

The Staged Approach to Efficiency

Identify and Sequence Low Cost Improvements



Low cost opportunities to improve facility and portfolio-wide energy performance



O & M



Occupants' Behavior



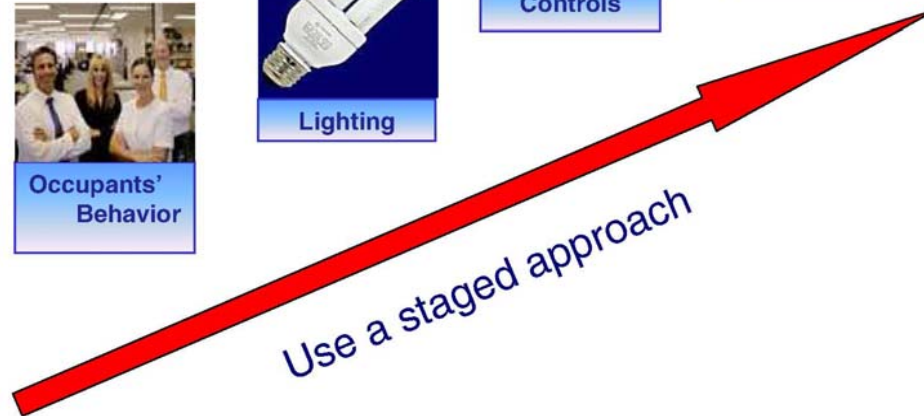
Lighting



Controls



Equipment



Use a staged approach

Retro-Commissioning

RETRO-COMMISSIONING

A systematic method for investigating how and why an existing building's systems are operated and maintained the way they are, and identifying ways to improve overall building performance.

Planning Phase

Investigation Phase

Implementation Phase

Turnover Phase

Persistence Phase

RCx Benefits

RCx Benefits

- Annual Energy & CO2 Savings
- Improved IAQ and Comfort
- Tenant Retention
- Worker Productivity
- Enhanced Asset Value



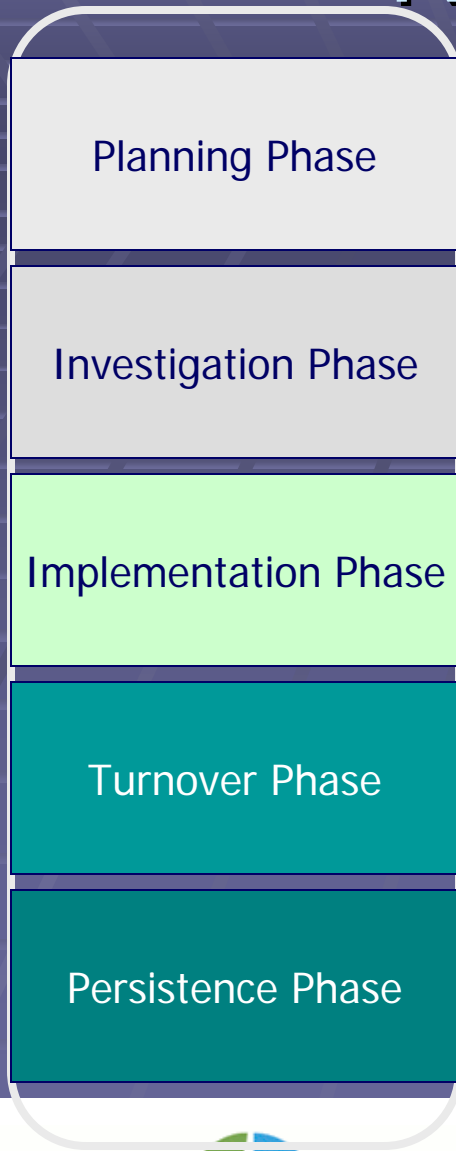
THE SAVINGS

- National \$18 Billion Savings Potential
- Building Metrics (from 57 projects)
 - Average annual cost savings of \$105,156
 - Savings ranged as high as \$1.8 million (\$3.83/sq ft - year)
 - Median energy payback of 0.7 years
 - Median energy savings of 15%
 - Non-Energy Benefits \$0.18/sf ft-year

SOURCE: *The Cost-Effectiveness of Commercial-Buildings Commissioning*, - LBNL, PECL, Texas A&M



