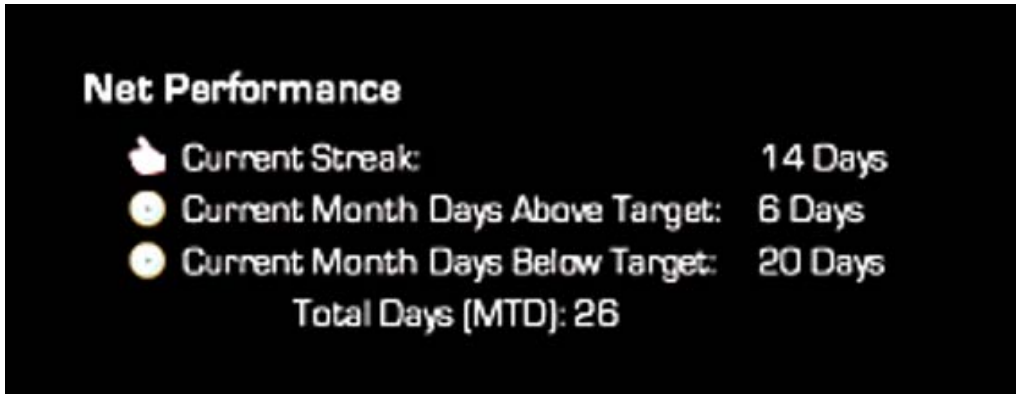
BAS Example: BuildingLogix

EIS
BAS
EAD
FDD

Predicted vs. Target usage



Current net performance streak:



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Energy Anomaly Detection

EIS
BAS
EAD
FDD

- Top-down approach: whole building / main meter level
  - Tool looks for deviations from model of historical energy use
  - Generally preferred by energy managers
  - Can be used to track energy savings

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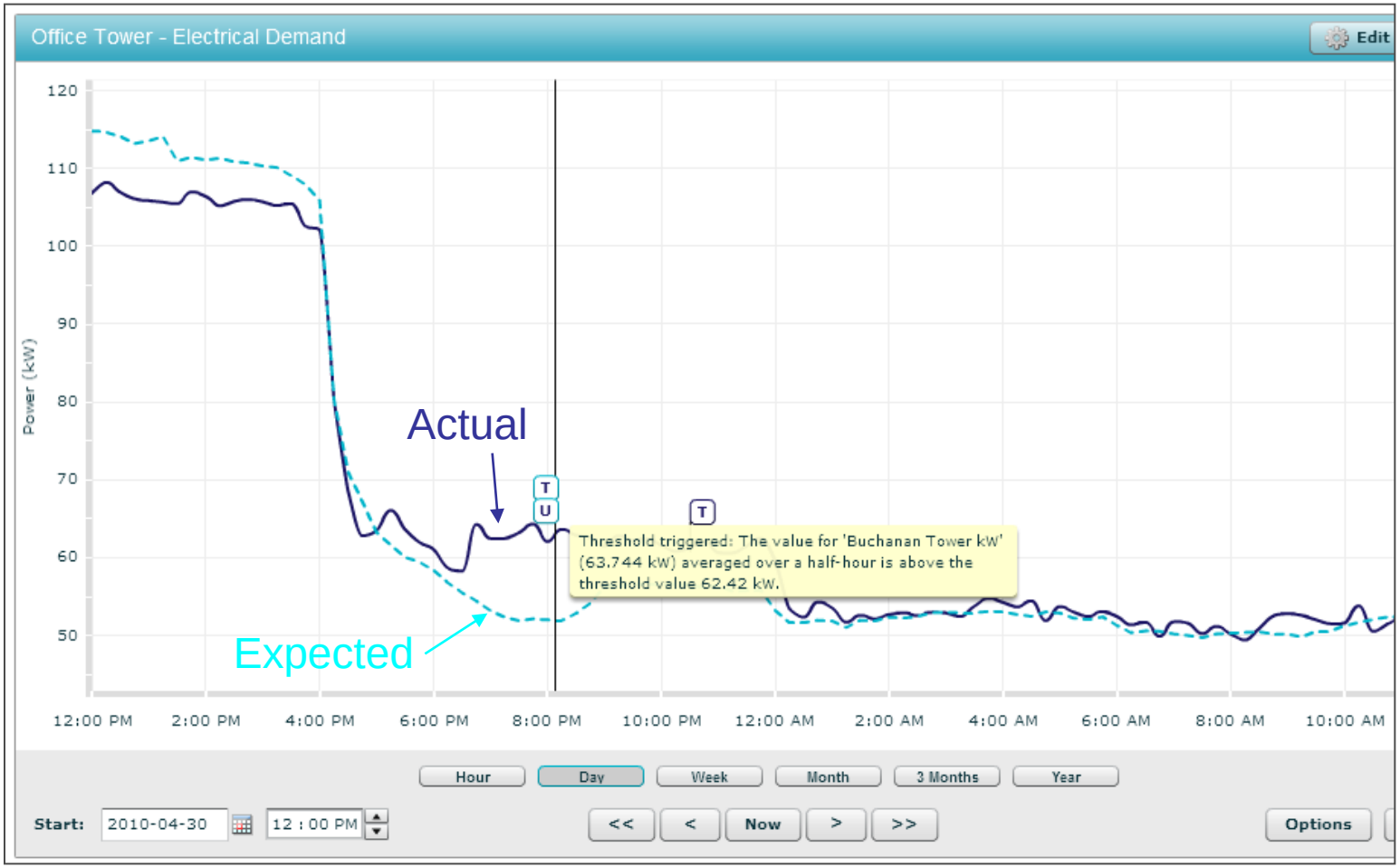
EAD Example: Pulse Energy

