



Best Practices to Improve Energy Performance

Online Etiquette & Technical Tips



Background noise

If you expect background noise during the training, please mute your phone.

Hold & Music

Please **do NOT put your phone on hold** during the training!

Slides not advancing

If slides are not advancing Refresh your screen.

Technical assistance

Call **1.866.229.3239** if you need help during the training.

Accurate Attendance



Please let me know if
anyone is sharing your computer.

I need to report an accurate
list of attendees to ENERGY STAR.

Training Objectives



At the end of today's training, you will be able to:

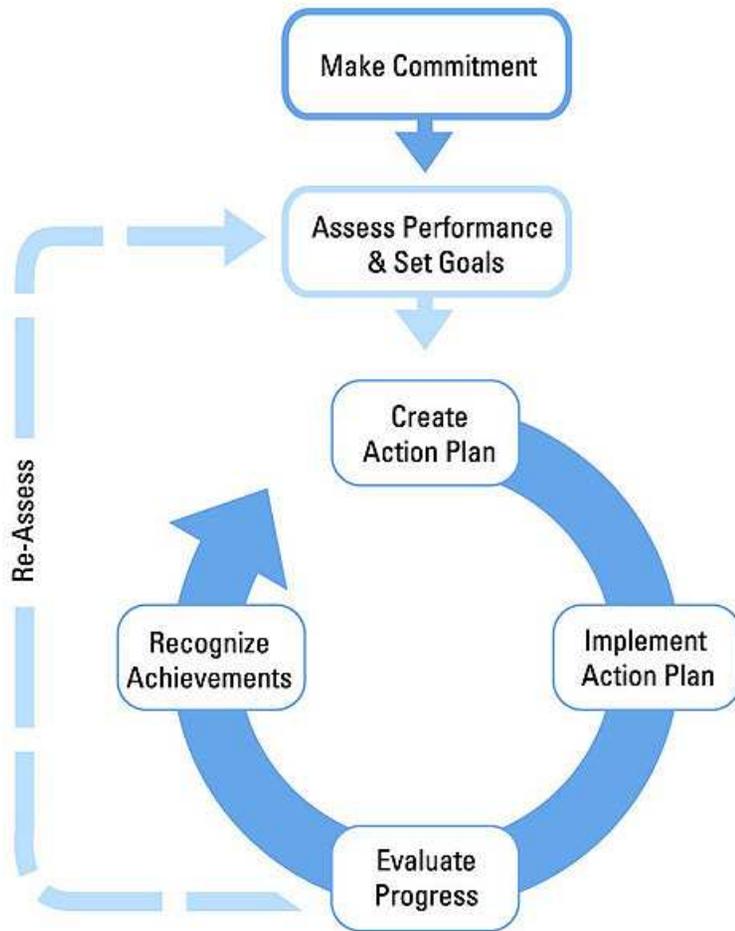
- **Identify** opportunities to improve energy performance
- **Quantify** specific operational changes to improve energy performance
- **Set** performance goals
- **Estimate** energy and financial savings using Portfolio Manager

Agenda



- Review ENERGY STAR's Energy Performance Rating System
- Identify specific areas for improvements
- Set realistic and achievable performance goals
- Create an action plan

US EPA Energy Performance Rating System



Based on the successful practices of ENERGY STAR partners, EPA has identified key components for a successful energy management program

Step 1: Benchmark the building to get a baseline Energy Performance Rating between 1 and 100

Step 2: **Improve the Energy Performance Rating**

Review Benchmarking Process



Process: A-B-C

Accuracy: Collect and input accurate data

Benchmark: Benchmark building to get a baseline rating

Consistency: Update energy and cost data monthly

Space Characteristics that Affect the Energy Performance Rating:

- Operating hours
- Occupant density
- Number of PCs per person

Use the 10% Rule to:

Create enough space categories to account for variations in how sf is used by occupants

Space Use			
Space Name	Space Type	Floor Area (sf)	% Floor Area
24/7 Tenants	Office (General)	125,000	18
High Density Areas	Office (Financial Center)	130,000	19
Low Density Areas	Office (Bank Branch)	15,000	2
Overtime Air Areas	Office (General)	250,000	37
Multiple PC Areas	Office (General)	20,000	3

Agenda



- Review Energy Performance Rating System
- Identify areas for improvements
- Set realistic and achievable performance goals
- Create an action plan

Sample Building Characteristics



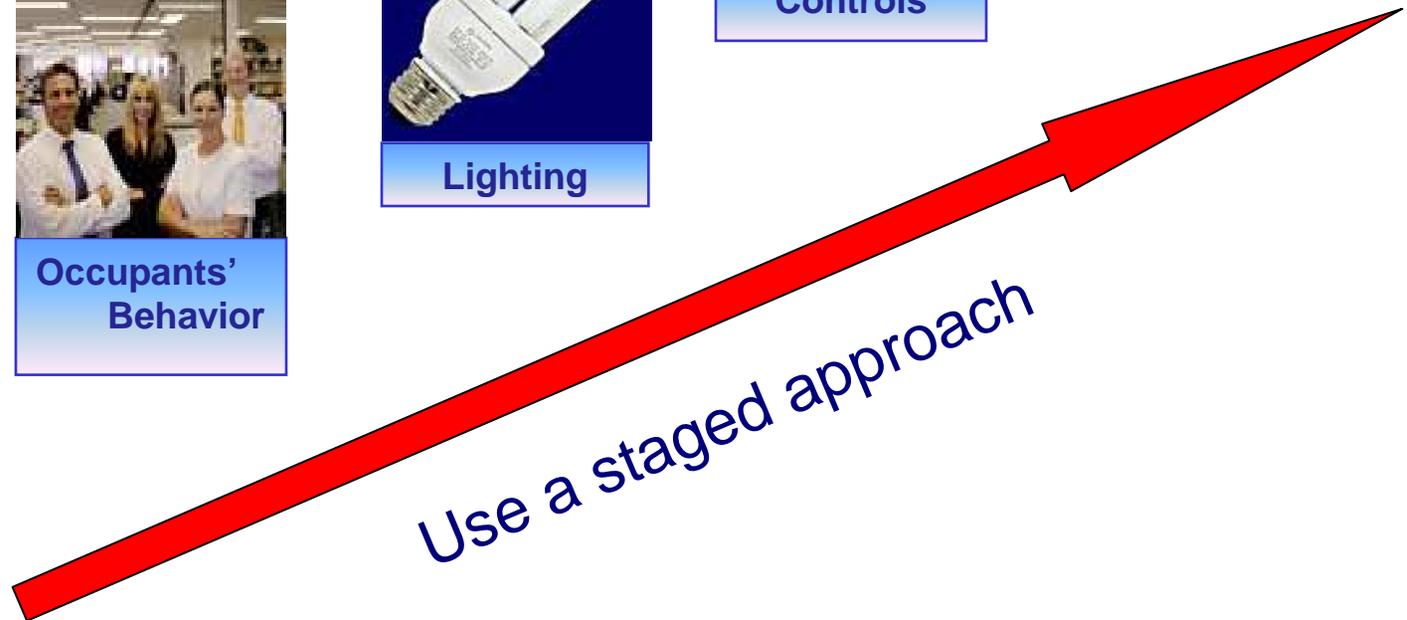
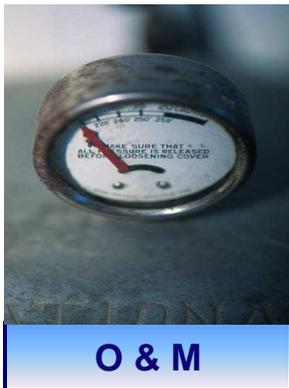
Size	100,000 sf
Occupant density	1 person/250 sf = 400 occupants
Plug load	1.2 PCs/person = 480 PC's
Operating hours	Average = 65 hrs/week
Cost per kWh	\$.09 (Blended rate)

Assume these base building characteristics throughout the training unless otherwise noted.

Identify and Sequence Low Cost Improvements



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

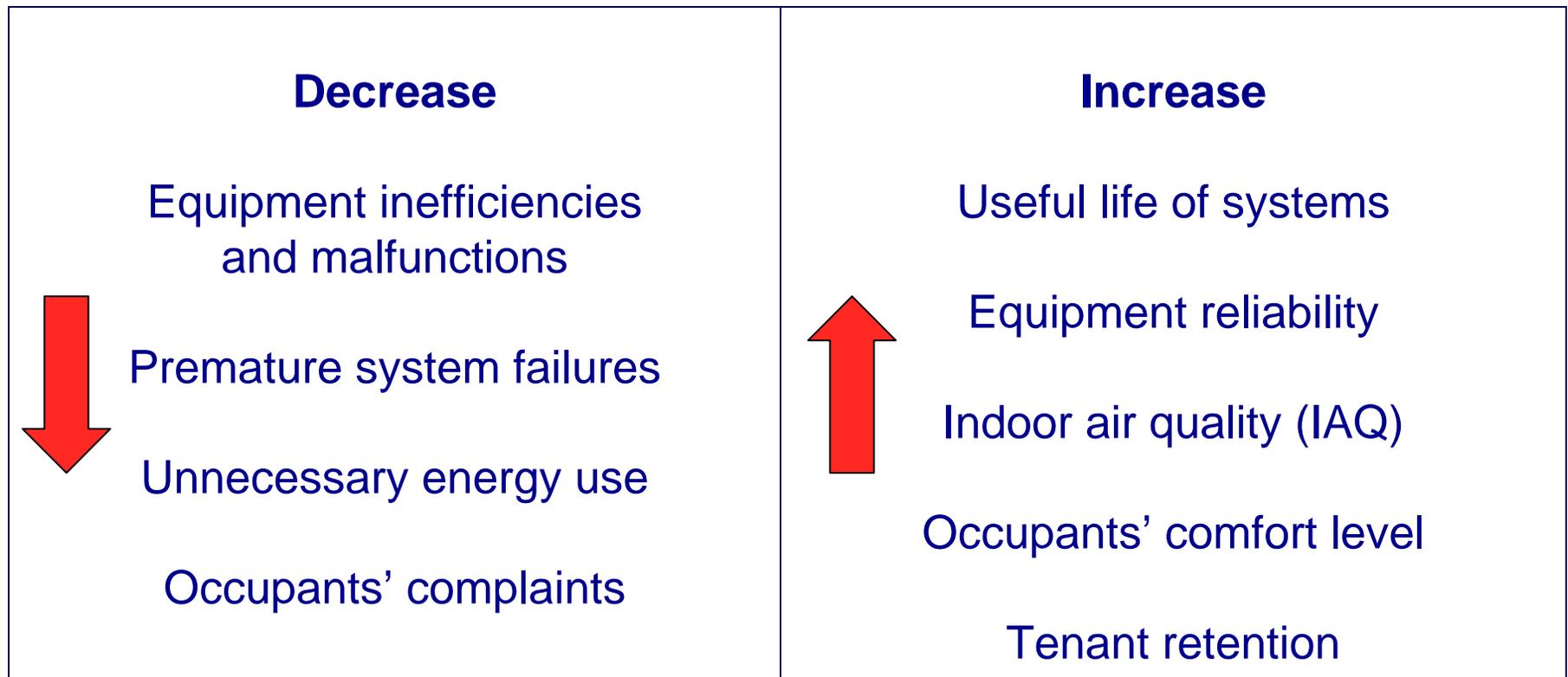


Effective O & M



Reduces the need for ***Unscheduled Maintenance***

Effective O & M Results in:



Operations & Maintenance



Functioning as designed

Calibrate thermostats

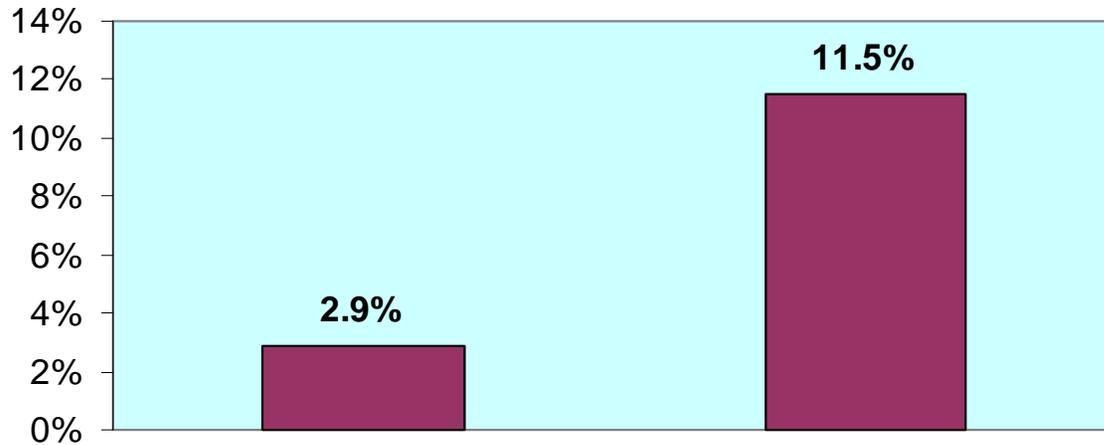
Adjust dampers

Janitorial services

Functioning as Designed



Whole Building Energy Savings Potential
Low Estimate / High Estimate



Regularly inspect all equipment and controls to ensure they are functioning as designed

Mini Case Study	Cost	Annual Savings	Payback	Asset Value Increase	ROI
Located and corrected chilled water pump control issue	\$1,200	\$43,000	7 days	\$537,500	3,583%

Class A Office Building Oregon



The EMS system code was written with an “AND” statement instead of an “OR” statement causing duct heaters to remain on all the time.

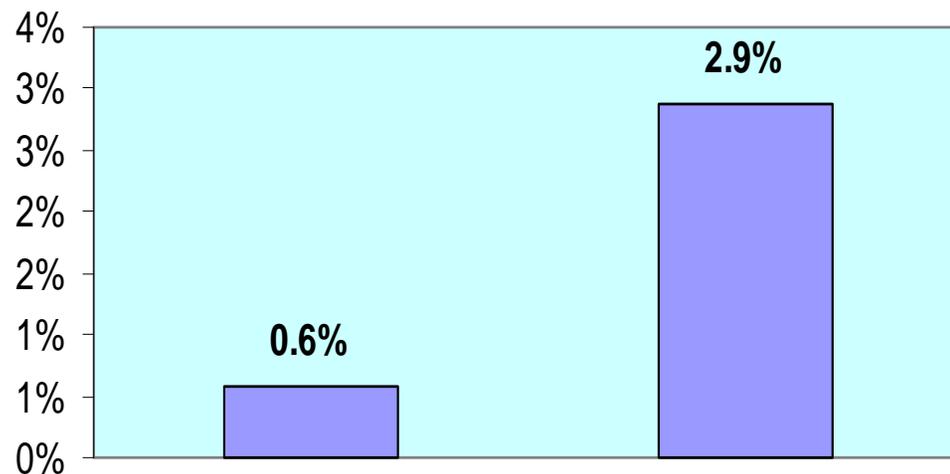


Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	Asset Value Increase	Annual Energy Savings
\$0	0¢	\$3,700	2¢	Immediate	\$46,250	1%

Calibrate Thermostats



**Whole Building Energy Savings Potential
Low Estimate / High Estimate**



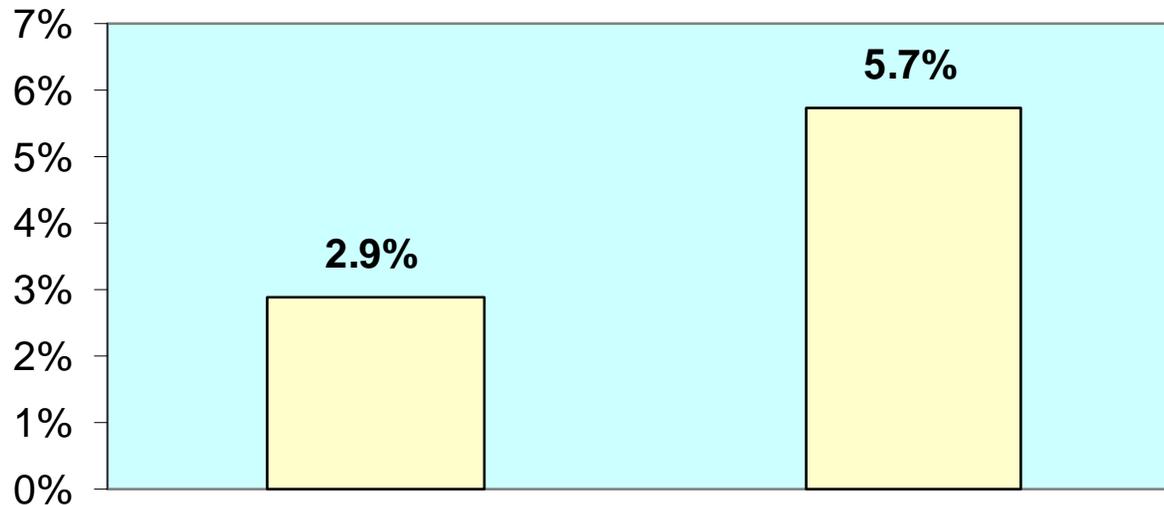
Periodically, walk through the building and compare the thermostat setting with a hand held digital thermometer (preferably with 2 decimal places)