RCx Phase 1: Planning



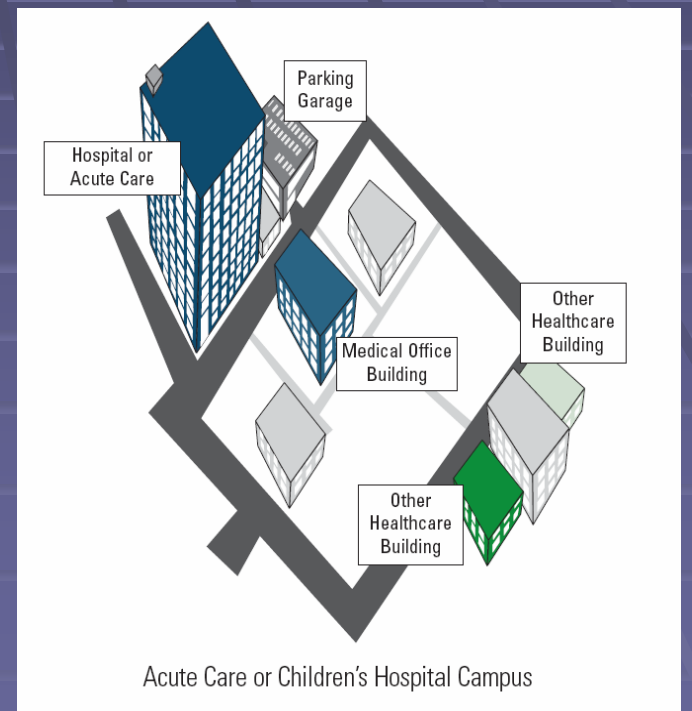
- Define project objectives & obtain support
- Assemble the retro-commissioning team and define roles & responsibilities
- Benchmark Building Performance
- Document the Current Facility Requirements (CFR)
- Perform an initial walk-through
- Develop the Retro-Commissioning Plan
- Hold a kick-off meeting

RCx Phase 1: Planning Energy Star Benchmark

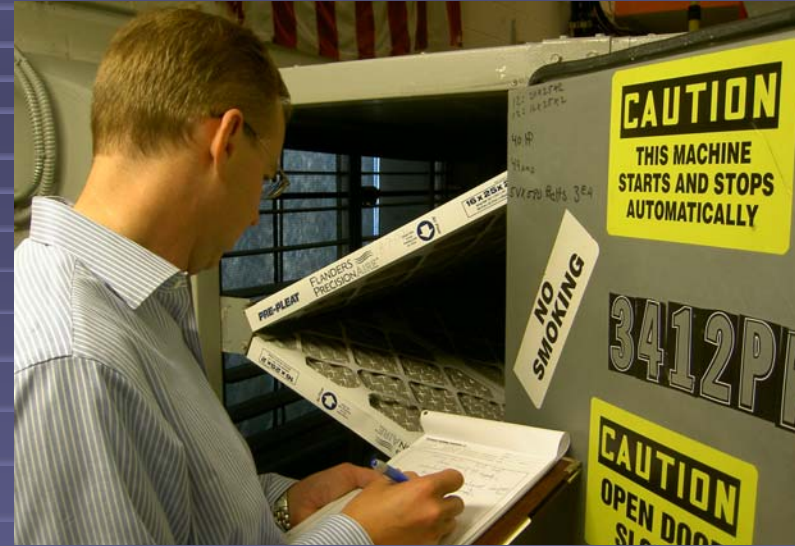


PORTFOLIO MANAGER - SPACE CLASSIFICATION GUIDE HEALTHCARE

- Provides benchmark of Energy Performance
- Rankings specific to building type
- Accounts for region, size, function
- Hospital Campus Classification accounts for:
 - Acute Care
 - Long-Term Care
 - Skilled Nursing
 - Exam Rooms
 - Medical Offices
 - Administrative Space



RCx Phase 2: Investigation



- Evaluate facility documentation, work orders & O&M procedures
- Perform diagnostic monitoring & functional testing
- Develop Master List of Findings
(Includes measure description savings, costs, benefits & ROI)

RCx Phase 3: Implementation

- Select Facility Improvement Measures for Implementation
- Develop Implementation Plan
- Implement selected operational improvements
- Verify results



