



Anticipate. Innovate. Deliver.



RCx – An Rx for Energy Savings in the Pharmaceutical Industry

5th Annual North East Retro-Commissioning Summit

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November 4, 2010**



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Today's Merck

Merck is a global healthcare leader working to help the world be well

- We provide innovative medicines, vaccines, biologic therapies and consumer and animal health products to help improve health and well-being
- We work with customers in 140 countries to deliver broad-based healthcare solutions
- Key Facts:

TRADE NAME

The Company is known as **Merck** in the United States and Canada. Everywhere else, we are known as **MSD**.

EMPLOYEES

Approximately 100,000

HEADQUARTERS

Whitehouse Station, New Jersey, U.S.A.

2009 REVENUES

\$27.4 billion

2009 R&D EXPENSE

\$5.8 billion

Global Recognition

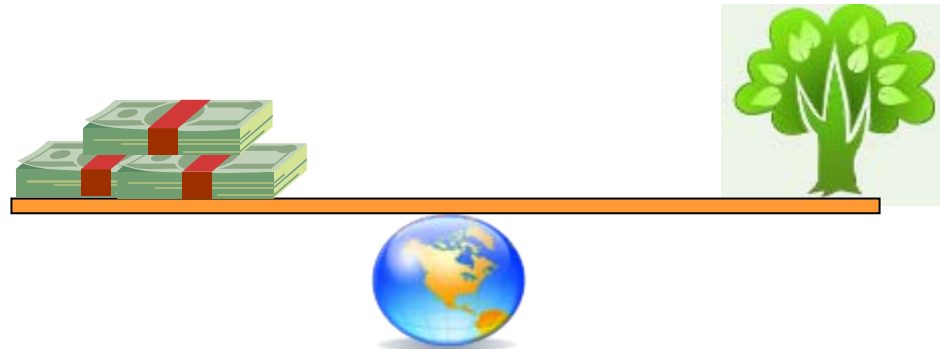
- **United States** - EPA named Merck as a 2010 ENERGY STAR Sustained Excellence Partner, the 5th time in a row receiving such recognition
- **Ballydine, Brinny and Rathdrum, Ireland** – have all received certification from Sustainable Energy Ireland (SEI) under Irish Standard 393 for Energy Management
- **Las Piedras, Puerto Rico** - Energy Custodian Team was recognized by the P.R. Manufacturing Association (PRMA) with a PRMA Quest Team Excellence Award
- **Cleveland, TN, Elkorn, NE, Las Piedras, PR, US** – receive the 2010 ENERGY STAR from the US Environmental Protection Agency (EPA) for ranking in the top 25 percent of energy performance. These sites represent three of only six pharmaceutical facilities in the US to receive the 2009 ENERGY STAR. This is the Cleveland sites second ENERGY STAR.
- **Tuas, Singapore** – the 9 MW trigen project was recognized with a grant from the National Environment Agency's Innovation for Environmental Sustainability fund.



Our Environment - Sustain and Enjoy

What is motivating the Pharmaceutical industry to improve energy efficiency?

- Environmental responsibility and sustainability
- A focus on reducing Greenhouse Gas emissions
 - Merck global GHG emission reduction target is a **10% absolute reduction** of 2009 CO₂ emission levels by 2015
 - The majority of the GHG emission reductions will come from energy efficiency improvements
- Increasing cost & global volatility of energy supply



■ Energy Efficiency Improvement

*The cheapest and **greenest** kWh is the one you don't use!*

- Colleague Awareness
 - No cost / low cost opportunities
 - Capital projects
- ## ■ Combined Heat & Power
- ## ■ Demand Response
- ## ■ Renewables
- Power Purchase Agreements

*" The biggest gains, in terms of decreasing the country's energy bill, the amount of carbon dioxide we put into the atmosphere, our dependency on foreign oil, **will come from energy efficiency and conservation in the next 20 years.**"*