EIS
BAS
EAD
FDD



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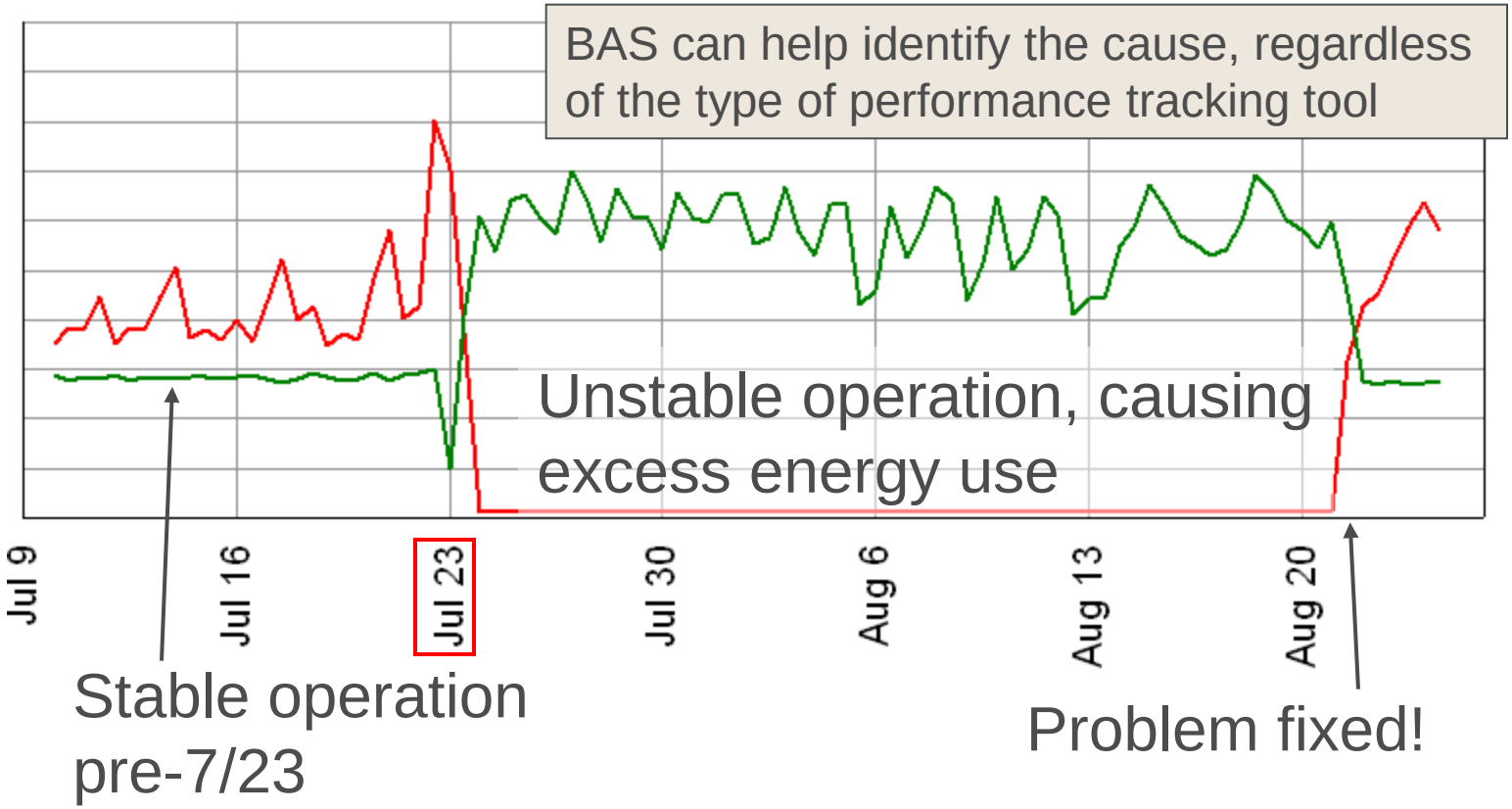
BAS trends help identify the root cause

EIS
BAS
EAD
FDD

Scenario: energy anomaly detection tool shows high energy usage starting July 23rd.

But **<u>what's the cause</u>**?



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Fault Detection and Diagnosis

EIS
BAS
EAD
FDD

- Bottom-up approach: equipment level
  - Monitors system data from BAS
  - System fault identification, “rules-based”
    - Helps to diagnose possible causes of faults
  - Generally preferred by facility engineers