Ensure thermostat setting equals actual space temperature

Adjust Dampers



**Whole Building Energy Savings Potential
Low Estimate / High Estimate**



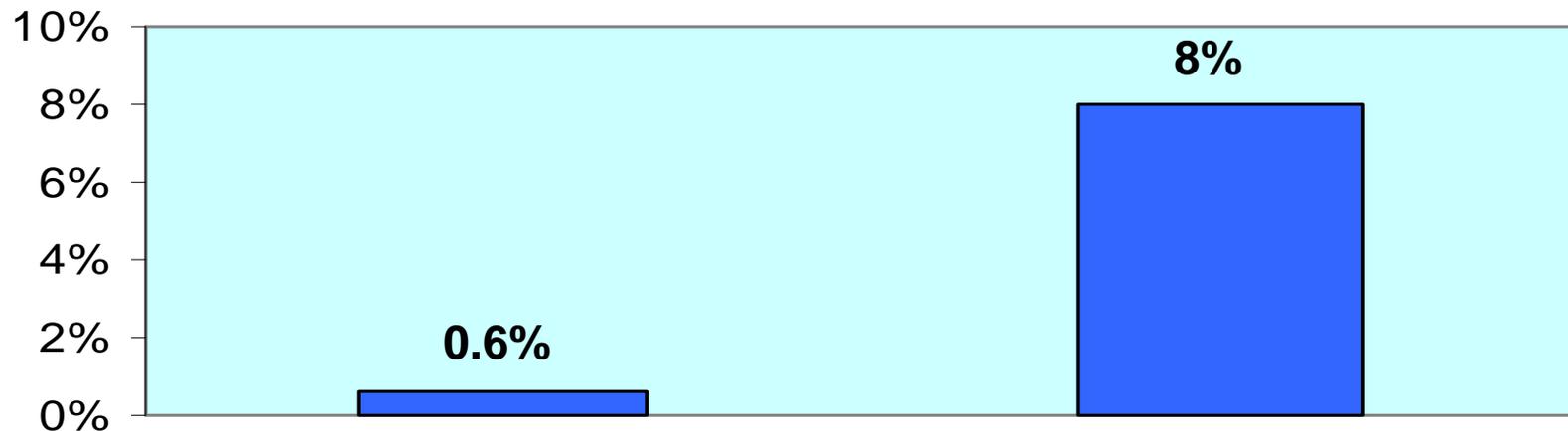
Bring in the least amount of outside air necessary to maintain proper air quality

Reduce outside air requirements by adjusting dampers to minimize the need to condition outside air (within codes)

Janitorial Best Practices



Whole Building Energy Savings Potential Low Estimate / High Estimate



Team Cleaning
Clean one floor at a time

Coordinate
Cleaning & security staff

Occupancy Sensors
Energy Star and SEIU study

Day Cleaning
Clean during work hours

Joe Serna, Jr. Building



Day Cleaning

Janitorial Hours
11:00 am – 8:00 pm

Instituted during 2001 energy crisis

Immediate energy saving of 8%

70% reduction in tenant complaints



Managed by
Thomas Properties
Group

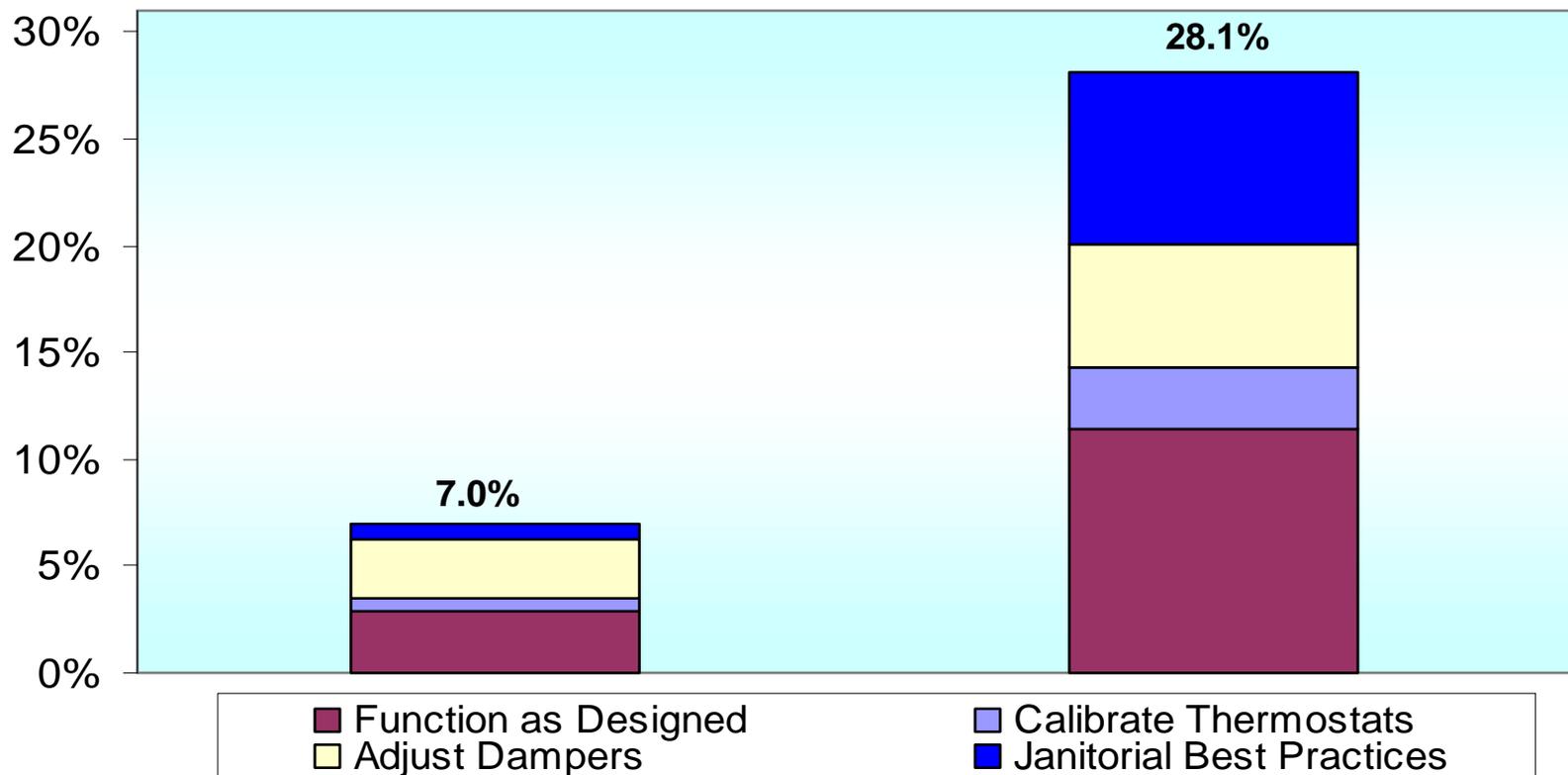
ENERGY STAR Energy Performance Rating = 94

Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	Asset Value Increase	Annual Energy Savings
\$0	0¢	\$100,000	11¢	Immediate	\$1.25 mil	8%

Cumulative Effect of Changes to O&M



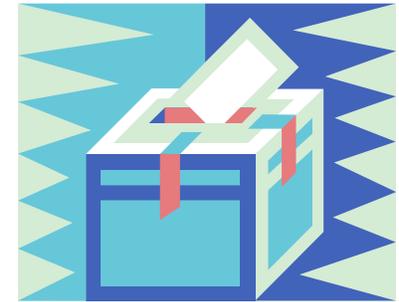
**Whole Building Energy Savings Potential
Low Estimate / High Estimate**



Polling Question



Please open the
Polling panel



to the right of your screen to answer
the polling question

Quantifiable Results for Changes to O&M



Note: 100,000 sf Blended rate = \$.09/kWh Initial Energy Performance Rating = 50	Low Estimate		High Estimate	
	Energy savings %	Cost savings \$	Energy savings %	Cost savings \$
Function as Designed	2.9	\$6,285	11.5	\$23,839
Calibrate Thermostats	.6	1,300	2.9	6,285
Adjust Dampers	2.9	6,285	5.7	12,353
Employ Janitorial Practices	.6	1,322	8.0	17,338
CUMULATIVE EFFECT	7.0	\$15,192	28.1	\$59,815

Ronald V. Dellums Federal Building



- The air flow through the ducts was in the reverse direction of that intended
- Sensor locations in air handlers caused excessive air supply

Solution—Corrected the air flow direction and relocated the sensors



Managed by U.S. General
Services Administration

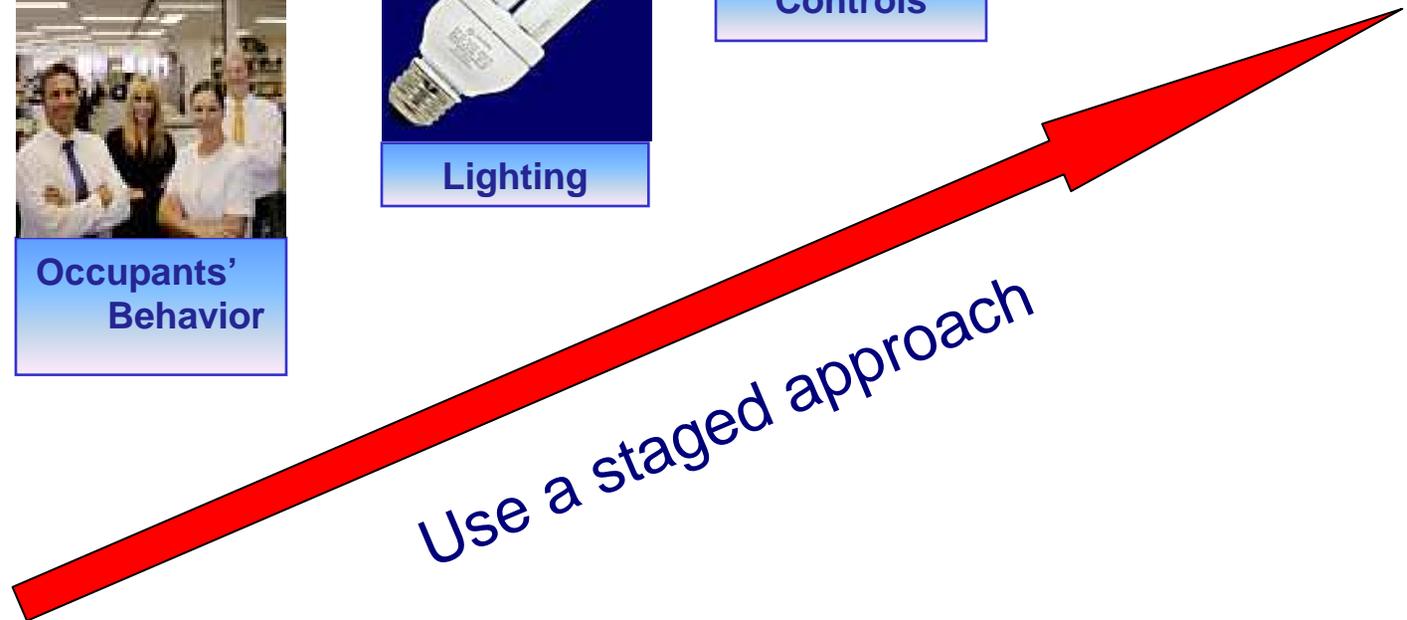
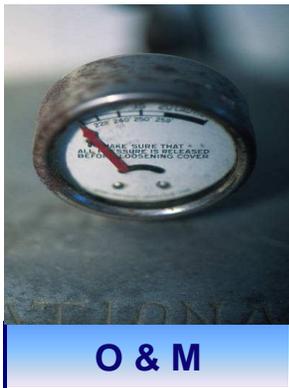
ENERGY STAR Energy Performance Rating = 85

Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI	Asset Value Increase
\$4,500	1¢	\$30,995	3¢	53 days	689%	\$387,438

Identify and Sequence Low Cost Improvements



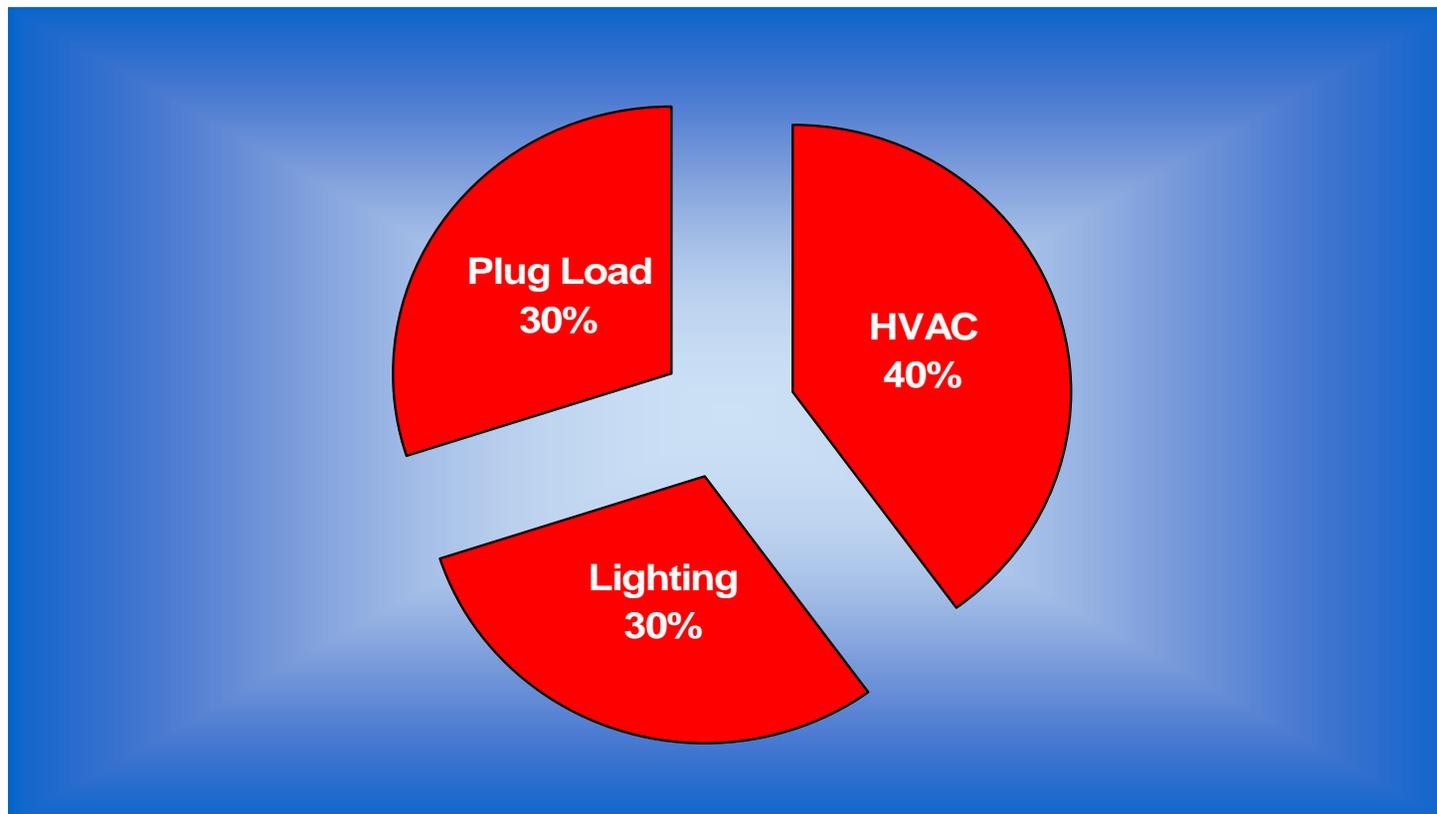
Low cost opportunities to improve
facility and portfolio-wide energy
performance