*Steven Chu,
Energy Secretary*



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

Retro-Cx Overview & Theory

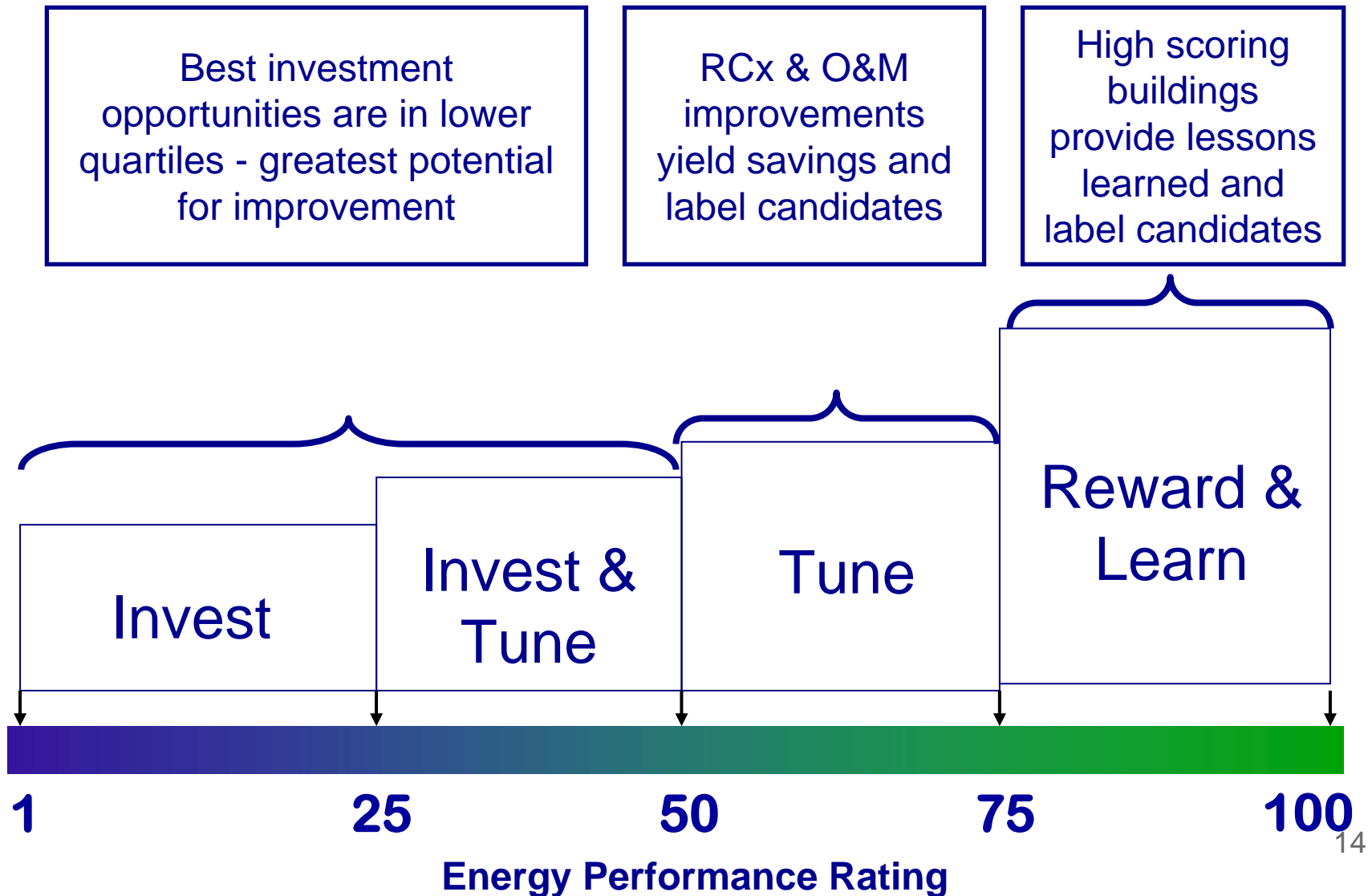
- Retro-commissioning is the process of systematically evaluating existing buildings and systems (that were never commissioned) to ensure:
 - Original Design Intent
 - Current Operational Needs
 - Energy Conservation Opportunities (ECO)
- Retro-Cx focuses on the following:
 - Instrument Calibration
 - 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 our Energy Program
 - Establish Retro-Cx as an Energy Best Practice