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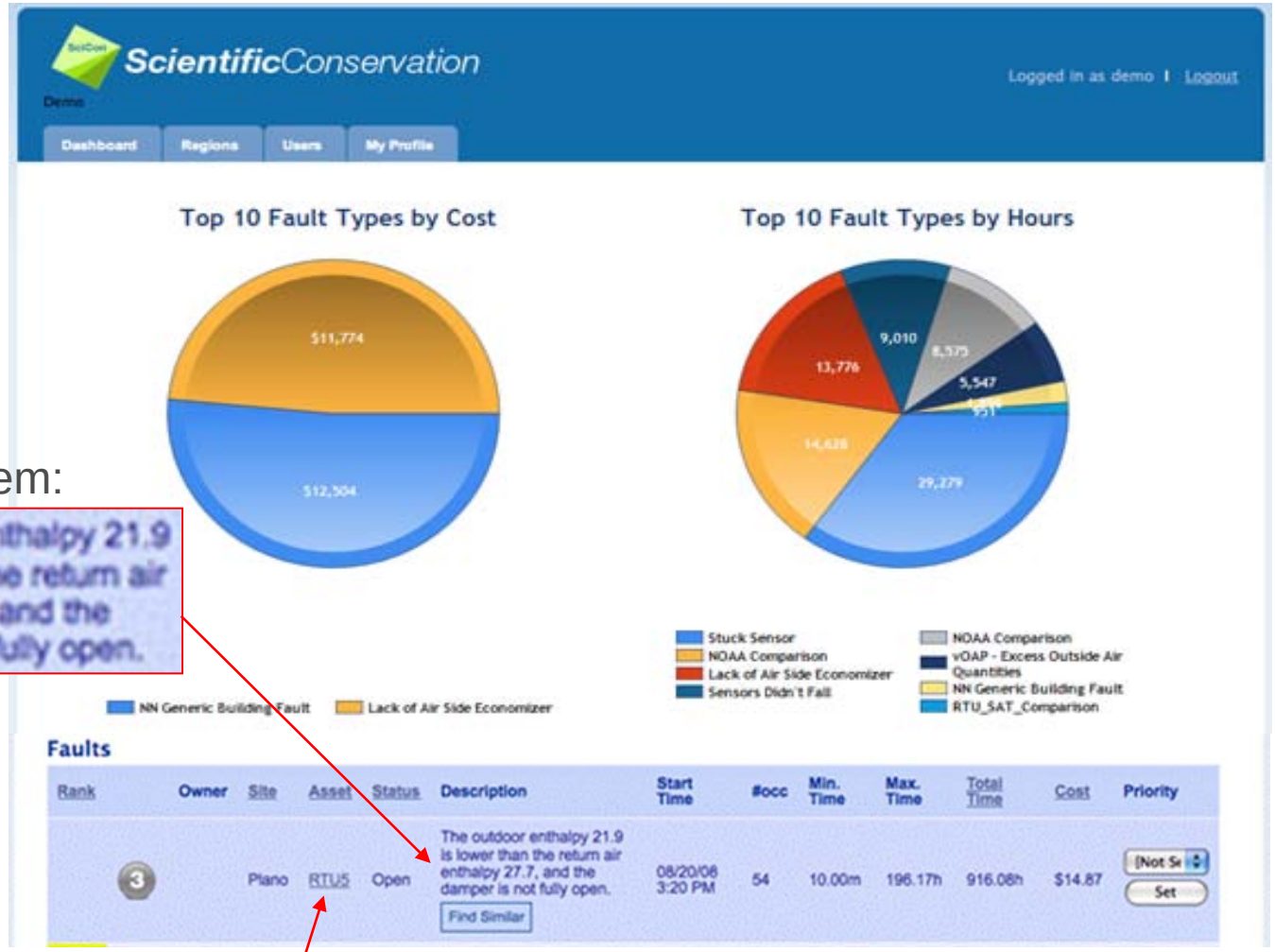
FDD Example: SCIWatch

EIS
BAS
EAD
FDD

Problem:

The outdoor enthalpy 21.9 is lower than the return air enthalpy 27.7, and the damper is not fully open.



Equipment

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Performance Tracking Tools

Pros

- Help protect investments, maintain performance and meet sustainability goals
- Help form an ongoing commissioning program
- Can be used for a portfolio of buildings

Cons

- Need to dedicate resources to use the tool, and act on identified anomalies
  - A person is still required!
- Wide range of tool options can be tough to sort through
  - Upcoming *Performance Tracking Guide* will help with this

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For More Information on Specific Tools

Recent presentation

- "Energy Performance Tracking: Tools and Best Practices"
  - Presentation at the 2010 National Conference on Building Commissioning
  - http://tinyurl.com/2c2jbtf
  - Includes details about each type of tool, including pros and cons

- What is ongoing commissioning?
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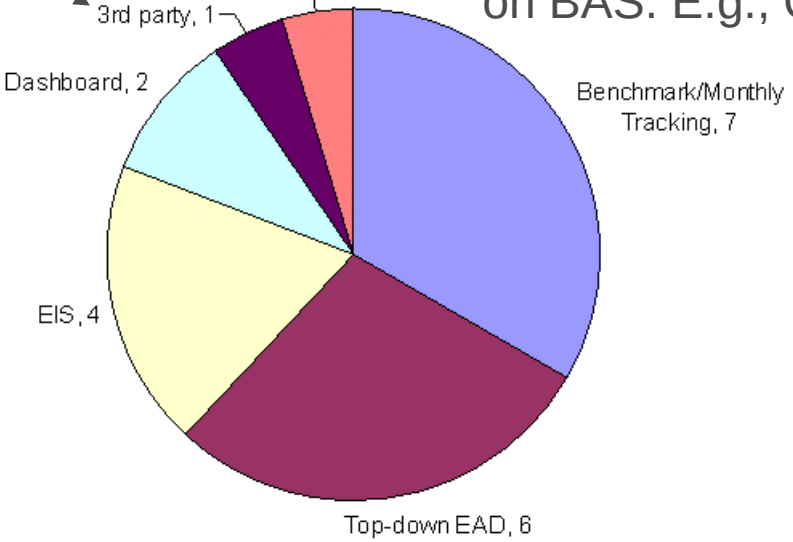
From ongoing research

- Talked to 21 organizations tracking performance at their large office and university buildings
- Most use relatively simple methods:

Offsite trend data analysis. E.g., Cimetrics.