Tenant/Occupant Impact on Energy Consumption



Occupants directly impact the three major energy consumption variables in office buildings



Occupants' Behavior



Turn off Equipment

Institute an Energy Awareness Program

Use ENERGY STAR® Equipment

Install Monitor Power Management Software

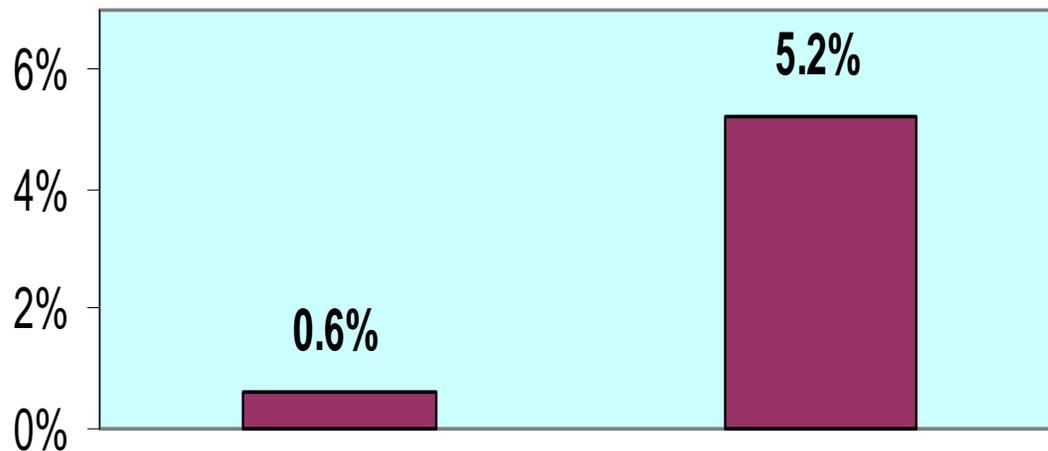
Harvest Daylight

Use Work Station Task Lighting

Turn Off Equipment



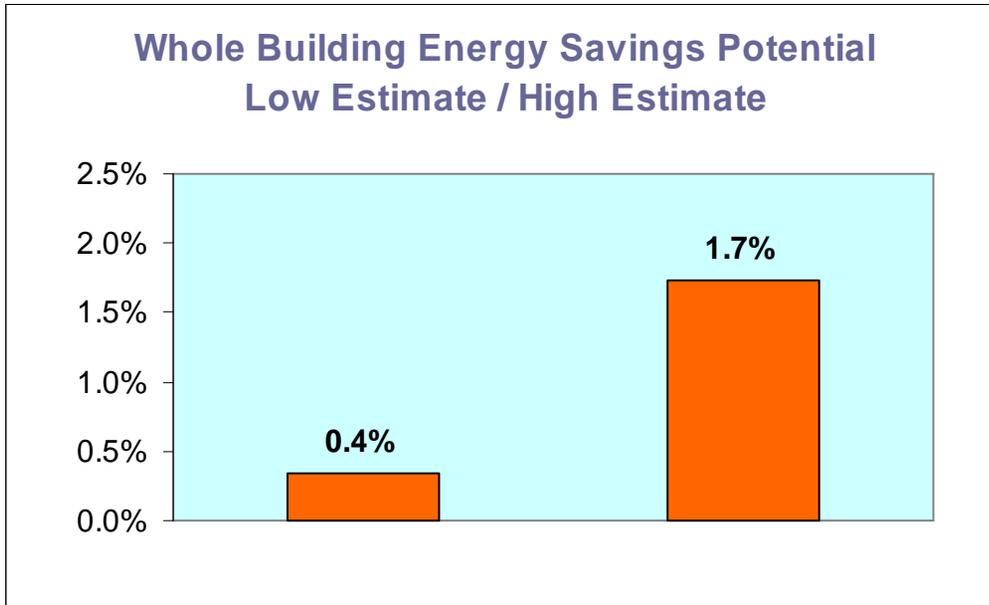
**Whole Building Energy Savings Potential
Low Estimate / High Estimate**



During off hours, make sure to power down everything – such as copiers, kitchen equipment, and task lights

Every year Americans use 4 billion kWh to brew 30 billion pots of coffee.

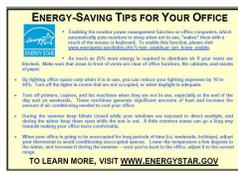
Institute an Energy Awareness Program



- Create Promotional Items
- Write News Releases
- Link to National Campaigns
- Communications Kit



Sponsor Promotional Events



Energy Tips Sheet



Company Newsletters



Company Announcements



Posters

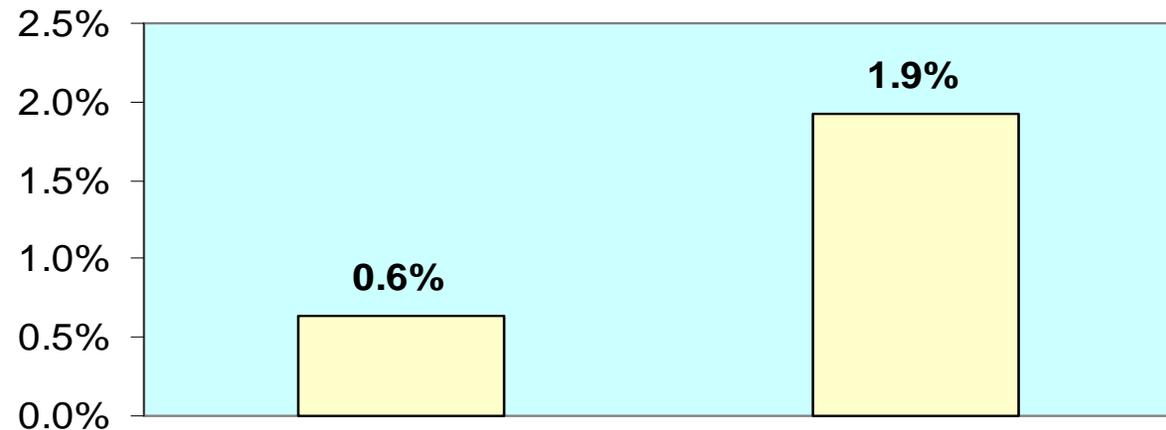
Use ENERGY STAR Equipment



Adopt a procurement policy as part of your overall successful energy management strategy



**Whole Building Energy Savings Potential
Low Estimate / High Estimate**



ENERGY STAR labeled computers, copiers, external power adapters, fax machines, laptops, monitors, multifunction devices, printers, scanners, water coolers, and more

Monitor & Computer Power Management Software

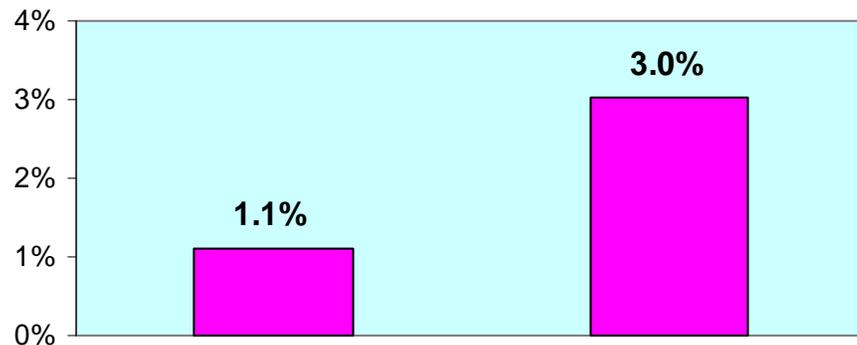


Monitor power management

Save up to

\$55 per monitor annually

Whole Building Energy Savings Potential
Low Estimate / High Estimate



Company	Monitors	Annual Savings	Annual Savings / Monitor
GE	100,000	\$3 mil	\$30
Cisco	20,000	\$528,000	\$26
Pitney Bowes	10,500	\$160,000	\$15

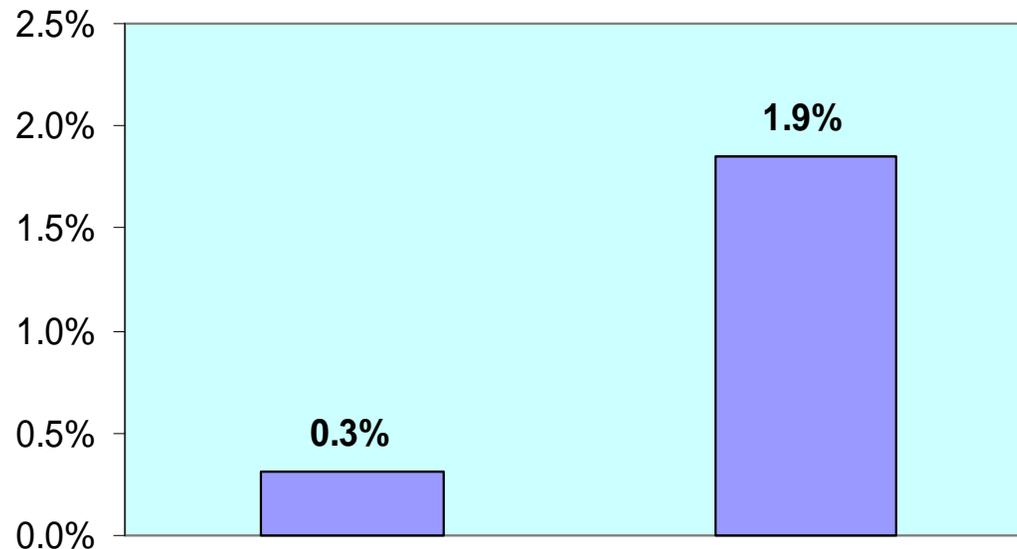
CPU/Hard Drive Power Management

Save up to an additional
\$45 per computer annually

Harvest Daylight



Whole Building Energy Savings Potential
Low Estimate / High Estimate



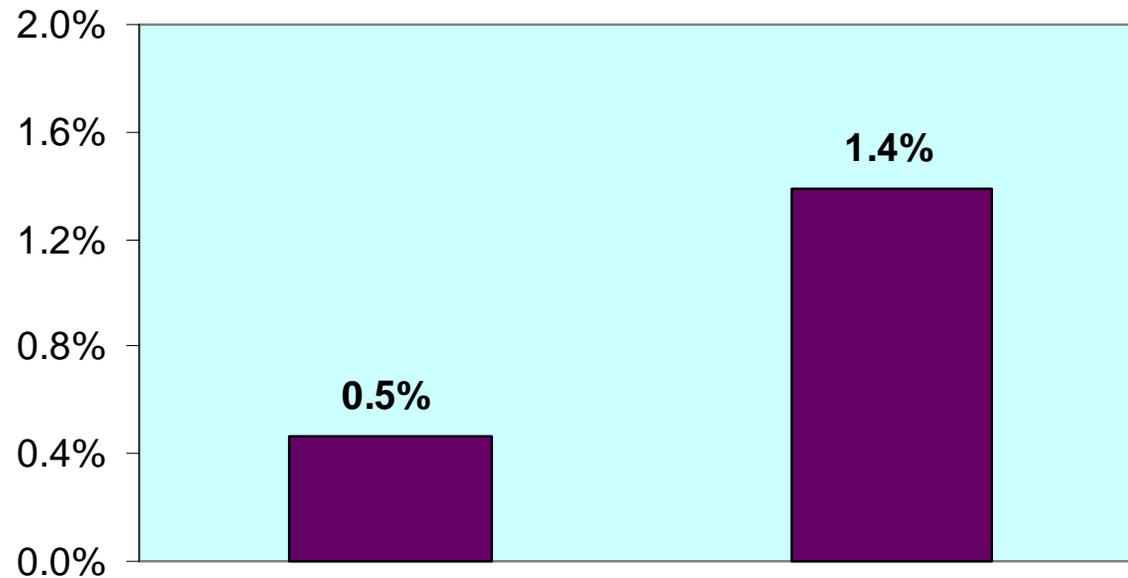
Turn off lights where natural light is sufficient

- Locate work stations requiring high illumination adjacent to windows
- Switch off lights when daylight is sufficient
- Clean windows and skylights

Work Station Task Lighting



**Whole Building Energy Savings Potential
Low Estimate / High Estimate**



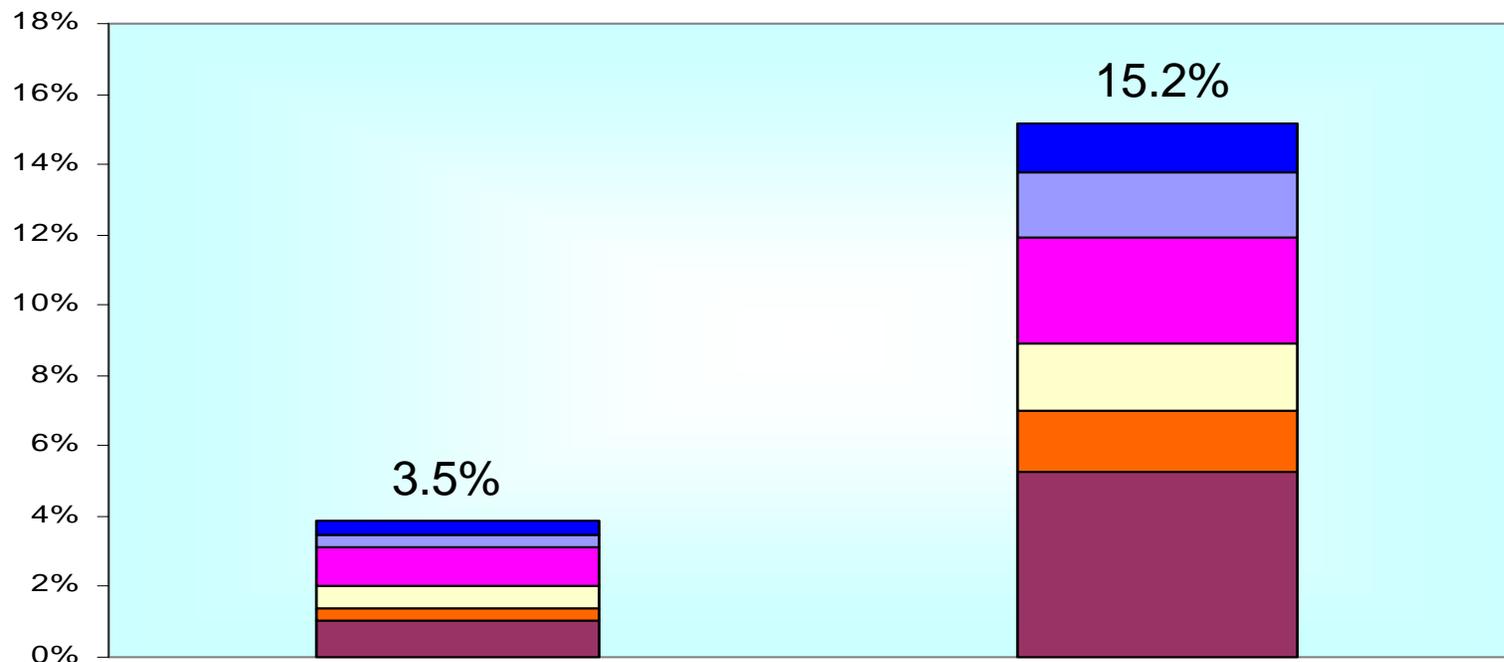
Direct light at areas where tasks are being performed and use lower wattage for overhead ambient lighting

Consider combining with motion-controlled power strips

Cumulative Effect to Changes in Occupants' Behaviors



**Whole Building Energy Savings Potential
Low Estimate / High Estimate**

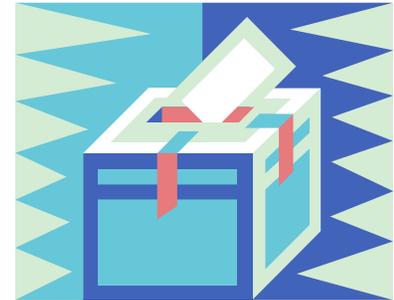


- Turn off Equipment
- Energy Awareness Program
- Use Energy Star Equipment
- Monitor Power Down Software
- Harvest Daylight
- Work Station Task Lighting

Polling Question



Please open the
Polling panel



to the right of your screen to answer
the polling question

Quantifiable Results for Changes to Occupants' Behaviors



Note: 100,000 sf Blended rate = \$.09/kWh Initial Energy Performance Rating = 50	Low Estimate		High Estimate	
	Energy savings %	Cost savings \$	Energy savings %	Cost savings \$
Turn off Equipment	0.6	\$1,322	5.3	\$11,486
Energy Awareness Program	0.4	759	1.7	3,684
ENERGY STAR Equipment	0.6	1,300	1.9	4,118
Power Management Software	1.1	2,384	3.0	6,502
Harvest Daylight	0.3	650	1.9	4,009
Work Station Task Lighting	0.5	997	1.4	3,034
CUMULATIVE EFFECT	3.5	\$7,412	15.2	\$32,833

Boston Edison Corporate Office



Over 70% of total energy use was consumed during non-occupied periods!