Retro-Cx is a Key Component of Building Performance Improvement

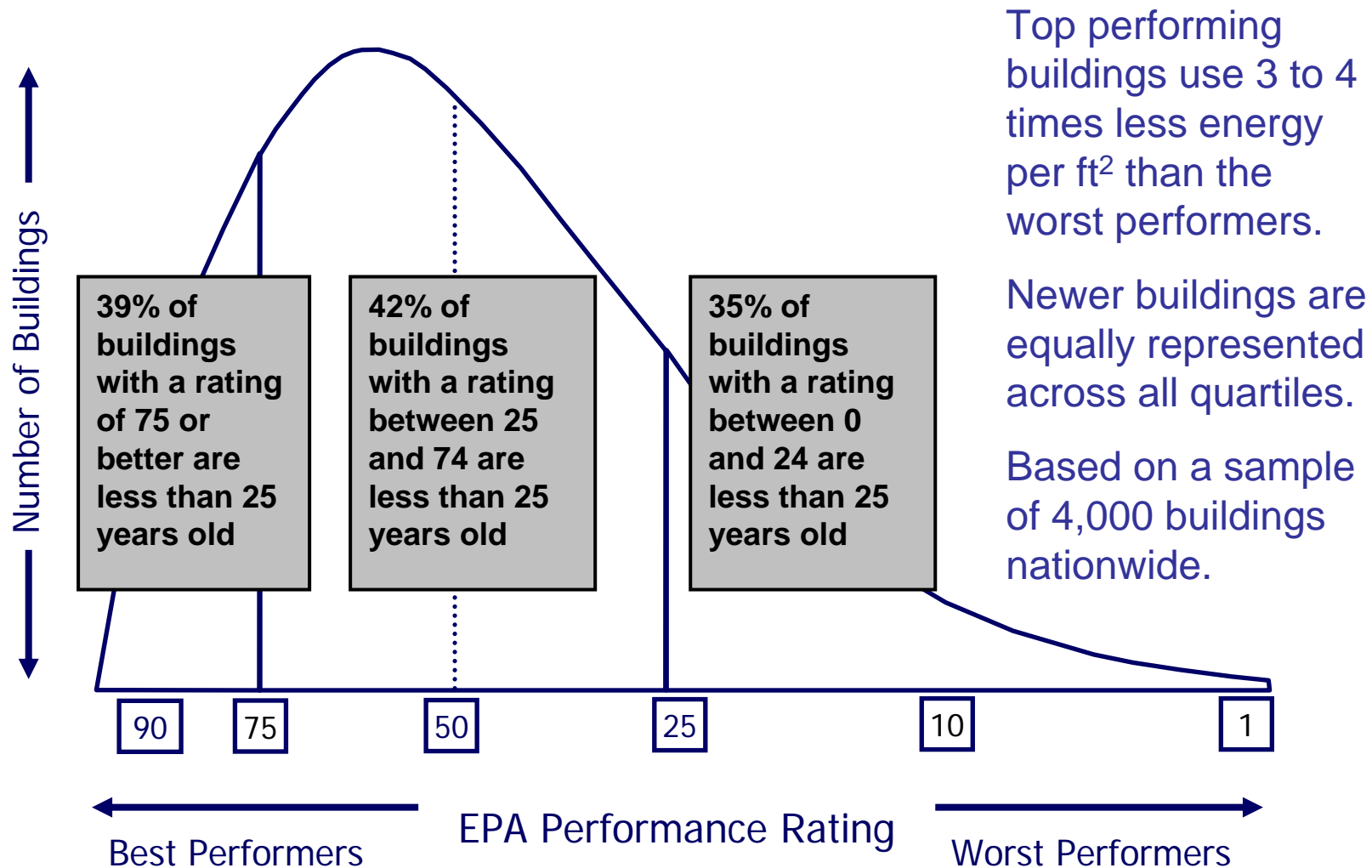


Optimize Existing Systems

- Retro-Cx can potentially yield greater energy payback than installing cutting edge technology or retrofitting existing equipment
 - Just because space temperature and humidity control are excellent, doesn't mean the HVAC systems are efficient
 - Are calibration and scheduling issues unnecessarily increasing operating costs?
 - Are you confident that mold and indoor air quality issues are not a problem in your facility?