Continual optimization software overlay on BAS. E.g., Optimum Energy.



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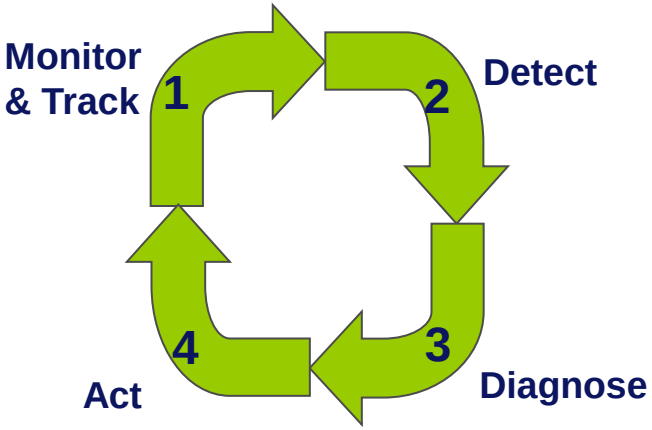
Summary of key considerations

For a successful ongoing commissioning program:

- Develop clear goals
- Assemble a solid team, with clear responsibilities
- Evaluate tool options, and weigh these against staff availability / capability
- Form and follow a well-defined OCx process, including:
  - Performance tracking
  - Updating documentation
  - Ongoing training
  - Periodic recommissioning



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Resources

www.cacx.org

- Case studies
- Research
- Tools and templates
- Upcoming Performance Tracking Guide for Building Owners

Stay tuned!

www.bcxa.org

- Best Practices in EBCx
  - Includes OCx
- Publications

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What does PECI do?

PECI delivers persistent savings through cost-effective approaches to energy management.

- Program design & implementation
- Program demonstration & pilots
- Commissioning research & analysis
- Tools & technical resources
- Workforce education & training

Thank You!

Dave Moser, PE
dmoser@peci.org

Portland Energy Conservation, Inc.
www.peci.org

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Ongoing Commissioning Strategies

August 18, 2010

Johnson & Johnson

Founded 1886

New Brunswick, New Jersey

in a Former Wallpaper Factory

By three brothers with a dream… that Joseph Lister's theories about sterilization could save lives in America's hospitals

Global Presence

Global Leader in Health Care

More than 250 Operating Companies

In 57 Countries

Selling Products in More Than 175 Countries

115,000 Employees Worldwide

$61.9 billion US in sales (2009)

- 3 Divisions:
  - Consumer, Pharmaceuticals, Medical Devices
- 250 operating companies
- Approximately 110,000 employees
- Operate in 57 countries

ETHICON ENDO-SURGERY, INC. a Johnson & Johnson company
Johnson & Johnson HEALTH CARE SYSTEMS INC.
JANSSEN PHARMACEUTICA PRODUCTS, L.P.
McNeil Consumer & Specialty Pharmaceuticals
THE SPECTACLE LENS GROUP OF Johnson & Johnson Vision Care, Inc.
Neutrogena
PSGA Pharmaceutical Sourcing Group Americas
LIFESCAN a Johnson & Johnson company
Ortho-Clinical Diagnostics a Johnson & Johnson company
ORTHO BIOTECH ORTHO BIOTECH PRODUCTS, L.P.
Johnson & Johnson MERCK CONSUMER PHARMACEUTICALS CO.
ORTHO-McNEIL PHARMACEUTICAL, INC.
ETHICON a Johnson & Johnson company
VISTAKON DIVISION OF Johnson & Johnson Vision Care, Inc.
Biosense Webster a Johnson & Johnson company
Cordis a Johnson & Johnson company
NORAMCO INC
DePuy a Johnson & Johnson company
Johnson & Johnson CONSUMER PRODUCTS COMPANY Division of Johnson & Johnson Consumer Companies, Inc.
ASP ADVANCED STERILIZATION PRODUCTS a Johnson & Johnson company
McNeil Nutritionals