Tenants lost their dial-in codes to activate lighting during off hours. Upon request, security would turn on entire floors of lighting for one person.



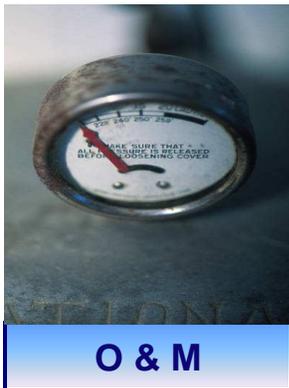
230,000 sf

Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI Increase	Asset Value Increase	Annual Energy Savings
\$2,000	1¢	\$121,200	53¢	6 days	6,060%	\$1.5 mil	6.5%

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

Lighting



Change Incandescents to CFL & HID

Convert T12 to T8 and T5

Delamp

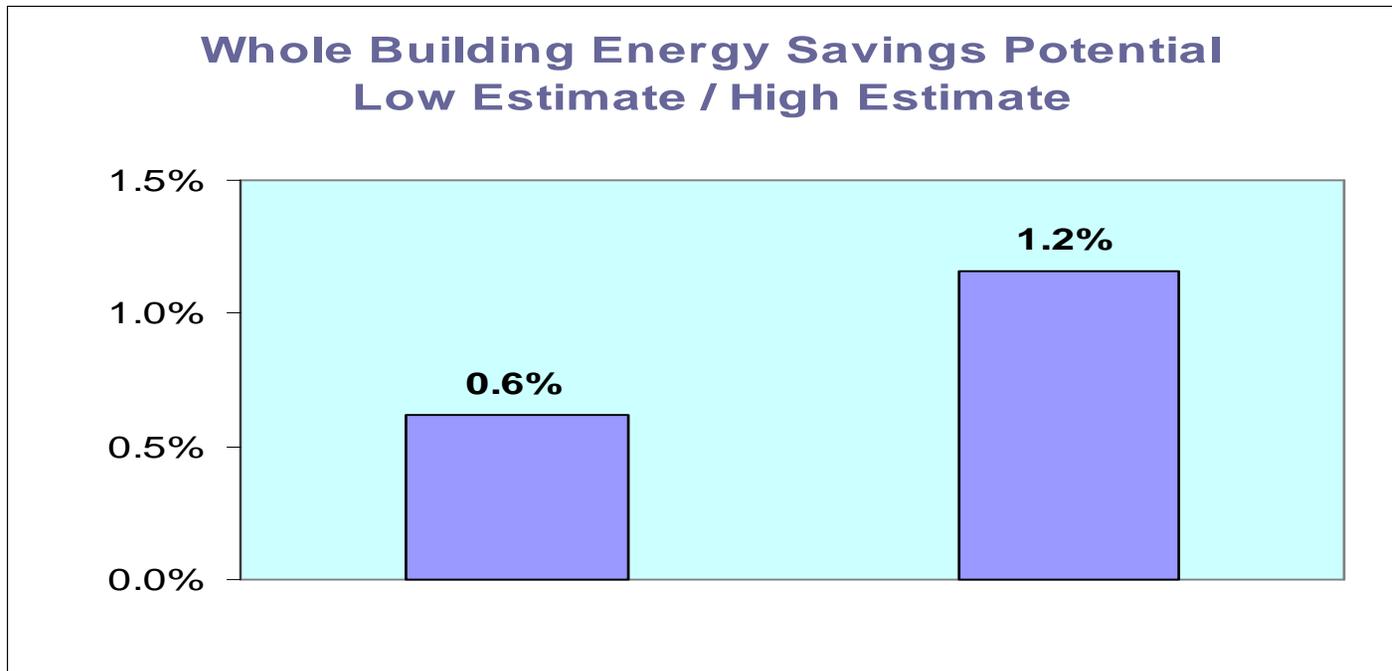
Full Floor Lighting Sweeps

Occupancy Sensors

High Efficiency LED Exit Signs

Install Timer Controls or Photocells for Exterior Lighting

Change Incandescents to CFL & HID

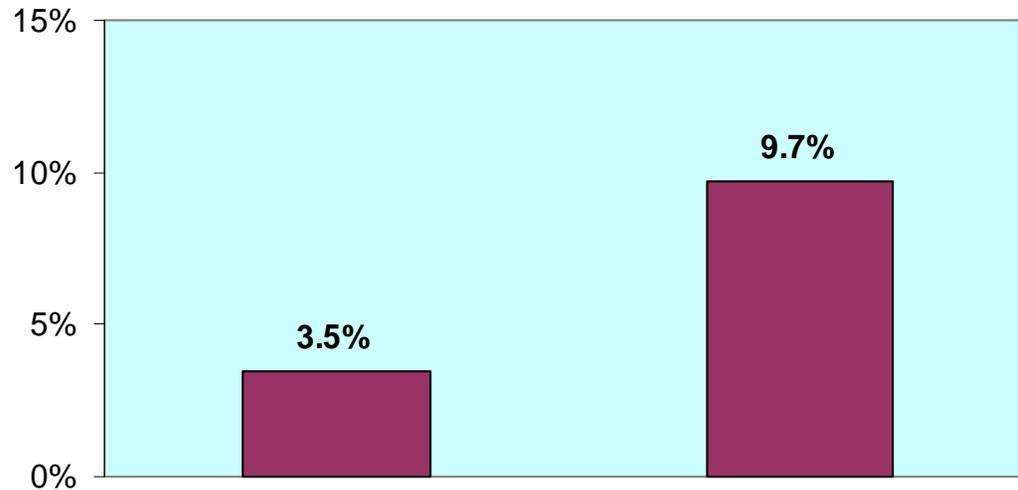


Mini Case Studies	Cost	Rebate	Annual Savings	Payback	ROI
Garage lighting retrofit	\$157,775	\$40,558	\$138,544	10 mos	118%
Garage lighting retrofit	\$51,053	\$0	\$62,936	10 mos	123%

Convert T12 to T8 & T5 and Electronic Ballasts



Whole Building Energy Savings Potential
Low Estimate / High Estimate



Convert T12s to T8s / T5s
and electronic ballasts
Eliminate magnetic ballasts

High efficiency 4 lamp T8 fixture:

40% less heat output

10% greater light output

40% less Watts than T12

Re-Lamping?

Consider

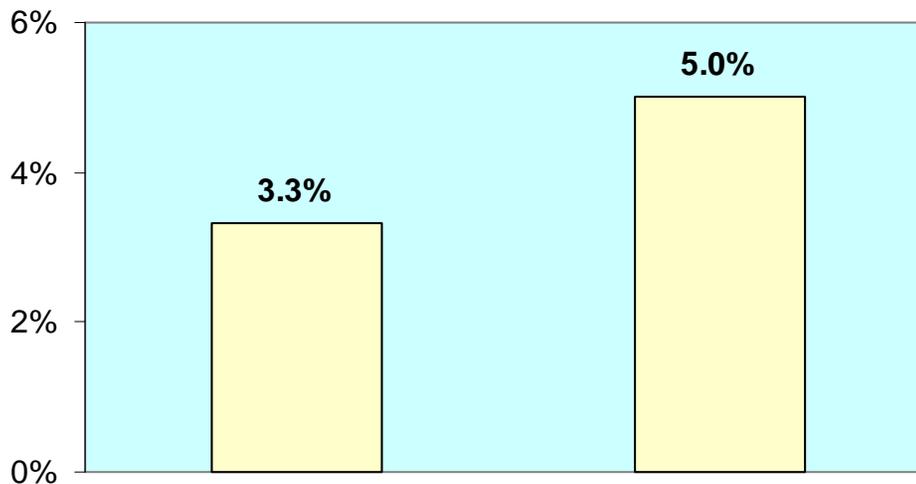
Luminaire Dirt Depreciation

Light loss factor resulting from dirt and dust accumulated on light fixtures and lamps

Delamp



Whole Building Energy Savings Potential
Low Estimate / High Estimate



Delamp and disconnect
unused ballasts

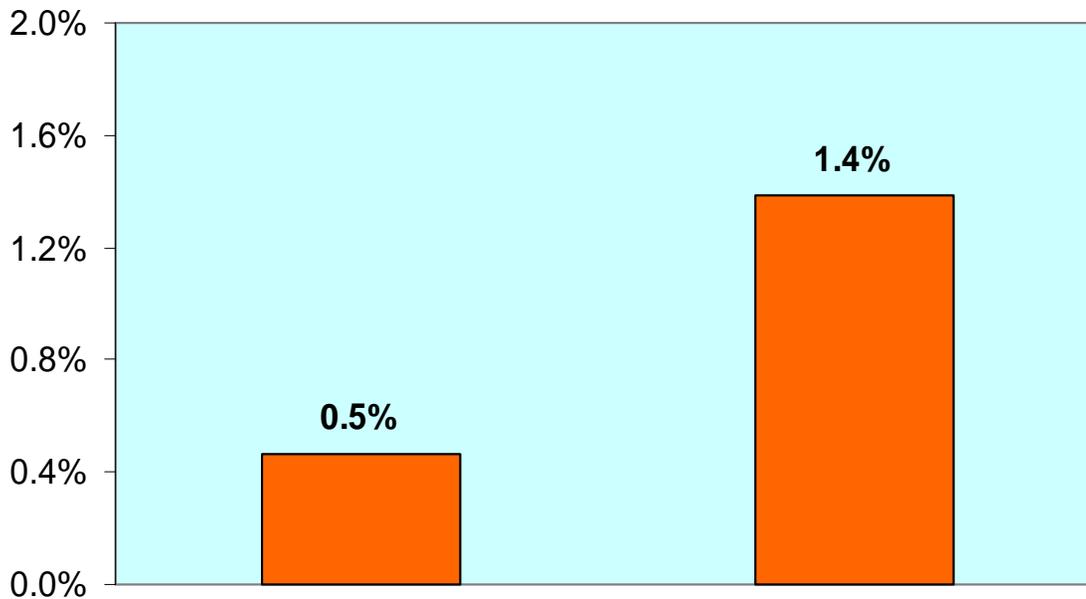
Reduce lighting levels

Mini Case Study	Cost	Cost/sf	Annual Savings	Payback	ROI
Delamped wherever possible	\$ 11,088	2¢	\$105,059	1 mo.	948%

Full Floor Lighting Sweeps



Whole Building Energy Savings Potential
Low Estimate / High Estimate



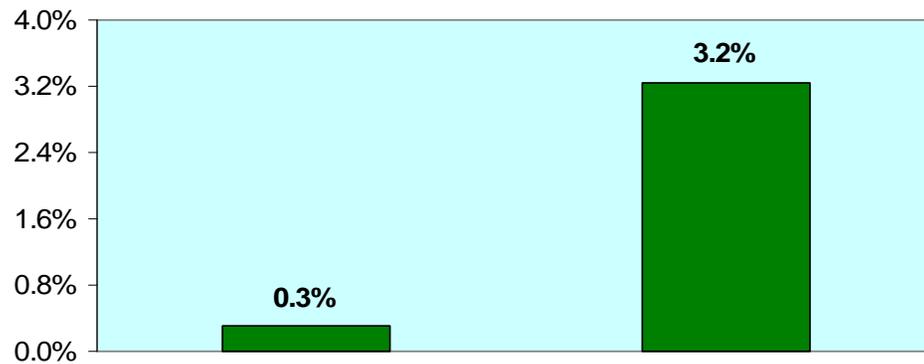
Program and periodically verify that the EMS system is performing full floor lighting sweeps

Install full floor lighting sweeps in the controls

Occupancy Sensors



Whole Building Energy Savings Potential
Low Estimate / High Estimate



Install occupancy sensors to automatically turn off lights when physical movement stops

Mini Case Studies	Cost	Rebate	Annual Savings	Payback	ROI
Installed motion sensors for HVAC controls in conference rooms	\$37,500	\$8,714	\$40,357	8.4 mos.	108%
Installed motion sensors in storerooms	\$10,212	\$888	\$5,800	1.6 yrs	57%
Adjusted motion sensors from 18 minutes to 5-7 minutes	\$2,750	N/A	\$750	3.7 yrs.	27%

6710 Rockledge Drive



Occupancy sensors were installed in the interior, perimeter offices, and hallways that shut off after 10 minutes of inactivity.

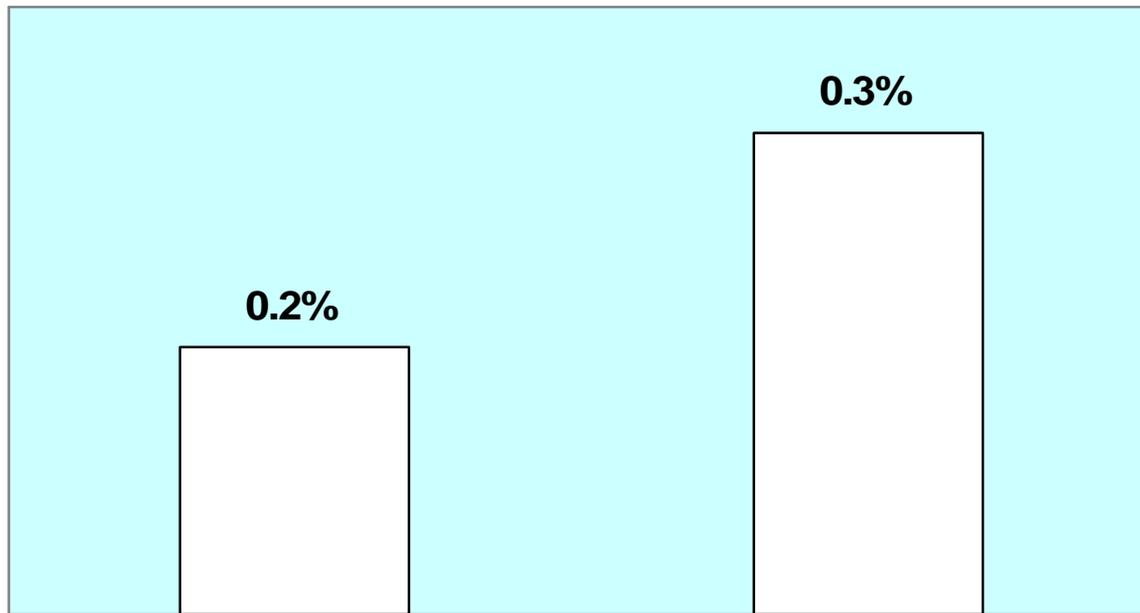


Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI	Asset Value Increase
\$117,000	52¢	\$36,000	16¢	3.25 yrs.	31%	\$450,000