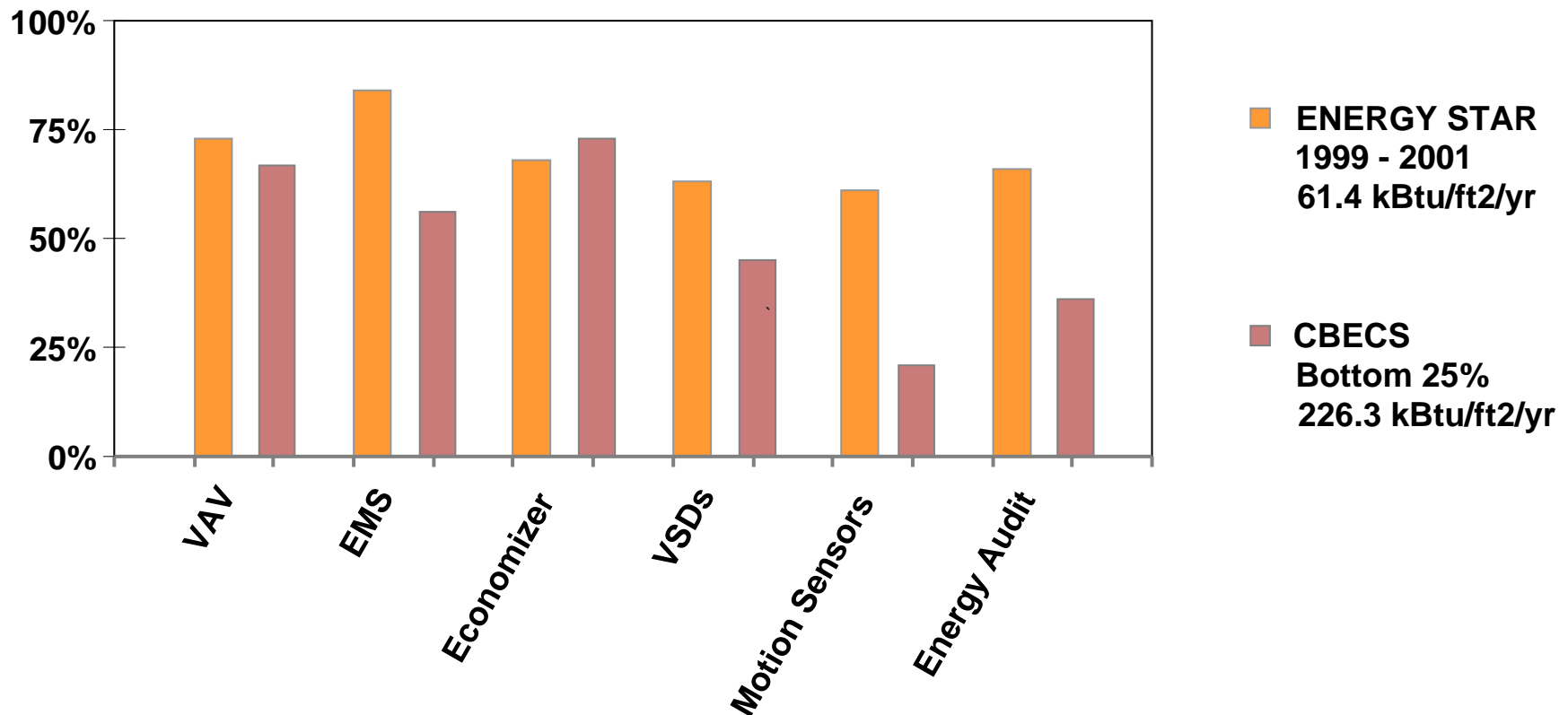


New Doesn't Always Equal Efficient



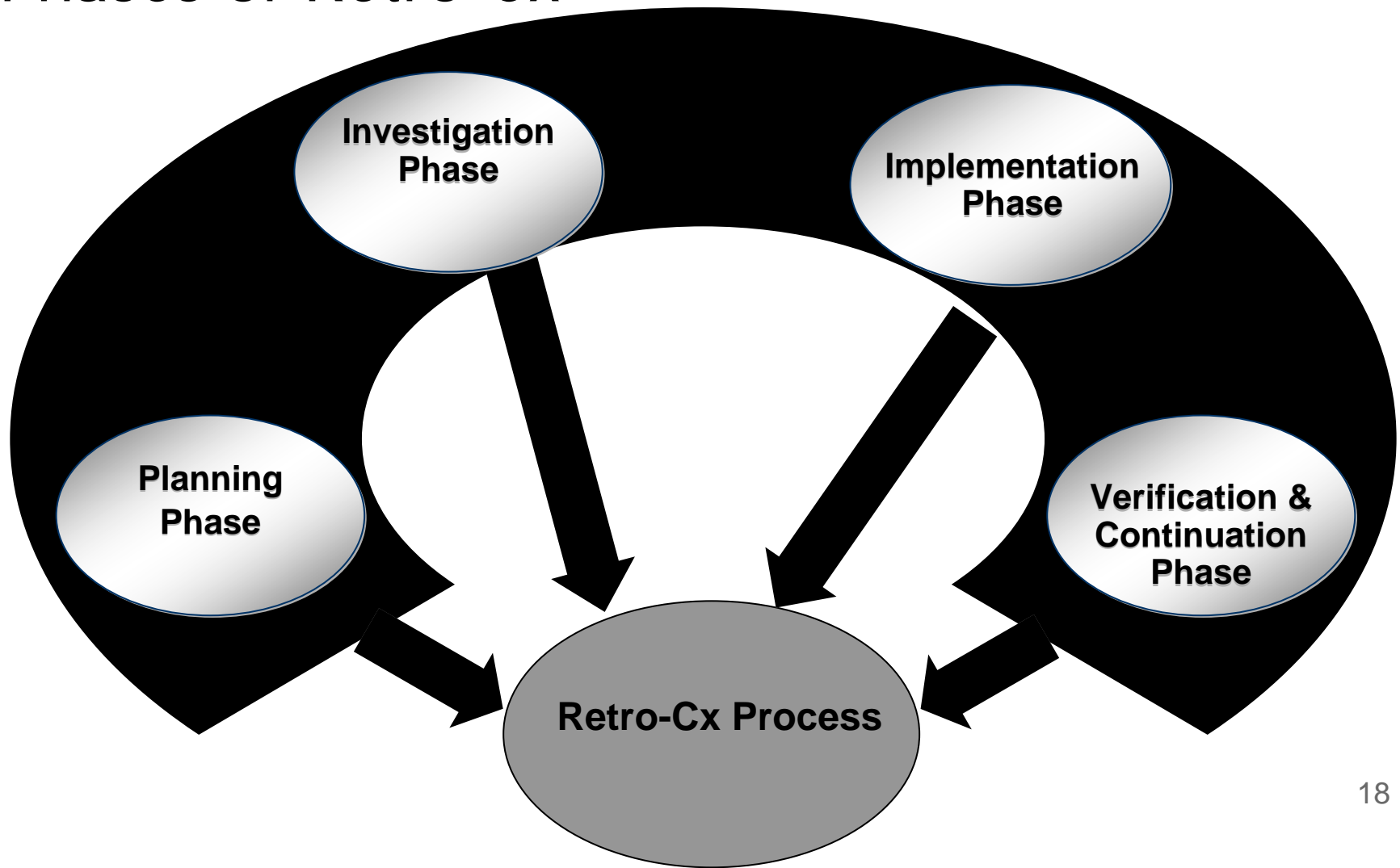
Technology does not guarantee energy efficient performance

Technology Doesn't Always Equal Performance...