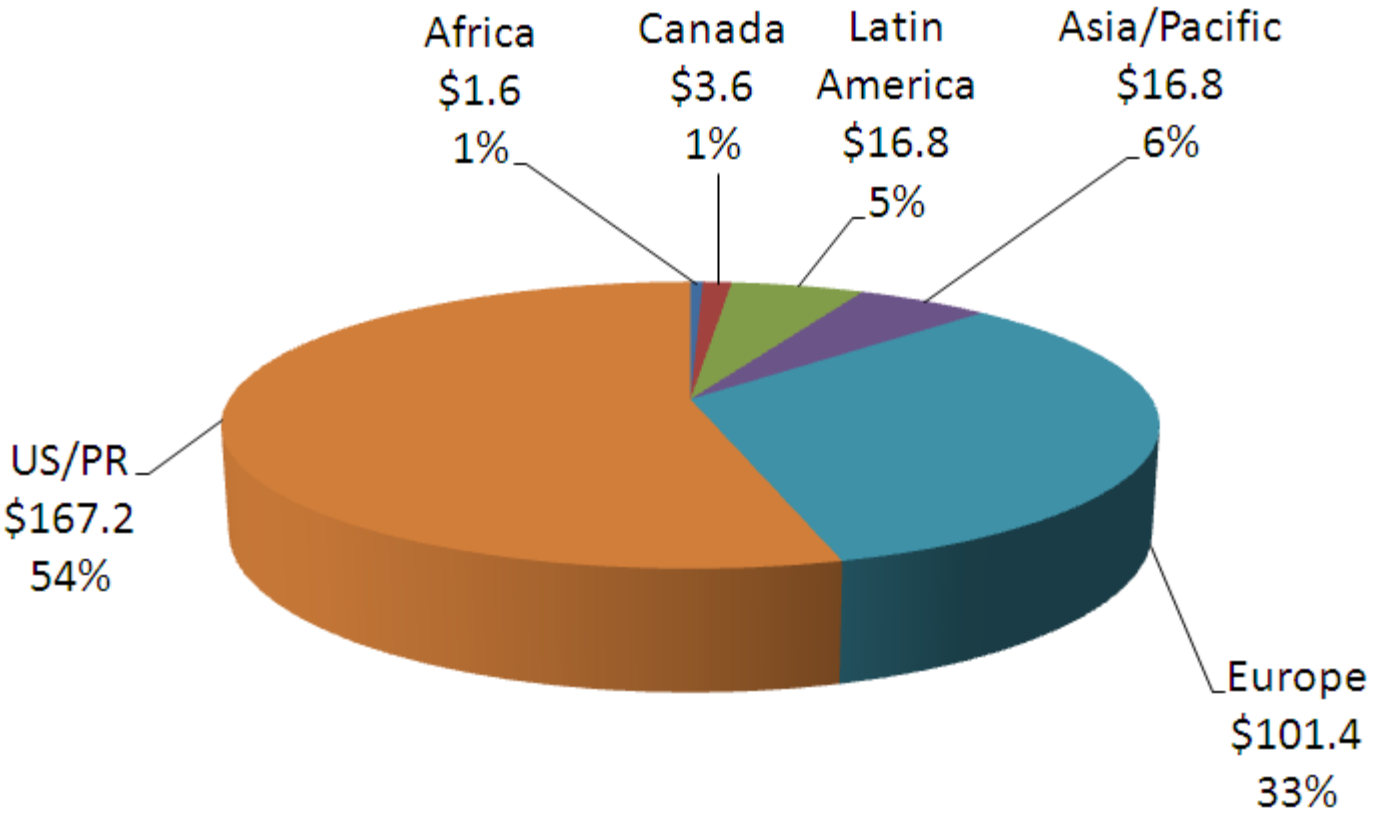
Our Credo

Patients
Employees
Community
Stockholders

65 years old

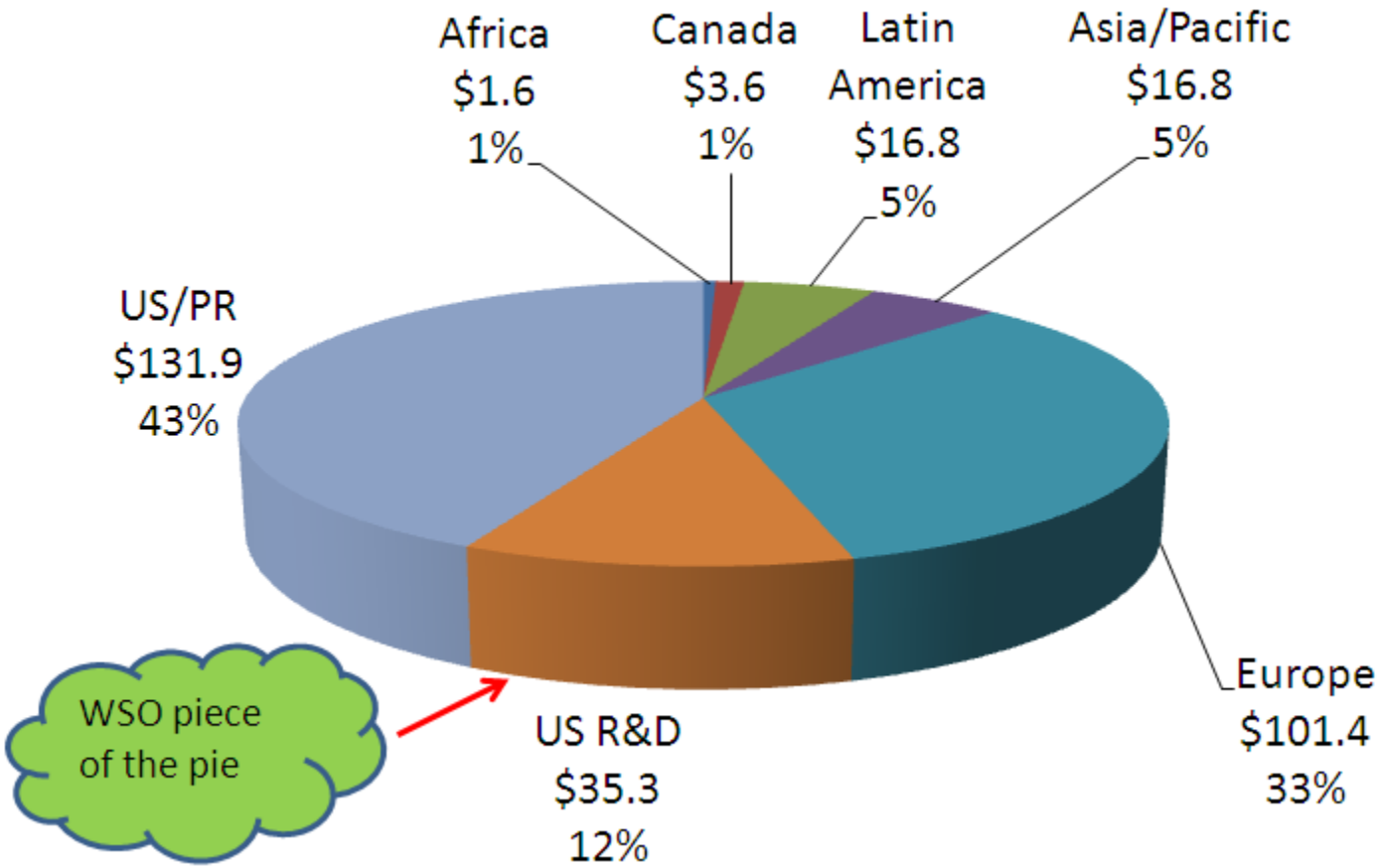
“We must maintain in good order the property we are privileged to use, protecting the environment and natural resources.”