High efficiency LED Exit Signs



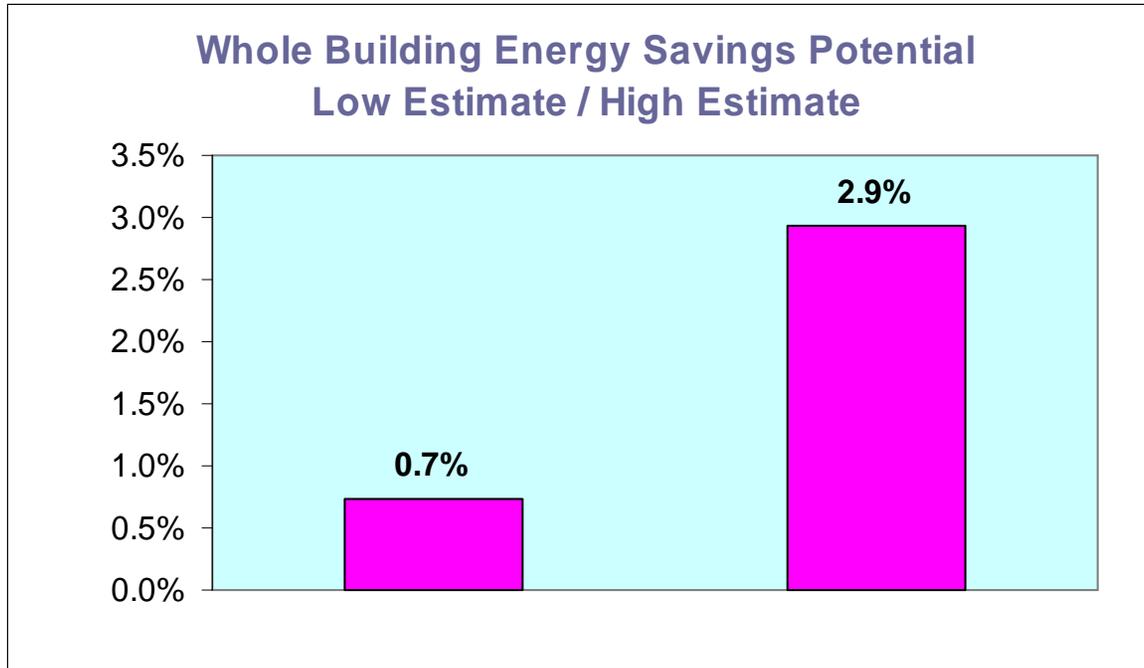
Whole Building Energy Savings Potential Low Estimate / High Estimate



Lower
maintenance
costs due to
extended life

Replace inefficient Exit signs with
high efficiency LED Exit signs

Install Timer Controls or Photocell for Exterior Lighting



➤ Automatically controls lights in response to daylight

➤ Install timer controls or photocell for exterior lighting

Mini Case Study	Cost	Rebate	Annual Savings	Payback	ROI
Installed photocells for exterior lighting	\$2,300	\$400	\$700	2.7 yrs.	37%

1500 Quail



95,435 sf

Exterior Lighting Retrofit

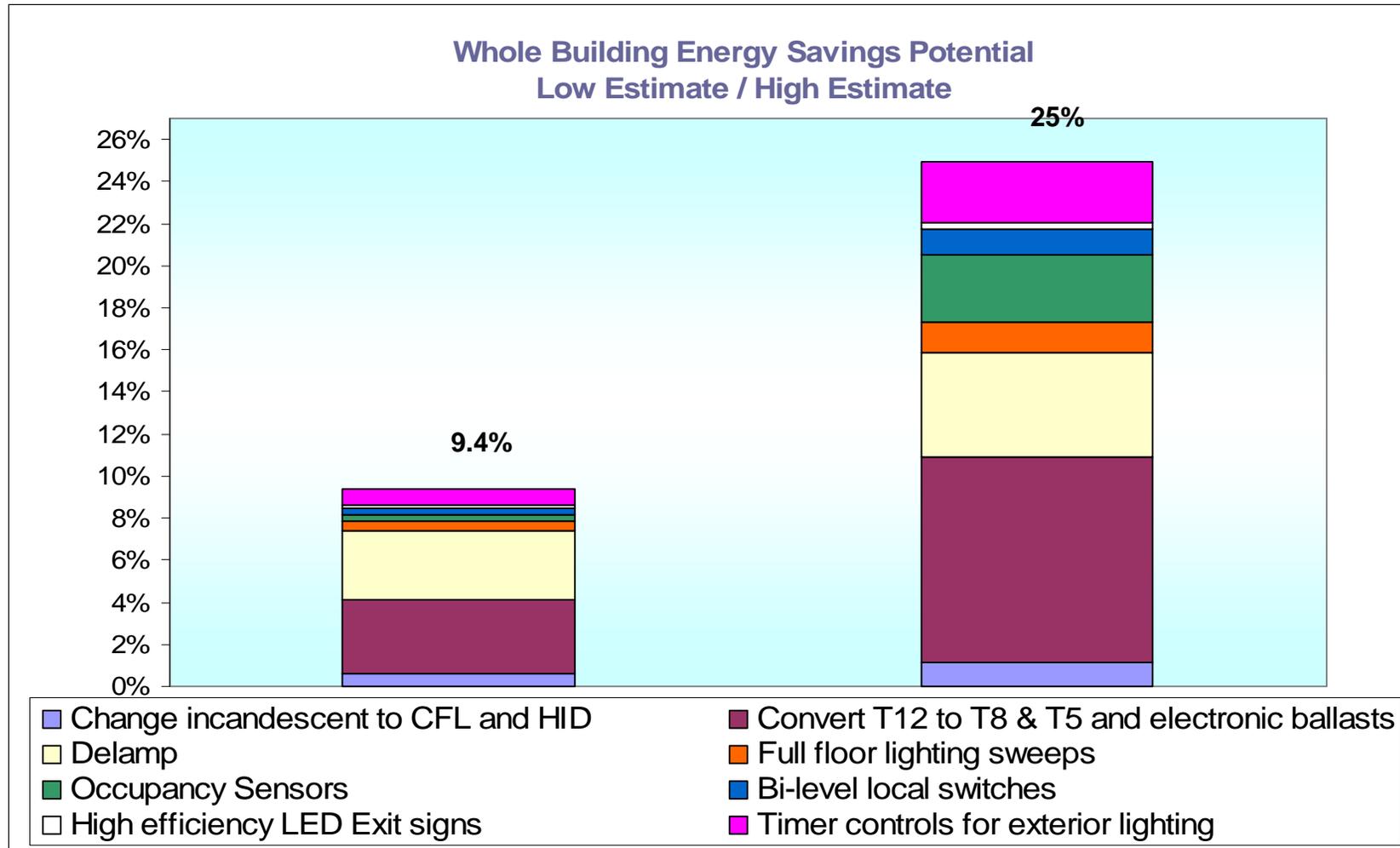
Electrical use in exterior lighting
decreased 43%



Managed by Cushman & Wakefield

Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI	Asset Value Increase
\$11,399	12¢	\$5,256	5¢	2.2 yrs.	46%	\$65,700

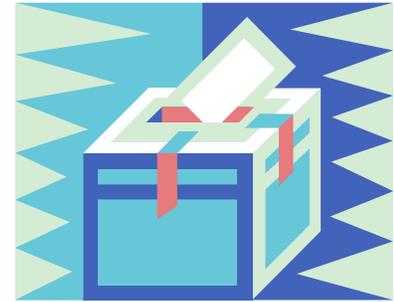
Summary Energy Savings for Lighting



Polling Question



Please open the
Polling panel



to the right of your screen to answer
the polling question

Quantifiable Results for Changes to the Lighting Systems



Note: 100,000 sf Blended rate = \$.09/kWh Initial Energy Performance Rating = 50	Low Estimate		High Estimate	
	Energy savings %	Cost savings \$	Energy savings %	Cost savings \$
Change ICL to CFL & HID	0.6	\$1,300	1.2	\$2,601
Convert T12 to T8 & T5	3.5	7,585	9.7	21,022
Delamp	3.3	7,152	5.0	10,836
Full floor lighting sweeps	0.5	997	1.4	3,034
Occupancy Sensors	0.3	672	3.2	6,935
High efficiency LED Exit Signs	0.2	325	0.3	607
Timer controls and photo cells	0.7	1,582	2.9	6,285
CUMULATIVE EFFECT	9.4	\$20,372	25.0	\$54,180

Denver Place Garage



Converted from 100W high pressure sodium to 28W fluorescent lamps

Reduced ballast factor from 30W to 9W

Reduced wattage per fixture by ½, even though the number of lamps per fixture was doubled



Managed by
Amerimar Realty
Management
Company—CO

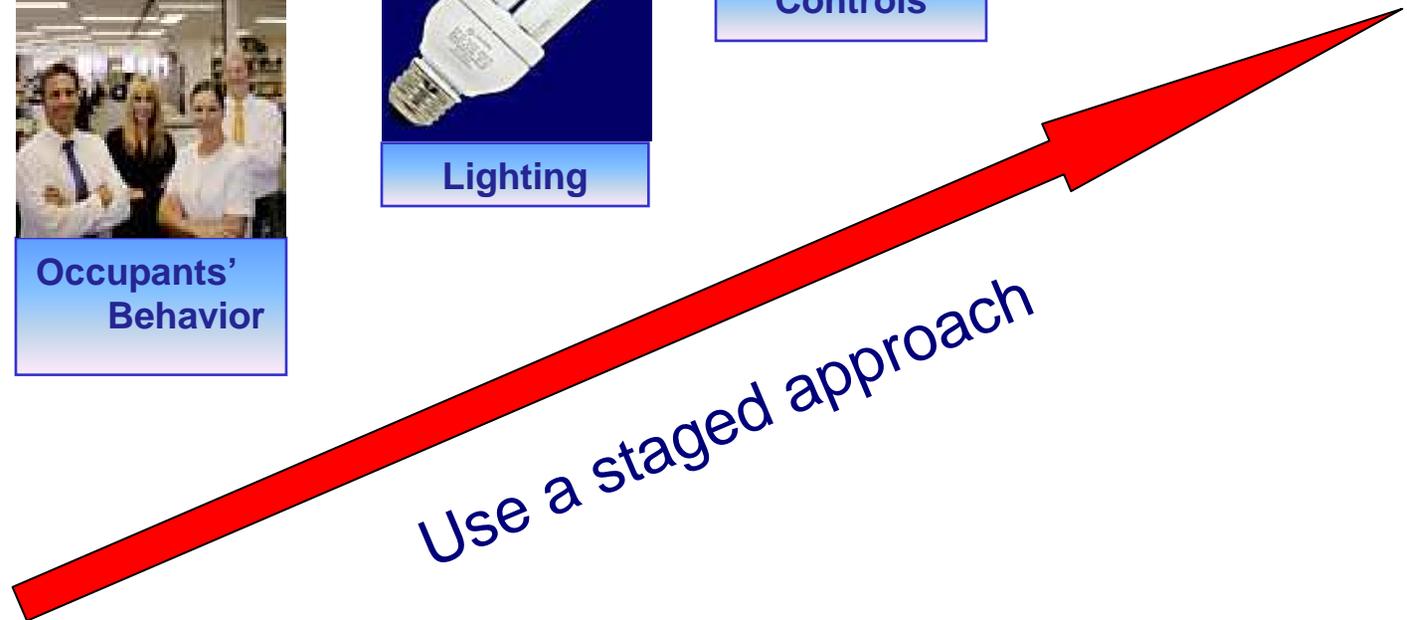
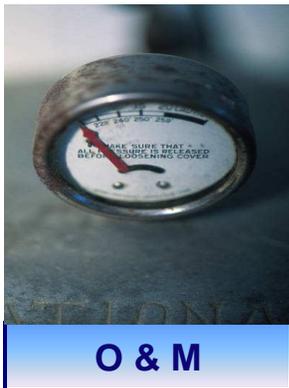
*ENERGY STAR Energy Performance Rating
Before Retrofit = 81 Current Rating = 87*

Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI	Asset Value Increase
\$61,210	16¢	\$20,564	6¢	3 yrs.	34%	\$257,050

Identify and Sequence Low Cost Improvements



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



Controls



Controls

Adjust Temperature

After Hours Usage

Adjust Ventilation

Limit Access to Thermostats

Seasonal Changes

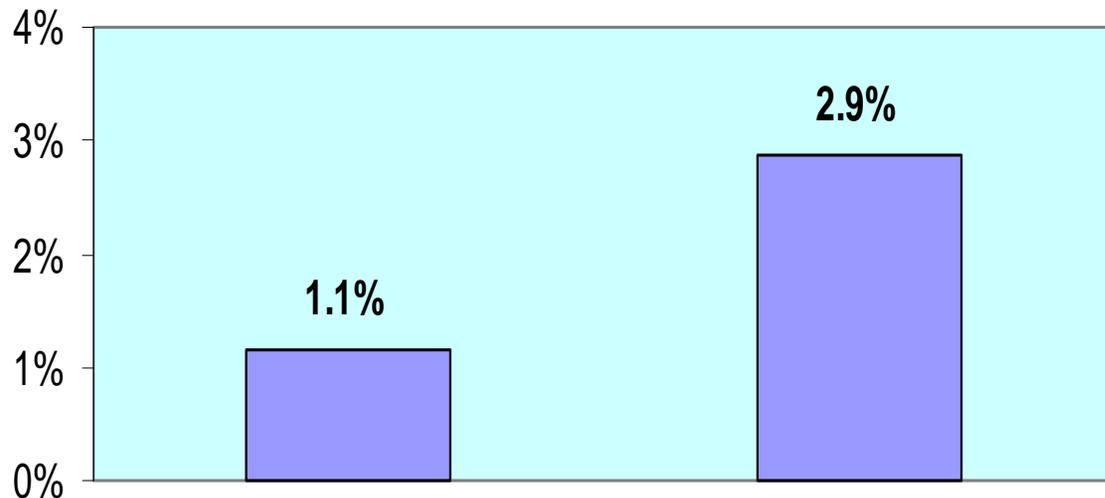
Optimize Start Up Time and Equipment Sequencing

Coast Last Hour of Operations

Adjust Temperature



**Whole Building Energy Savings Potential
Low Estimate / High Estimate**

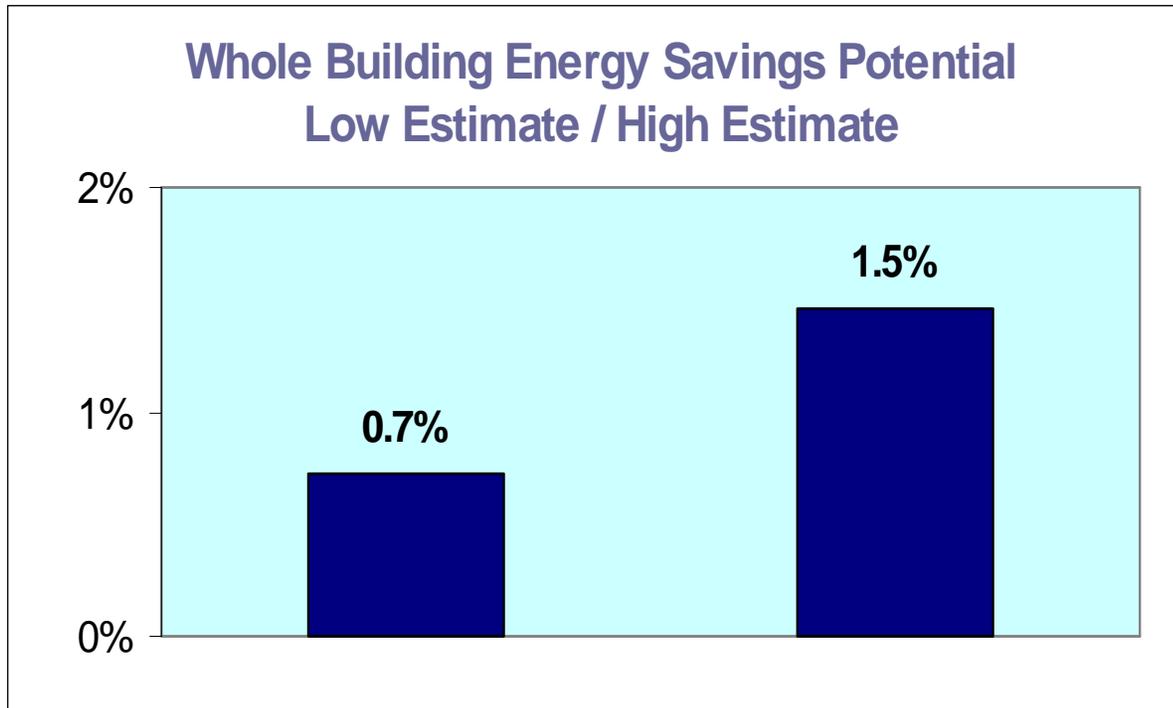


Physically walk through the building and talk with tenants to determine if the actual temperature is comfortable.