Note: "CBECS" is the Energy Information Administration's Commercial Building Energy Consumption Survey, <http://www.eia.doe.gov/emeu/cbecs/contents.html>

Phases of Retro-Cx



Find a Target for Pilot Study

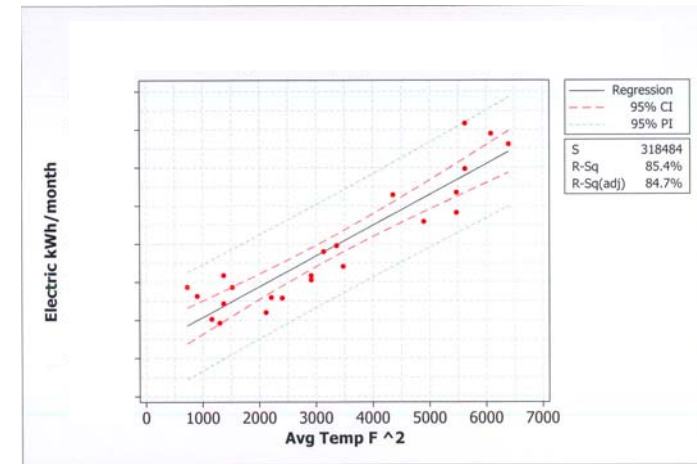
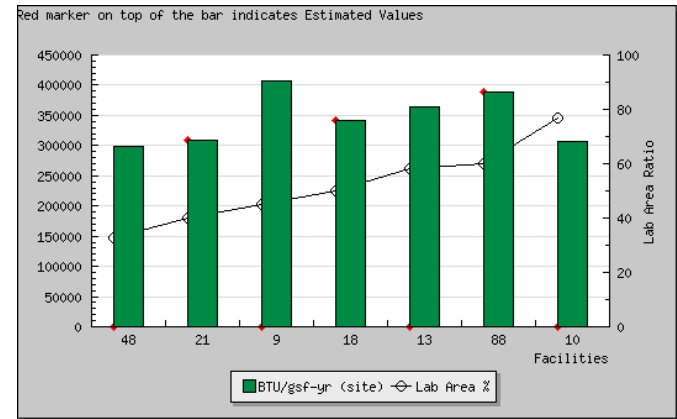
- Potential for big impact
 - Laboratory Building
 - once through air
 - high number of air changes
 - fume hoods

- Drug Discovery Building – Kenilworth, NJ
 - Big area
 - Many fume hoods
 - High energy cost
 - Moderately inefficient
 - High cost of energy electric in NJ



Planning Phase

- Benchmark and Baseline the Bldg
 - Labs21
 - assess efficiency
 - Regression analysis
 - monitor impact of changes
- Identify Team
- Scoping Study:
 - Break building down into smaller pieces
 - Evaluate current HVAC operations and associated controls.
 - Evaluate the operation of lab fume hoods.
 - Identify potential energy conservation opportunities (ECO)
- Obtain Sr. Mgmt concurrence & approval