2009 ENERGY COSTS BY REGION (Million)



TOTAL ENERGY COSTS: $307.4 MILLION

2009 ENERGY COSTS BY REGION (Million)



US R&D Facilities = WSO (Workplace & Site Operations)

Johnson & Johnson

Johnson & Johnson

CLIMATE FRIENDLY ENERGY POLICY

POLICY

As indicated in our Next Generation Goals, adopted in 2000, it is the responsibility of each Company/Business Unit to meet our greenhouse gas reduction goal of a 4% reduction by 2005 and a 7% reduction by 2010, in absolute terms with 1990 as a base year.

The pathways for a climate friendly energy policy include five elements:

- Energy efficiency improvements in all of our operations
- Cogeneration: on-site generation of electricity and recovery of the waste heat for overall efficiencies of 80+%
- On-site renewable energy that produces no CO_2 emissions
- Renewable electricity purchases
- Carbon trading and sequestration

The Johnson & Johnson businesses worldwide will adopt this climate friendly energy policy to reduce our operating costs, meet our emerging legal and societal obligations and improve the environment for all of us and future generations.

Dennis Canavan
Executive Director, Worldwide Energy Management

Approved:
R.C. Deyo
Vice President and General Counsel

Approved:
Robert Darretta
Vice Chairman and Chief Financial Officer
Chairman, Worldwide Environmental Steering Committee

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Original 4/28/03
Re-Issue 6/14/04

Climate Friendly Energy Policy 1999, 2003

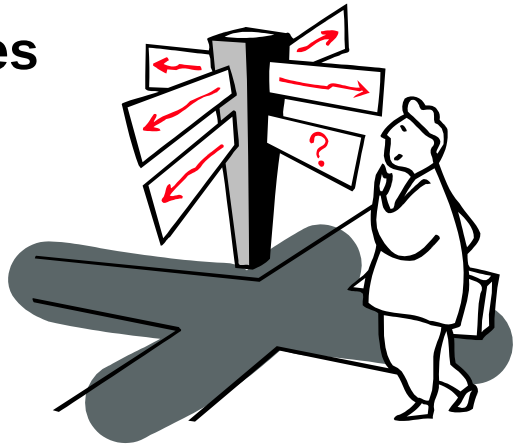
Achieve a 7% absolute reduction in Green House Gas (CO_2) emissions by 2010, compared to a base year of 1990

CO_2 Reduction Strategy

- Energy Efficiency – Best Practices
- On-site cogeneration
- On-site renewables: solar, biomass, landfill gas
- Green power purchases
- Supply chain & Fleet Efficiencies
- Employee Based Programs
- Carbon offsets

Questions & Challenges Faced by Facility/Energy Managers…

- **How do we best allocate our limited resources**
- **… without jeopardizing operations,**
- **… without compromising safety,**
- **… where the real benefit is greater than the perceived one,**
- **… without sacrificing real opportunities in energy reduction?**



Ongoing Commissioning Recommendations

Implementation feasibility

• High feasibility • Low return	• High feasibility • High return
• Low feasibility • Low return	• Low feasibility • High return

Returns

In general, corrective actions are low cost & can be implemented quickly!

How is it done?

- J&J
- Facilities

- Database

- Report

- Achieved
- Savings

1 Establish connectivity…

…to BAS through a fully secure connection.

2 Transmit data…

for analysis by energy experts and technology.

3 Report with recommendations…

… based on analytics of monitored data. Analytics are compiled in a periodic report with prioritized actionable recommendations.

4 Implement recommendations…

…by staff or outside vendors, resulting in $ savings.

High level overview of four sites

What did we analyze?

- **2,000,000** Sq. ft. of office, manufacturing and laboratory space (5 BAS's on 3 sites)
- **20,000** BAS points
- **1,000+** major pieces of equipment (multiple types)