Consider clothing worn during that season

Reduce (increase) temp. a min of 10 degrees F at night, weekends and holidays during heating (cooling) season

Review Operating Hours

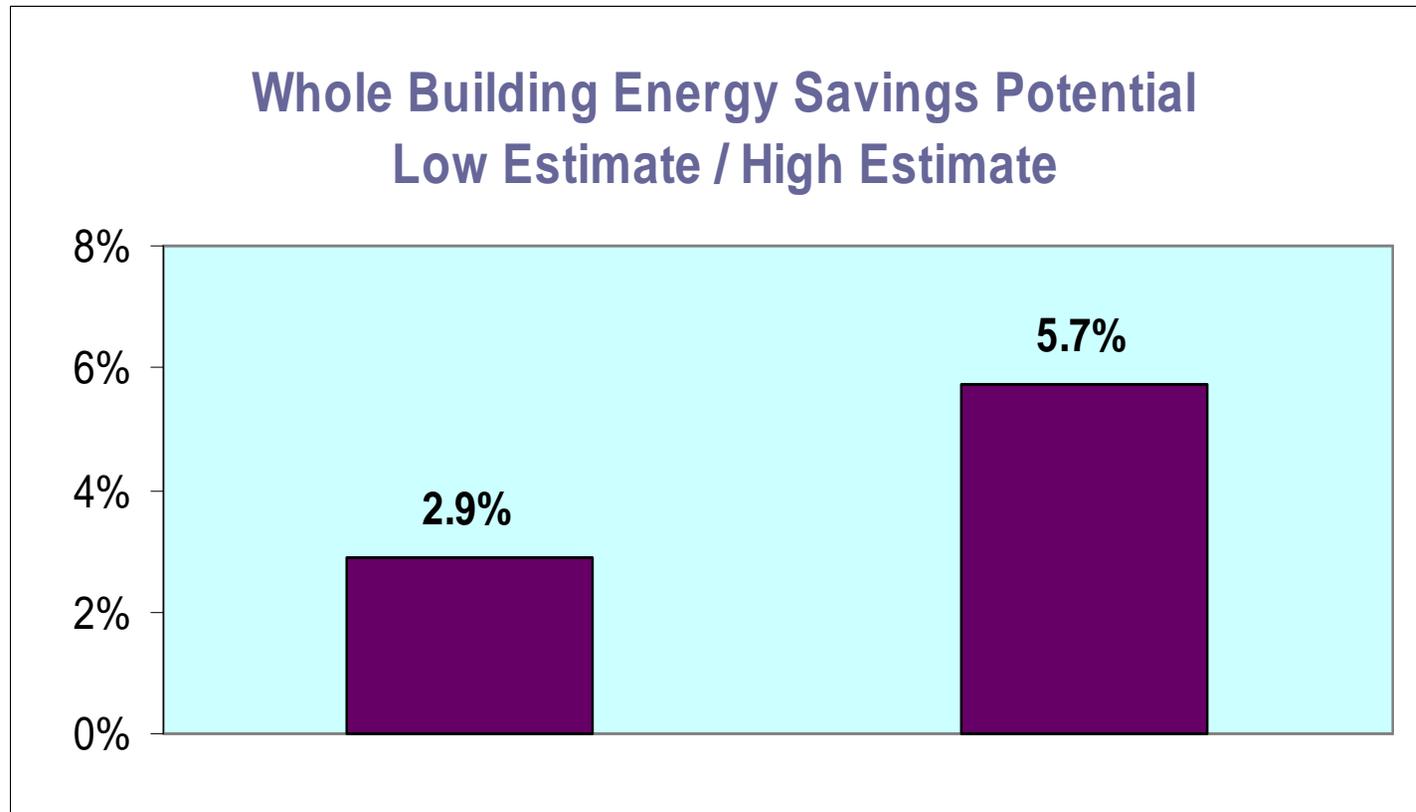


Are you conditioning space when no one is there?

Talk to the tenants to see if they are actually using their space during the lease required operating hours.

Do they really need the air until 7 pm? Or on weekends?

Adjust Ventilation in Low Density or Vacant Space



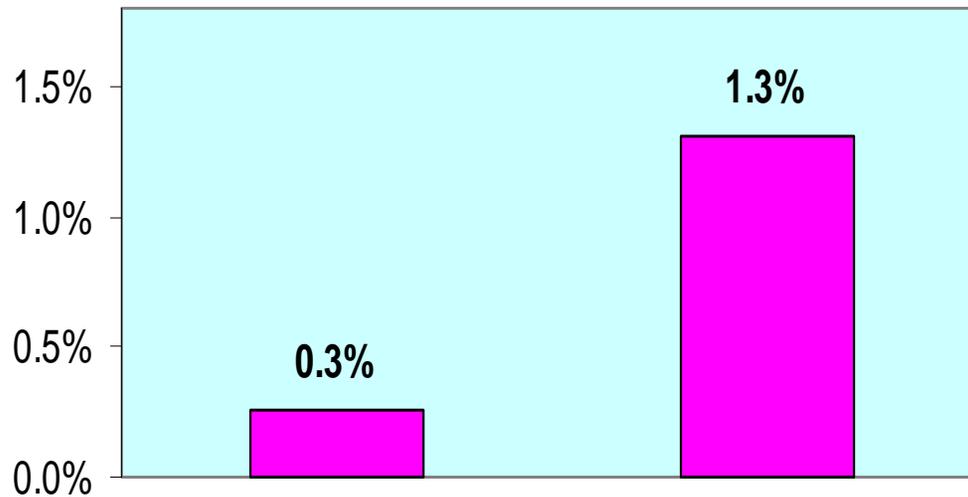
Adjust ventilation in low or unoccupied spaces

Reduce exhaust and outdoor-air ventilation rates within codes

Limit Access to Thermostats



Whole Building Energy Savings Potential
Low Estimate / High Estimate

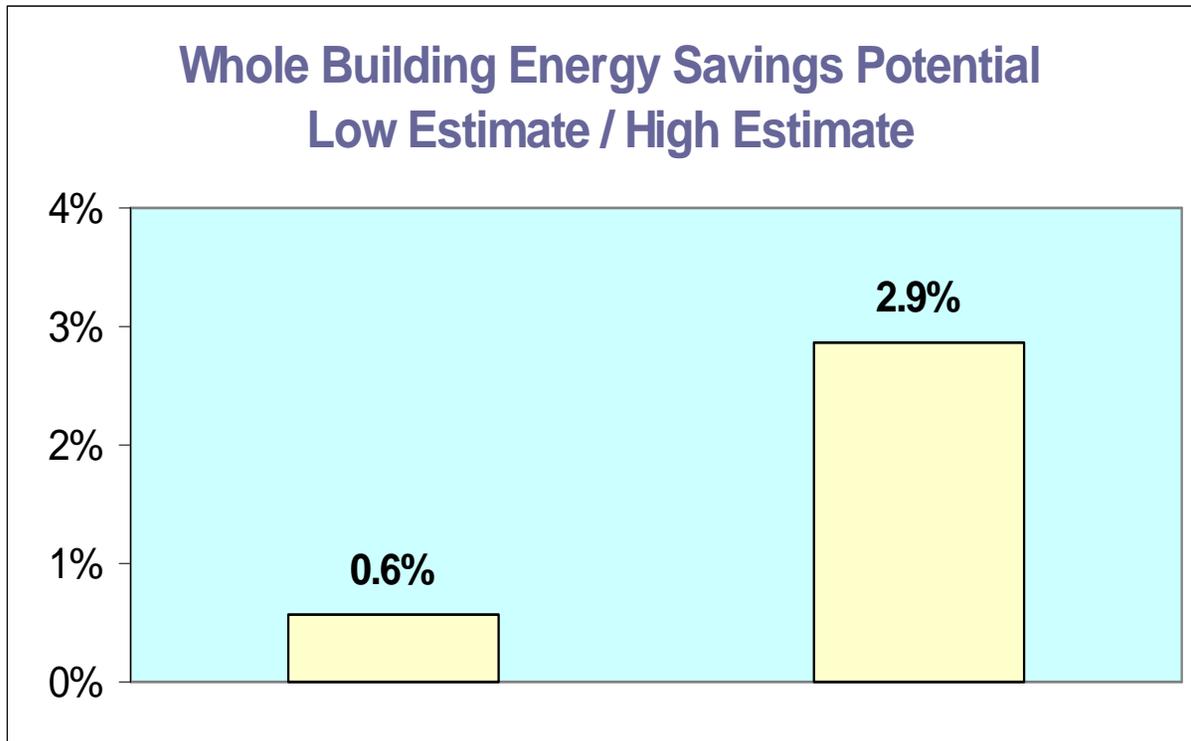


Your job is to protect the thermostats from unauthorized adjustment

- EMS controls
- Tamper-proof locking covers on thermostats
- Locking screws to prevent tampering

Eliminate or minimize tenants' access to thermostats

Optimize Start Up Time & Equipment Sequencing

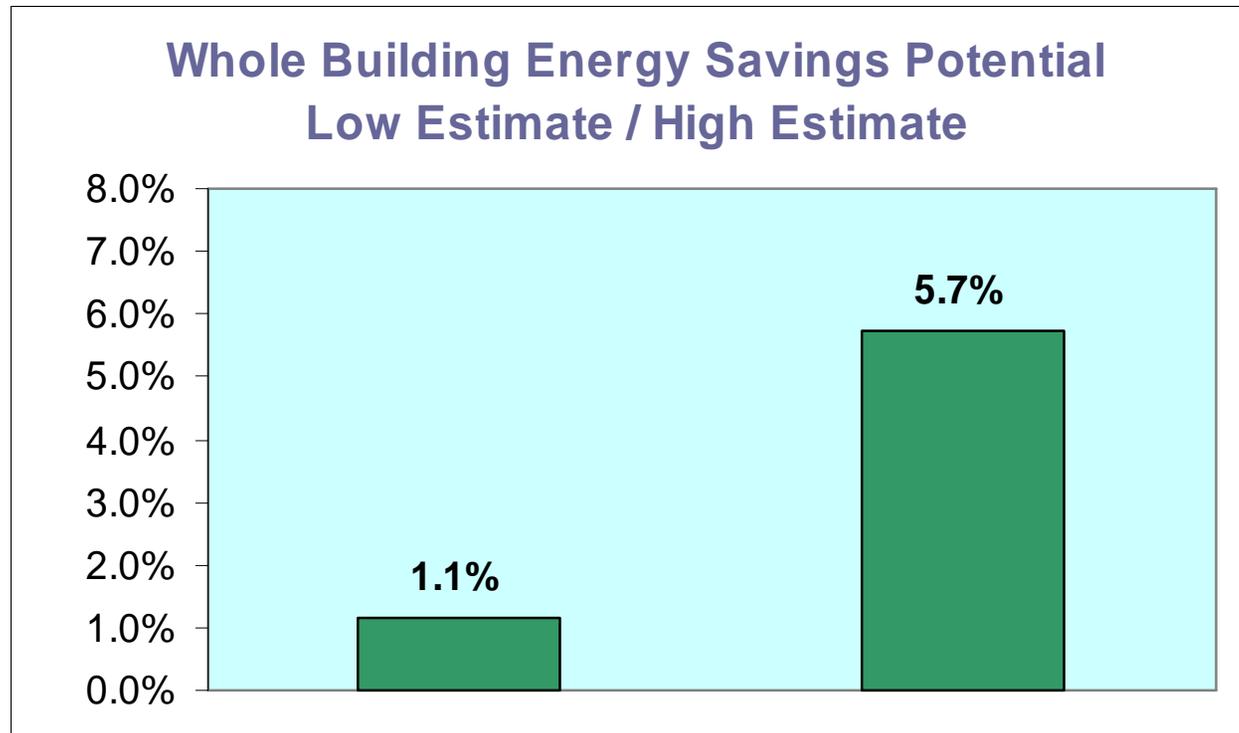


Experiment to determine the **LATEST possible start up time.**

Can you start your systems 5, 10, 15, 30 minutes later and still achieve the desired temperature when tenants arrive?

Mini Case Study	Cost	Annual Savings	Payback	ROI
Changed cooling tower staging and sequencing—50% reduction	\$575	\$12,272	17 days	2,134%

Seasonal Changes



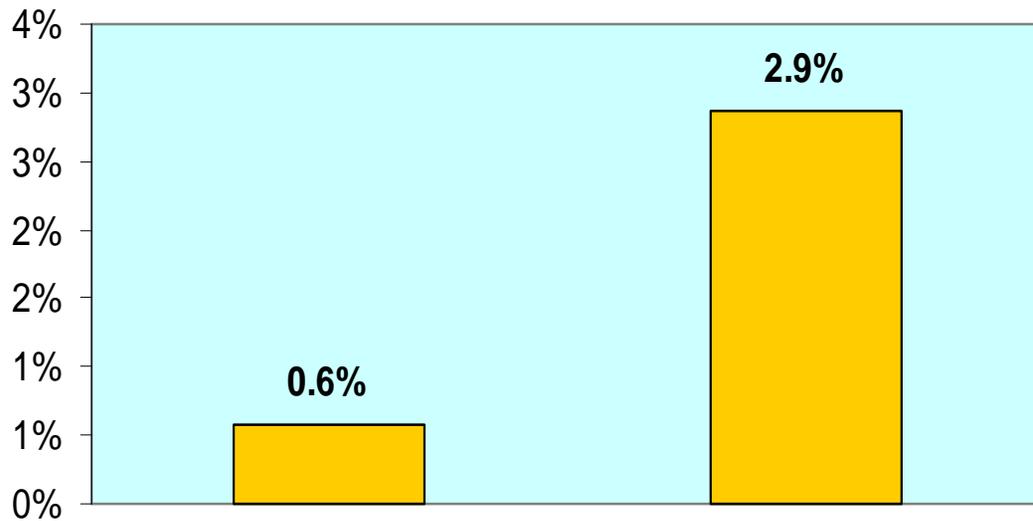
Revisit temperature set points and consider:

- Lower set point in the winter months where tolerable
- Higher set point in the summer months where tolerable

Coast Last Hour of Operations



Whole Building Energy Savings Potential
Low Estimate / High Estimate



Experiment to determine the **EARLIEST possible time** the systems can be powered down while maintaining comfort.

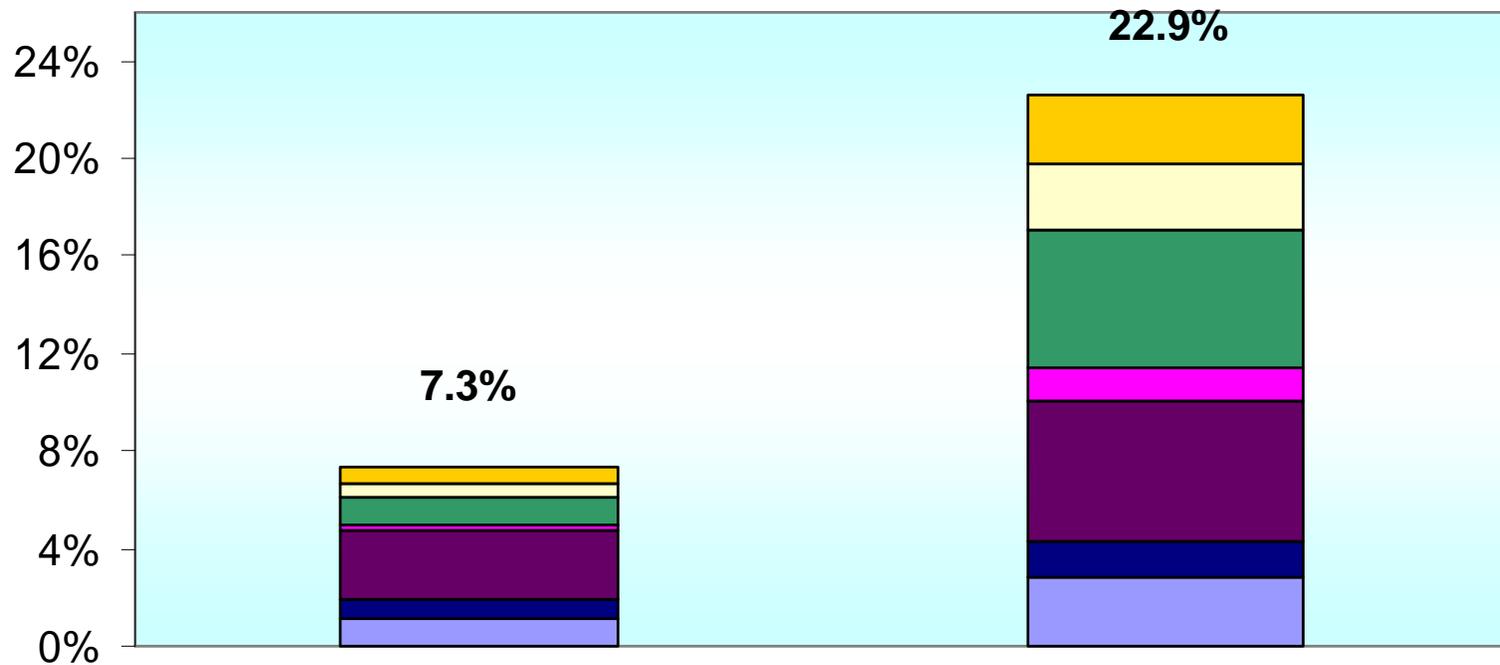
Can you shut down 15, 30, 45, 60 minutes early and still maintain adequate IAQ?