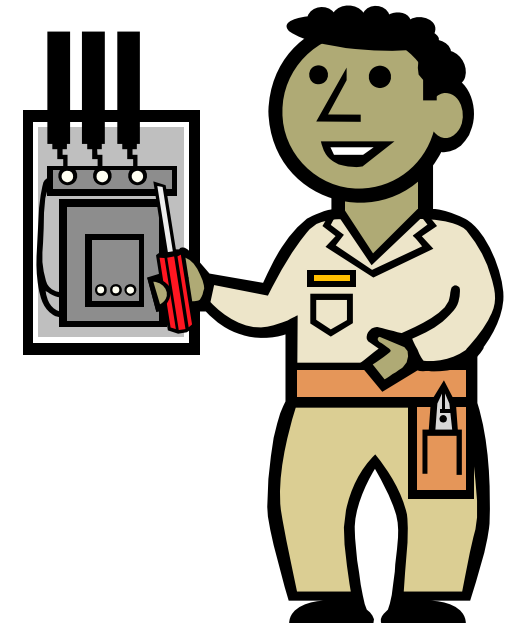


Investigation Phase

- Creation of investigative sub-teams
 - Team 1 – Fume hood operations
 - Team 2 – HVAC operations & calibration
- Fume hood operation findings:
 - Performed Pilot Lab Study
 - 90% + Exhaust Air-Flow Sensors out of calibration
 - 50% Sensor failure rate
 - Difficult to access
- HVAC operations & Calibration findings:
 - Mechanical issues
 - Calibration issues
 - Controls issues
 - Effectiveness of Preventive Maintenance (PM) & Calibration plan
- Economic analysis to adjust projected savings
- Provide Recommendations



- Implement recommendations identified in Investigation Phase:
 - HVAC Operations & Calibrations
 - Operation of Fume Hoods
- Functional Testing
- Documentation of all changes
 - Sequence of operations
 - Updated control schemes



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



- 28 Retro-Cx Projects have been completed
 - Various space types
 - Laboratory
 - Office
 - Manufacturing
 - Scoping Studies and Projects with ECM Implementation
 - Energy Modeling
 - Infrared Surveys

- To date, these studies have identified significant energy savings

Typical Findings

- Time of Day
- Air Change Reductions
 - Labs / Occupancy
- Sensors / Calibration
- Simultaneous Heating / Cooling
 - Leaking Valves
- Resets – Temperature & Pressure
- Controls Adjustments
 - Lighting, Economizers
- Demand Control Ventilation

- All issues identified are closed-out.
- Final verification of estimated savings
- Ensure effectiveness of PM and Calibration plans.
- Long-term plan to sustain savings:
 - Continuous trending & monitoring of energy usage
 - Plan to document and commission all new modifications



Barriers Become Lessons Learned

- 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

■ 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

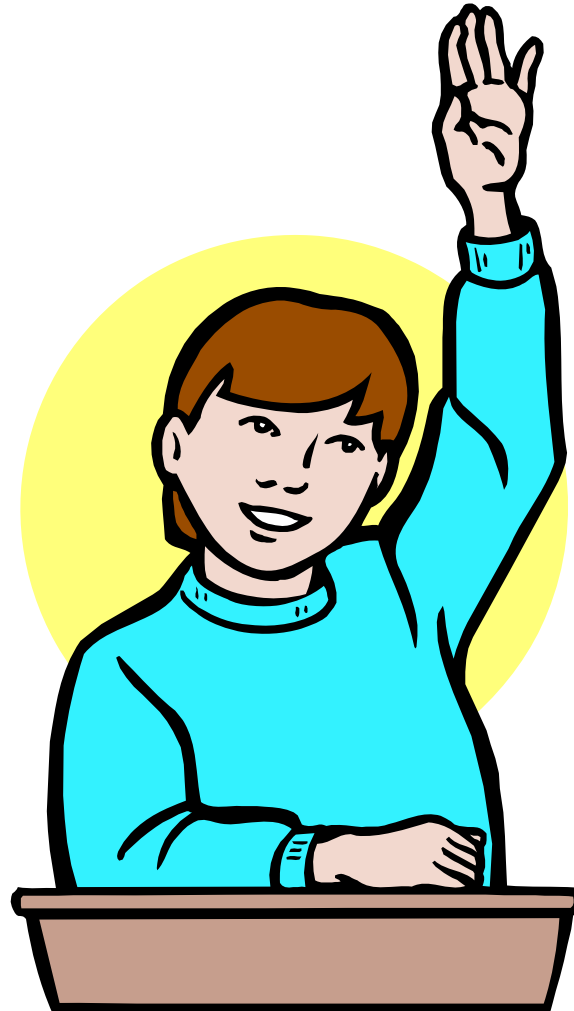
- redesign the system – variable volume fume hoods
- accessible from ground without disturbing scientist

- 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
- Be realistic about DIY
- Building owner should be accountable for energy bill

- The triple bottom line
 - Savings
 - Sustainability
 - Society

Helping the World be Well

Questions ???





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