RCx Phase 3: Implementation

Sample of RCx Implementation Measures

- Reset chiller discharge temperature
- Replace pneumatic variable air volume boxes with Direct Digital Control
- Reset pump & fan speeds
- Improve free cooling shift over
- Add control scheme to Electric unit heaters
- AHU Supply Fan Static Pressure Optimization
- Install critical systems heat exchanger to increase efficiency of technology cooling during summer periods
- Broaden humidity set points in Data centers
- Improve and validate demand base ventilation systems



RCx Phase 4: Turnover

- Develop Final Report
- Compile a Systems Manual
- Update O&M Documentation & As-Builts
- Develop a Re-commissioning Plan
- Provide training
- Hold close-out meeting



RCx Phase 5: Persistence

- Goal of “Continuous Improvement” through life of building
- Continuously benchmark the building energy use



- Utilize EMS system to ensure persistence
- Ongoing or continuous trending of key system parameters (*consider continuous commissioning/data mining tools*)
- Use CMMS or operator’s log for maintenance & persistence strategies of equipment
- Re-commission after 3-5 years



Join the Challenge!

.....next steps

- Become a Cool Partner
- Make Pledge
- Calculate Your Carbon Footprint
 - ENERGY STAR Benchmark Your Building
 - Account for other Corporate CO2 Emissions

Corporate CO₂ Emissions



Business Travel



Direct Emissions

Building Energy



Direct GHG Emissions

Boilers, Furnaces,
HFC Emissions from Refrigeration
& Air Conditioning equipment

Indirect GHG Emissions

Electricity

Employee



Commuting

Solid Waste Disposal



Wastewater Handling

Calculating Carbon Emissions from Building Energy Use

Cool Capital Carbon Footprint Calculator
Building Energy Use
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BUILDING: KATHERINE IVERSON RESIDENCE HALL

YEAR	2006	2007	2008	2009	2010
BUILDING GSF	0	0	0	0	0

Below are two options to calculate emissions resulting from building energy use. Please choose only one.

OPTION 1. Use the Energy Star website to calculate your CO₂ emissions. Enter the total number calculated on the Energy Star sheet below. Note that Energy Star states your emissions in thousands of pounds of CO₂.

Thousands of Pounds of CO ₂	2006	2007	2008	2009	2010
	0	0	0	0	0

OPTION 2. Calculate emissions using the worksheet below
Note: For some fuels (e.g. gas), multiple units are provided for consumption for each year. Please use only one consumption line per fuel.

Step 1. Enter Power Grid Region (To determine your power grid region see the "Power Grid Regions" sheet):
Click to select from dropdown list:

Step 2. Enter energy use:

	2006	2007	2008	2009	2010
Electricity					
Consumption (kWh)	0.0	0.0	0.0	0.0	0.0
Natural Gas (Choose one)					
Consumption (CCF)	0.0	0.0	0.0	0.0	0.0
Consumption (MCF)	0.0	0.0	0.0	0.0	0.0
Consumption (Therms)	0.0	0.0	0.0	0.0	0.0
Fuel Oil (#1)					
Consumption (Gals)	0.0	0.0	0.0	0.0	0.0
Fuel Oil (#2)					
Consumption (Gals)	0.0	0.0	0.0	0.0	0.0
Fuel Oil (#4)					
Consumption (Gals)	0.0	0.0	0.0	0.0	0.0
Fuel Oil (#5 & #6)					
Consumption (Gals)	0.0	0.0	0.0	0.0	0.0
Diesel					
Consumption (Gals)	0.0	0.0	0.0	0.0	0.0

Calculate your building's emissions using the ENERGY STAR website or use the Cool Capital Carbon Footprint Calculator worksheet

Track Cool Pledge Progress

Cool Capital Carbon Footprint Calculator

Total Emission:

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Total Pounds of CO₂ Emitted by Corporation

45,000	44,600	0	0
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Pledge

Enter your Base Year	2006	Enter your pledge Total Lbs of CO ₂ you plan to save compared to your base year	2,300
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Performance

	Base Year Emissions	Annual Reduction in pounds of CO ₂ emissions compared to Base Year			
		2007	2008	2009	2010
Emissions	45,000	400			
Cumulative Reduction in CO ₂ Emissions	NA	400			
Percent of Goal Achieved	NA	17.4%			



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