Mini Case Study	Cost	Rebate	Payback	Annual Savings
Reduced operating hours on a fountain from 119 to 60 hrs/week	Negligible	\$926	Immediate	\$6,706

Summary Energy Savings for Control Measures



Whole Building Energy Savings Potential
Low Estimate / High Estimate

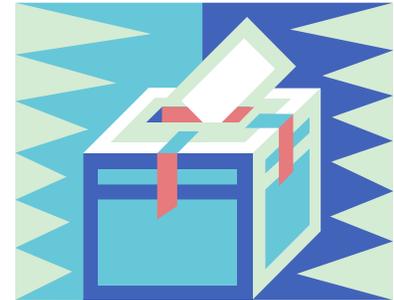


- Adjust Temperature
- Adjust Ventilation
- Seasonal Changes
- After-hours Usage
- Limit Access to Thermostats
- Optimize Start Up Time

Polling Question



Please open the
Polling panel



to the right of your screen to answer
the polling question

Quantifiable Results for Changes to Controls



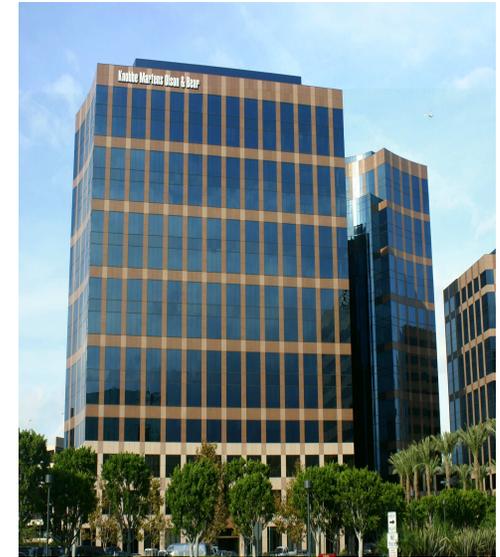
Note: 100,000 sf Blended rate = \$.09/kWh Initial Energy Performance Rating = 50	Low Estimate		High Estimate	
	Energy savings %	Cost savings \$	Energy savings %	Cost savings \$
Adjust Temperature	1.1	\$2,384	2.9	6,285
After Hours Usage	0.7	1,517	1.5	3,251
Adjust Ventilation	2.9	6,285	5.7	12,353
Limit Access to Thermostats	0.3	563	1.3	2,817
Optimize Start-up Times	0.6	1,300	2.9	6,285
Seasonal Changes to Thermostats	1.1	2,384	5.7	12,353
Coast Last Hour of Operation	0.6	1,300	2.9	6,285
CUMULATIVE EFFECT	7.3	\$15,821	22.9	\$49,846

2040 Main Street



Installed new control sequence programming to control:

- Variable frequency drives (VFD)
- Chiller and tower optimization
- Air handler points for static pressure
- Supply/return resets
- Local/global lockouts for strip heaters



Managed by Transwestern
Commercial Services

ENERGY STAR Energy Performance Rating

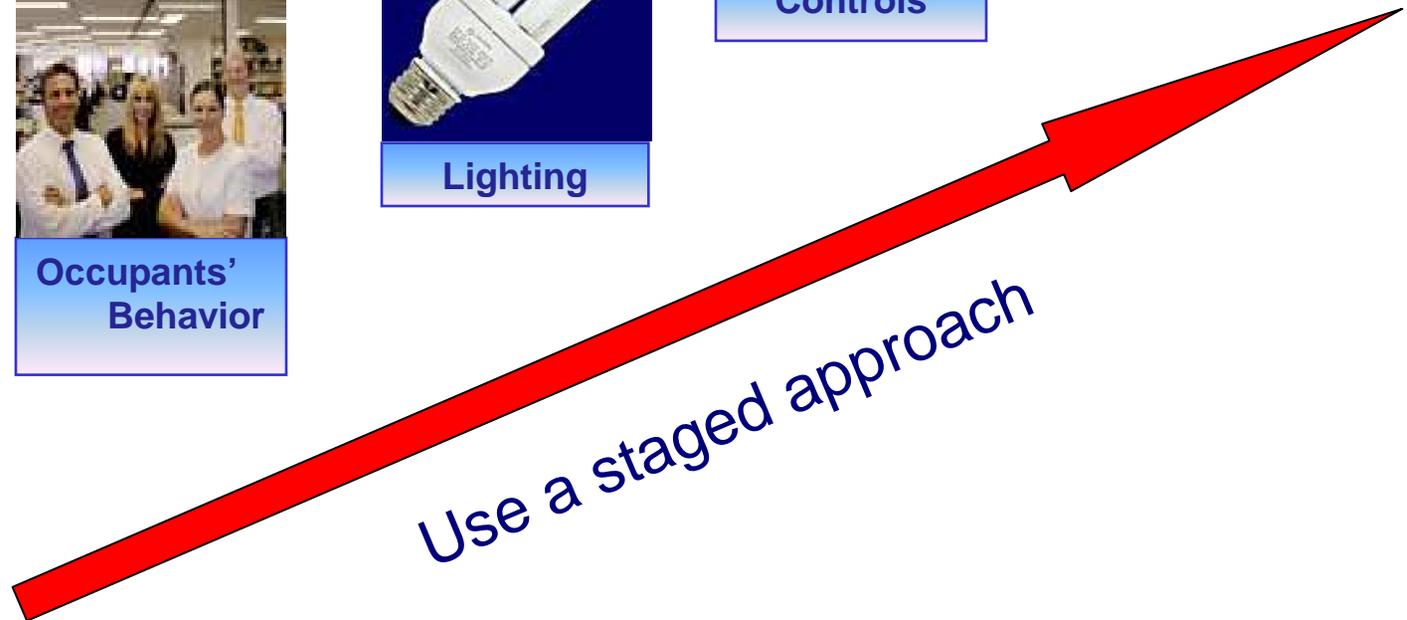
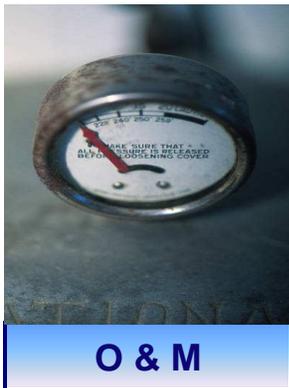
Before Upgrades = 74 Current Rating = 82

Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI	Asset Value Increase
\$56,000	17¢	\$47,000	14¢	1.2 yrs	84%	\$587,500

Identify and Sequence Low Cost Improvements



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



Equipment



Install VFD & VAV

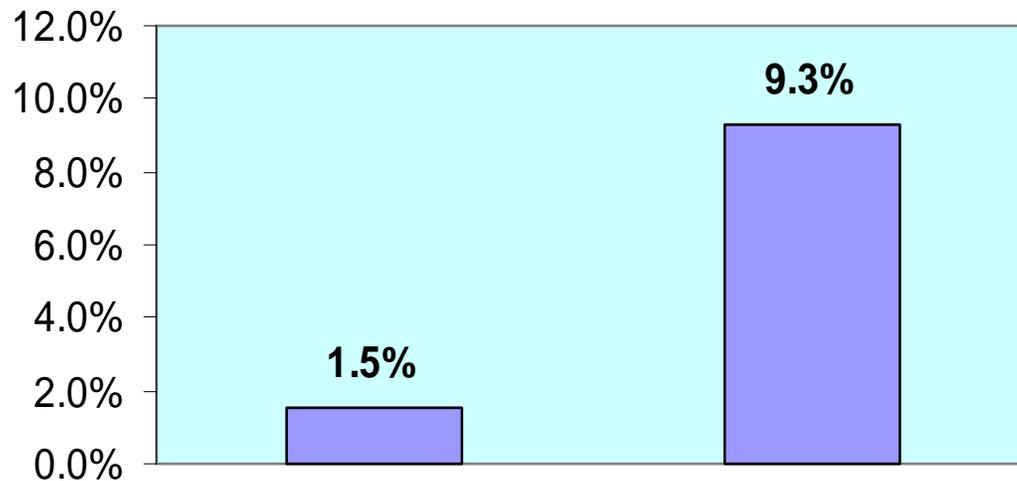
Install Heat Recovery Equipment

Relocate Thermostats to Optimal Locations

Install Variable Frequency Drives & Variable Air Volume Systems



Whole Building Energy Savings Potential
Low Estimate / High Estimate



“Air handling and distribution is the most prevalent deficiency in office buildings.”

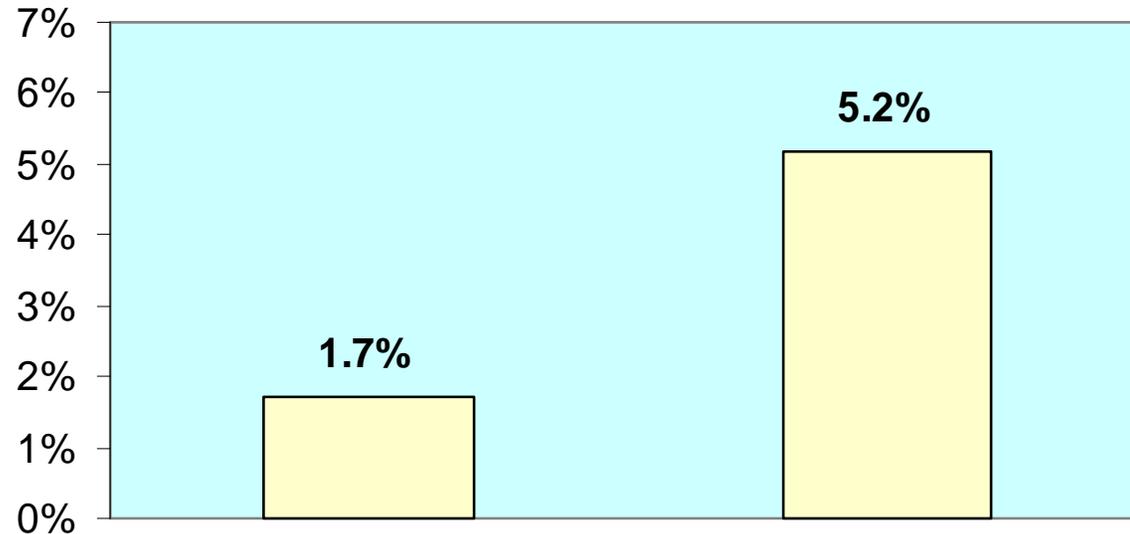
- Motors operate at part-load 98% of the time
- VAV air systems use 30% less energy than constant volume

Mini Case Study	Cost	Annual Savings	Payback	ROI
Install VFDs	\$31,000	\$16,000	2 yrs.	52%

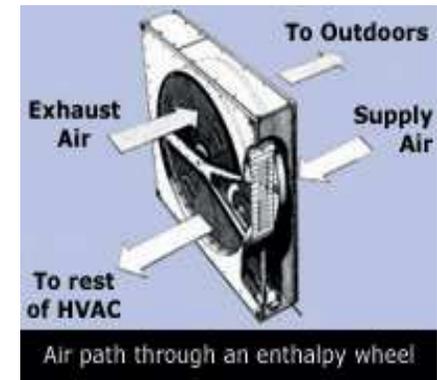
Install Heat Recovery Equipment



**Whole Building Energy Savings Potential
Low Low Estimate / High Estimate**



Enthalpy Wheel



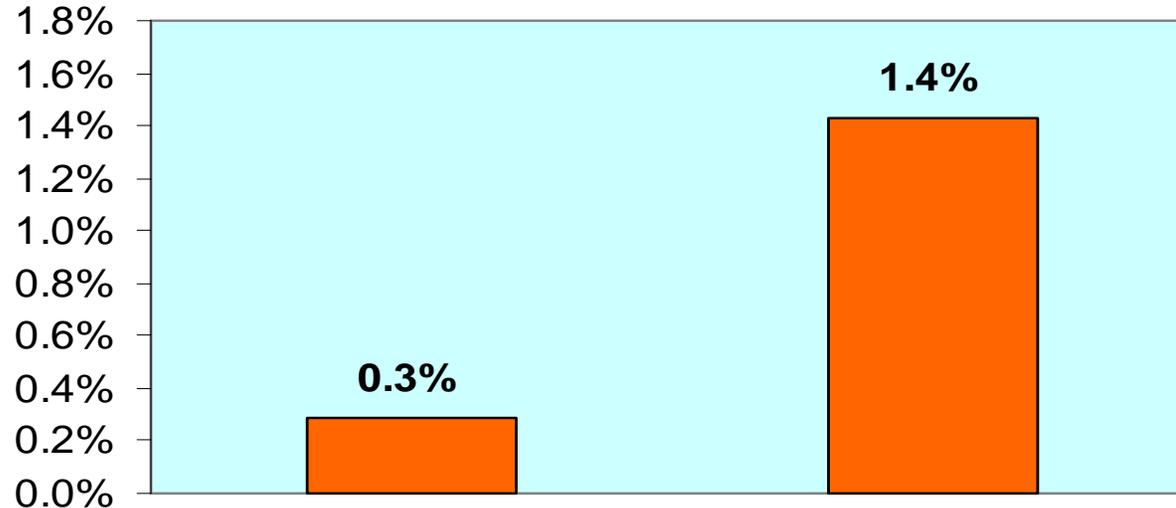
Source: Queen's University, School of Applied Science

**Install heat recovery equipment (enthalpy wheels, heat pipes)
to optimize conditioning of ventilated air**

Relocate Thermostats to Optimal Locations



**Whole Building Energy Savings Potential
Low Estimate / High Estimate**



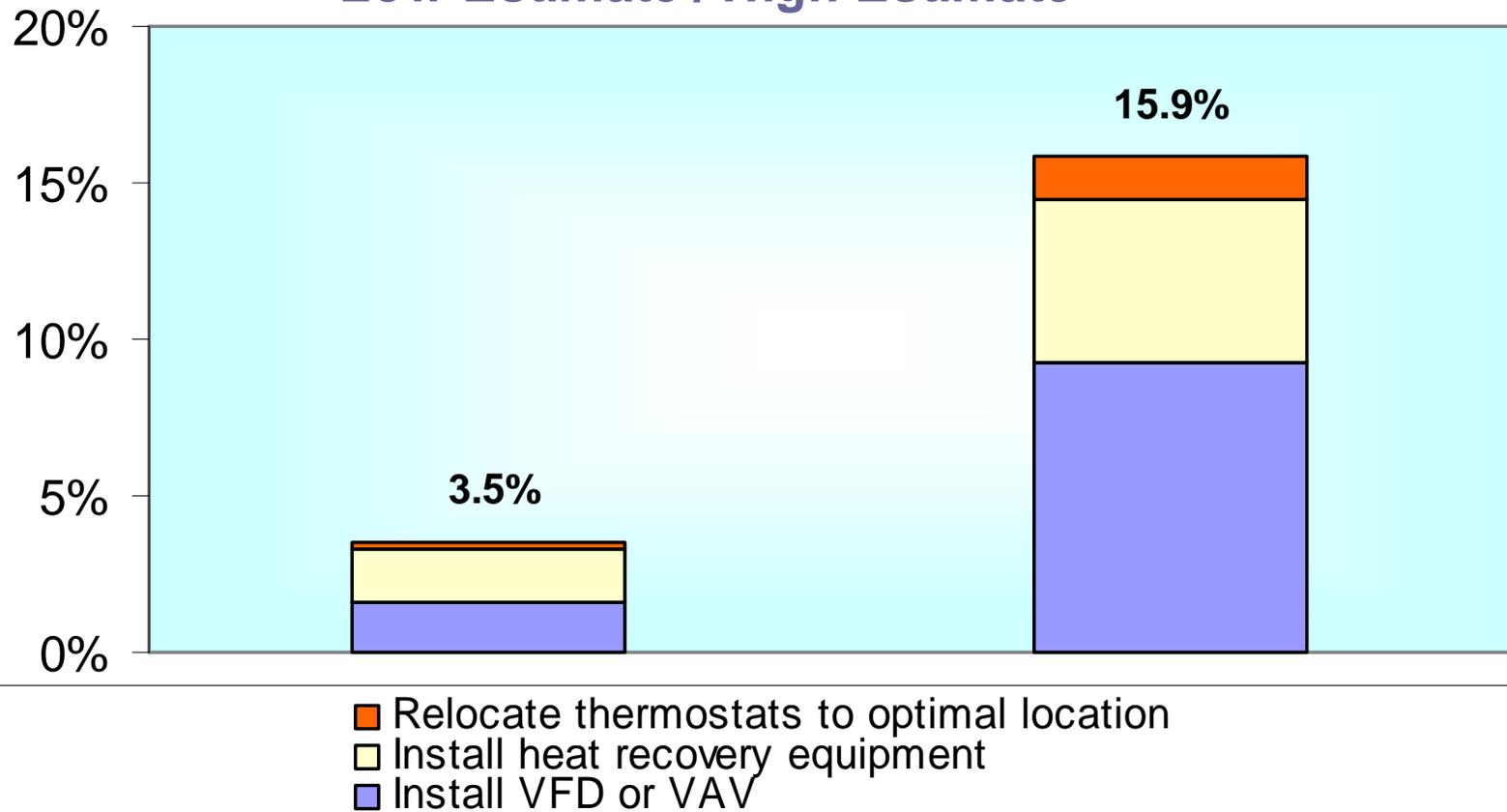
Install or relocate thermostats near return air ducts