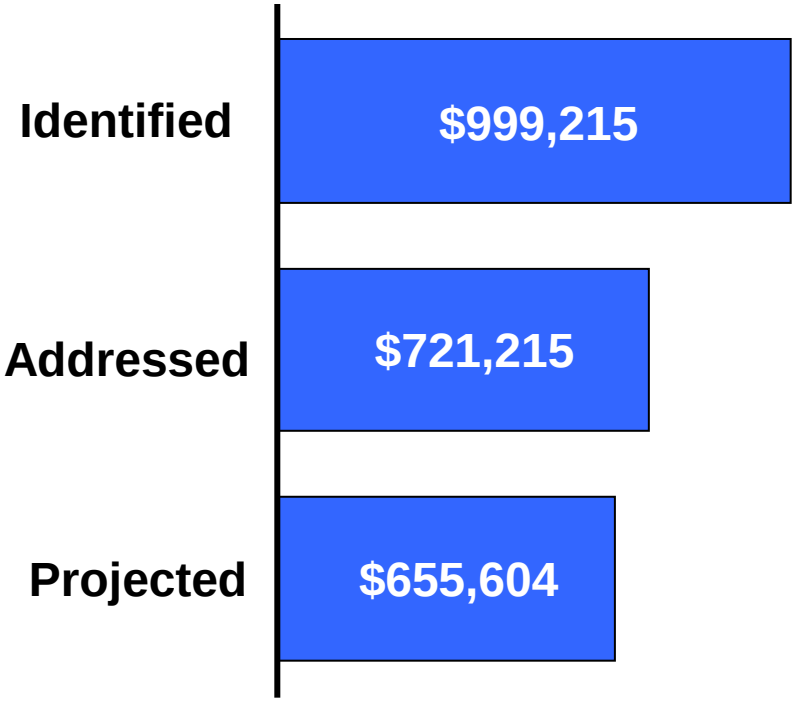
All of these are monitored 24 hours a day, 7 days a week.

What did we find?

- **260** improvement opportunities
- **$999,215** in potential savings per year
- **4,975** Metric tons of potential CO_2 savings per year

Energy cost savings (aggregate: four facilities)

Energy savings ($ per year)

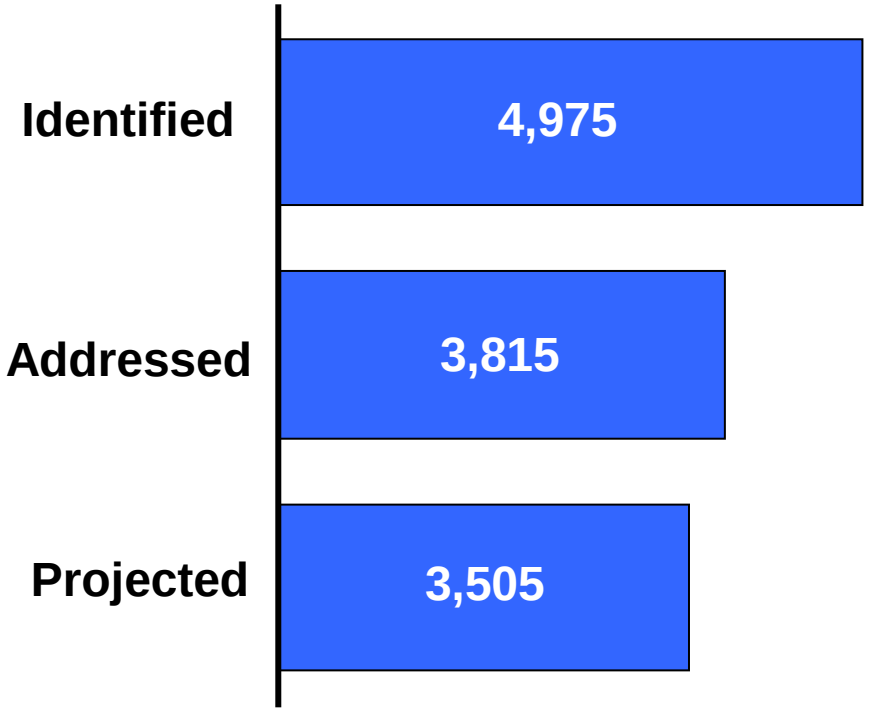


What does it mean?

- **10.2% HVAC (4.2% total) realized energy cost savings.**
- **Identified potential of 14.2% HVAC (5.9% total) reduction in your energy budget expense.**

CO_2 savings (aggregate: four facilities)

CO_2 savings (Metric tons per year)



What does it mean?

- **Positioned for two of the three LEED Energy and Atmosphere prerequisites**
- **Qualifying for at least 10 LEED Energy and Atmosphere points**
- **Smaller carbon footprint sites**

J&J On-Going commissioning – Example 1

Savings Opportunity

Discharge Air Pressure for AHU A1 appears to be above the setpoint. Investigate the intended pressure control scheme and operation.

Savings summary

Energy: **$4,619/yr**

CO2: **27 metric tons/yr**

Priority: **High**

- **Discharge air pressure <u>setpoint</u> is 1 inch of water column.**
- **<u>Observed</u> discharge air pressure is about 1.8 inches of water column.**
- **Fan energy being wasted to maintain higher pressure**

Source: J&J project example. Facility names concealed for confidentiality purposes.

J&J On-Going Commissioning - Example 2

Savings Opportunity

AHU B2 appears to operate its heating & cooling valves concurrently. Investigate the sequence of operations and loop tuning.

Savings summary

Energy: **$4,893/yr**

CO2: **22 metric tons/yr**

Priority: **High**

- **Signal to heating valve is about 50%.**
- **Signal to cooling valve is about 10%.**
- **Supply air heated excessively and then cooled back to maintain desired temperature**

Source: J&J project example. Facility names concealed for confidentiality purposes.

J&J On-Going Commissioning – Example 3

Savings Opportunity

AHU C3 appears to have an inefficient economizing sequence.
Investigate the sequence of operation.

Savings summary

Energy: **$468/yr**

CO2: **3 metric tons/yr**

Priority: **High**

- **Outside air (OA) damper is signaled 100% when outside air temperature is greater than return air temperature.**
- **As a result mixed air temperature is higher resulting in more energy required to cool the air.**

Source: J&J project example. Facility names concealed for confidentiality purposes.

Recommendations

- Start with a pilot site
- Need team buy-in and should identify a "Champion"
  - Form team up-front and define roles & responsibilities of team
  - Not very time consuming, but needs to be defined
  - Initial set-up requires dedicated effort
  - Monthly Meetings and/or response to day-to-day findings requires in-house resource
- Decision point after Year 1
  - Monthly? Quarterly? Discontinue?
- Many vendors offer this service – need to find which works best for you

Key lesson learned

J&J's Experience & Future Plans

- Payback has been less than 18 months for all buildings
  - ~35% of the space included is lab & manufacturing
  - HVAC is the #1 energy consumer in these buildings
- Completed a pilot for new building commissioning with good results
- Currently evaluating existing sites and always looking to expand to new buildings
- J&J has had excellent results and recommends Ongoing Commissioning
  - Measurable results
  - Short payback period
  - High savings to investment ratio

Acknowledgements

Cimetrics, Inc.
Boston, MA
(617) 350-7550 (main office number)
www.cimetrics.com

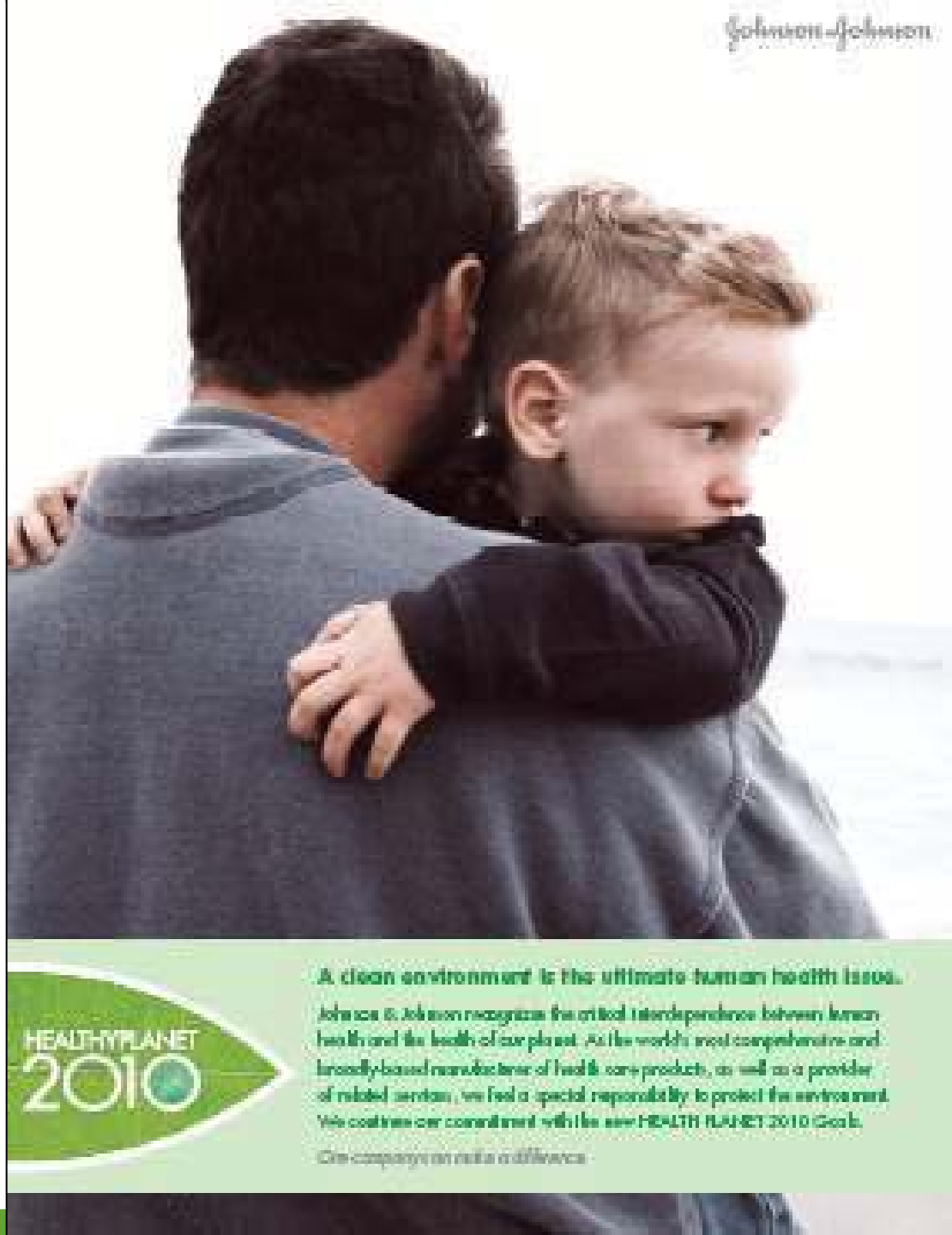
Questions

Dan Cassidy

Email: dcassidy@its.jnj.com

Johnson & Johnson

“ A clean environment is the ultimate human health issue”



Questions & Discussion

- Use # **6** to un-mute phone
- *** 6** to mute phone.

Additional Resources

- Texas A&M Energy Systems Lab
  - FEMP Continuous Guidebook
  - Case studies
- http://esl.eslwin.tamu.edu/continuous-commissioning-.html

- California Cx / Rx website:
- www.green.ca.gov/CommissioningGuidelines/default.htm

Upcoming Web Conferences

September – Our Top Energy Projects

Speakers: HEI Hotel & Resort

Brown Printing

October – Energy & GHG Management

Register online at:
energystar.webex.com/meetings

- Thank you