Mini Case Study	Cost	Annual Savings	Payback	ROI
Relocate thermostats	\$3,230	\$2,519	1.3 yrs	78%

Summary Energy Savings for Equipment Changes



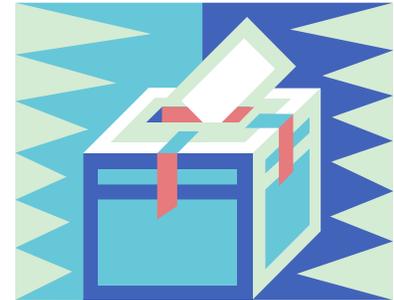
**Whole Building Energy Savings Potential
Low Estimate / High Estimate**



Polling Question



Please open the
Polling panel



to the right of your screen to answer
the polling question

Quantifiable Results for Changes to Equipment



Note: 100,000 sf Blended rate = \$.09/kWh Initial Energy Performance Rating = 50	Low Estimate		High Estimate	
	Energy savings %	Cost savings \$	Energy savings %	Cost savings \$
Install VFD or VAV	1.5	\$3,251	9.3	\$20,155
Install Heat Recovery Equipment	1.7	3,684	5.2	11,269
Relocate Thermostats	0.3	650	1.4	3,034
CUMULATIVE EFFECT	3.5	\$7,585	15.9	\$34,675

International Square



Lighting retrofit
New VFD's

As a result of the **reduced heat load**,
two 3,400 ton chillers
replaced **two 3,800 ton chillers**



Owned and Managed
by CarrAmerica

ENERGY STAR Energy Performance Rating = 84

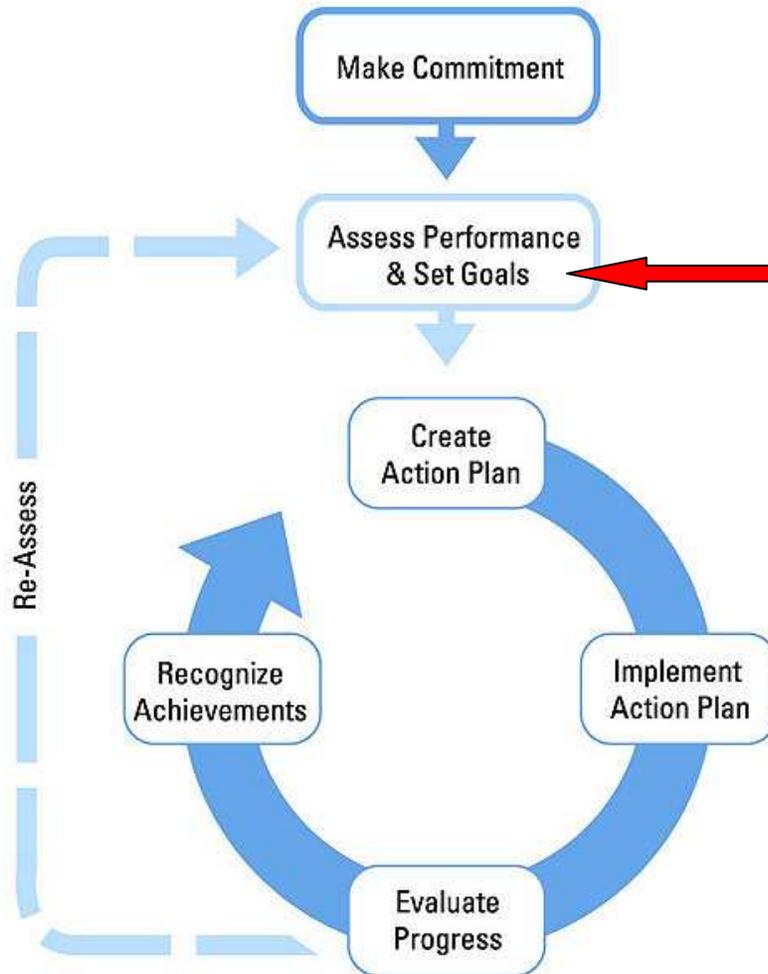
Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI	Asset Value Increase	Annual Energy Savings
\$577,397	61¢	\$241,500	26¢	2.4 years	42%	\$3 mil	3 mil kWh

Agenda



- Review Energy Performance Rating System
- Identify areas for improvements
- **Set realistic and achievable performance goals**
- Create an action plan

Set Energy Performance Goals



Upon completing the benchmarking process you can set performance goals by setting a:

1. Target rating
2. Target energy reduction

Set Energy Performance Goals



Set either an Energy Performance Target Rating
or a target Energy Reduction Goal

Baseline Period (12 Months Ending): 03/31/2006					
Target	Baseline Rating (1-100)	Baseline Energy Use (kBtu/year)	Target Energy Use (kBtu/year)	Energy Cost Savings (\$/year)	Target Reduction (%)
<input type="text" value="57"/>	50	8,216,096	7,487,827	\$21,672	<input type="text" value="10"/>
Set Target Rating			Set Target Reduction		

Cancel

Recalculate

Save

Reduce Consumption Increase Savings



100,000 sf
 Operating hours = 65
 # of Occupants = 400
 # of PC's = 480
 Cost of energy = \$.09/kWh

Cost Savings at Various Levels of Energy Reduction

Initial Rating	1% Energy Reduction	3% Energy Reduction	5 % Energy Reduction	10% Energy Reduction
50	\$2,167	\$6,502	\$10,836	\$21,672
70	\$1,620	\$4,860	\$8,100	\$16,200
90	\$1,187	\$3,561	\$5,936	\$11,871

Agenda



- Review Energy Performance Rating System
- Identify areas for improvements
- Set realistic and achievable performance goals
- Create an action plan

Best Practices Checklist



<i>Best Practices Checklist for Improved Energy Performance</i>	High Estimate Potential Energy Savings %	Opportunity Exists?	Target Reduction	Who is Responsible?	Target Date to Complete	Actual Date Completed	Notes
Operations & Maintenance							
Ensure all equipment is functioning as designed	11.5						
Calibrate thermostats	2.9						
Adjust dampers	5.7						
Implement janitorial best practices	8.0						
Occupants' Behaviors							
Turn off equipment	5.2						
Institute and energy awareness program	1.7						
Purchase Energy Star equipment	1.9						
Install Power Management Software	3.0						
Harvest daylight	1.9						
Install work station task lighting	1.4						
Lighting							
Change incandescent to CFL & HID	1.2						
Convert T-12 to T-8 and T-5	9.7						
De-lamp	5.0						
Install full floor lighting sweeps	1.4						
Install occupancy sensors	3.2						
Install high efficiency LED exit signs	0.3						
Install timer controls	2.9						

Best Practices Checklist



<i>Best Practices Checklist for Improved Energy Performance, continued</i>	High Estimate Potential Energy Savings %	Opportunity Exists?	Target Reduction	Who is Responsible?	Target Date to Complete	Actual Date Completed	Notes
Adjust temperatures for comfort	2.9						
Evaluate and combine after hours usage	1.5						
Adjust ventilation	5.7						
Limit access to thermostats	1.3						
Optimize start-up times	2.9						
Adjust thermostats for seasonal changes	5.7						
Coast last hour of operations	2.9						
Equipment							
Install VFD or VAV	9.3						
Install heat recovery equipment	5.2						
Relocate thermostats	1.4						

Industry Resources



ENERGY STAR Resources

- Guidelines for Energy Management (sample Energy Management Plan)
http://www.energystar.gov/index.cfm?c=guidelines.download_guidelines
- ENERGY STAR Building Manual
 - Recommissioning http://www.energystar.gov/ia/business/BUM_recommissioning.pdf
 - Lighting Stage http://www.energystar.gov/ia/business/BUM_lighting.pdf
 - Load Reductions http://www.energystar.gov/ia/business/BUM_supplemental_loads.pdf
 - Fan System: http://www.energystar.gov/ia/business/BUM_fan_systems.pdf
 - Heating and Cooling Systems http://www.energystar.gov/ia/business/BUM_heat_cool.pdf
 - Glossary http://www.energystar.gov/ia/business/BUM_glossary.pdf
- Monitor and CPU Power Management
http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_management
- Communication Kit http://www.energystar.gov/index.cfm?c=ck.ck_communications_kit
- ProjectKalc—a tool to analyze lighting upgrades
http://www.energystar.gov/index.cfm?c=business.bus_projectkalc
- Quik Chill—a tool to assess centrifugal chillers upgrades
http://www.energystar.gov/index.cfm?c=business.bus_quikchill
- Find Expert Help: ENERGY STAR Service and Product Providers Directory
http://www.energystar.gov/index.cfm?fuseaction=SPP_DIRECTORY
- ENERGY STAR Brochure for Commercial Tax Incentives
http://www.energystar.gov/ia/business/comm_bldg_tax_incentives.pdf
- The Financial Power of Energy Star
http://www.energystar.gov/ia/business/comm_real_estate/downloads/CRE_Financial_Power.pdf
- Contact ENERGY STAR Buildings@EnergyStar.gov

Industry Resources



Department of Energy Resources

- Actions You Can Take to Reduce Cooling Costs
http://www1.eere.energy.gov/femp/pdfs/om_cooling.pdf
- Actions You Can Take to Reduce Heating Costs
http://www1.eere.energy.gov/femp/pdfs/om_combustion.pdf
- Facility Metering for Improved Operations, Maintenance, and Efficiency
http://www1.eere.energy.gov/femp/pdfs/om_metering.pdf
- Case Study: In-house Retro-commissioning at a DOE National Laboratory
http://www1.eere.energy.gov/femp/pdfs/om_retrocx.pdf
- Maintaining Effective and Efficient Lighting Can Help Save Energy and Reduce Costs
http://www1.eere.energy.gov/femp/pdfs/om_lighting.pdf
- O&M Tips to Save Money Now http://www1.eere.energy.gov/femp/pdfs/om_savemoney.pdf
- O&M Best Practices: A Guide to Achieving Operational Efficiency
<http://www.eere.energy.gov/femp/pdfs/OandM.pdf>
- Financing Solutions and Incentives <http://www.doe.gov/energyefficiency/financing.htm>

Lawrence Berkley National Laboratory

- Portland Energy Conservation Incorporation, Energy Systems Laboratory: Texas A&M University, and the Department of Energy. *The Cost-Effectiveness of Commercial Buildings Commissioning: A Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States* <http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html>

Industry Resources



Portland Energy Conservation Incorporation Resources

- 15 O&M Best Practices: For Energy Efficient Buildings http://www.peci.org/library/PECI_15BestOM_0302.pdf
- Operations & Maintenance Assessments: A Best Practice for Energy Efficient Operations http://www.peci.org/library/PECI_EEOp1_0302.pdf
- Putting the O Back into O&M: Best Practices in Preventive Operations, Tracking, and Scheduling http://www.peci.org/library/PECI_OBackinOM.pdf

Texas A&M University System

- Continuous Commissioning in Energy Conservation Programs <http://www-esl.tamu.edu/cc/index.html>
- Green Cooling: Improving Chiller Efficiency http://eetd.lbl.gov/newsletter/cbs_nl/nl10/greencooling.html

Washington State University Energy Program

- Energy Auditor Checklist <http://www.energy.wsu.edu/ftp-ep/pubs/rem/energyaudit/audit2.pdf>

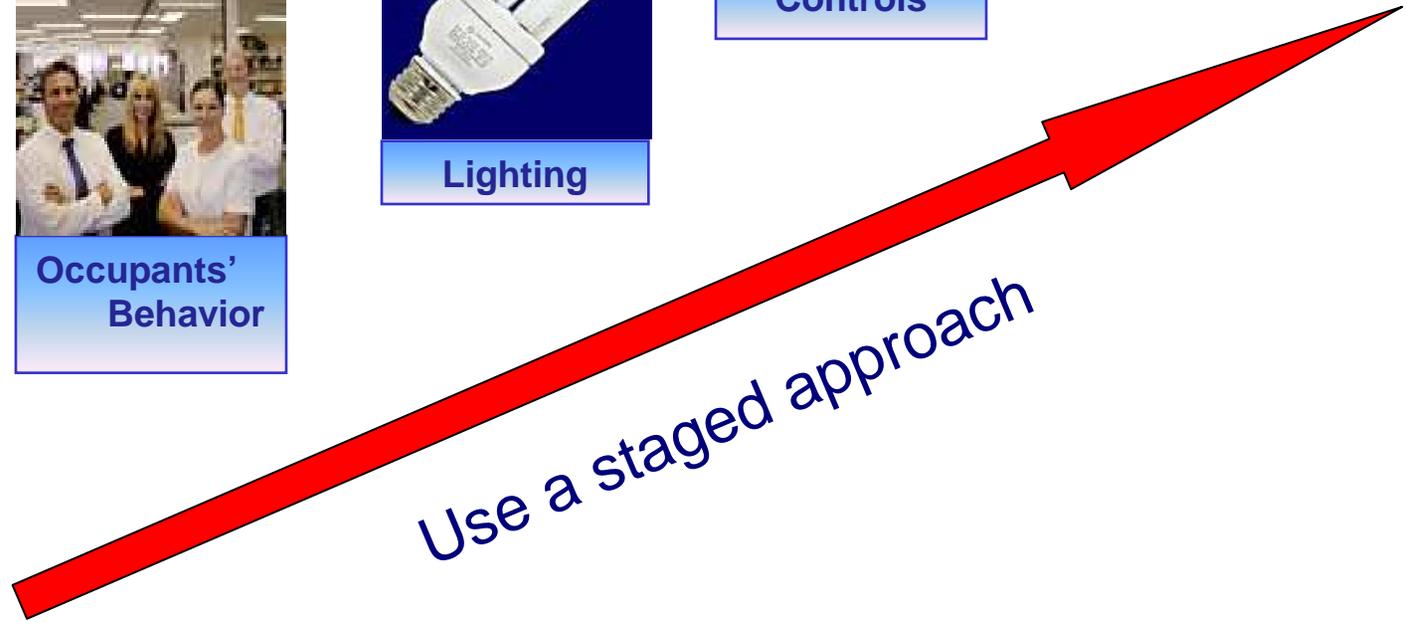
Other Relevant Articles

- Enthalpy Wheel <http://www.appsci.queensu.ca/ilc/greenBuilding/enthalpy/>
- Wheels Turning for Energy Savings at High School http://www.esmagazine.com/CDA/ArticleInformation/Case_Item/0,2534,69410,00.html

Identify and Sequence Low Cost Improvements



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



Adobe Systems



Reduction goal: Reduce energy consumption 10%

Actual performance: Reduced energy consumption 13.7%

Implemented over 40 low and no-cost improvements



ENERGY STAR Energy Performance Ratings

Three building complex 86, 84, & 79

Managed by
Cushman & Wakefield

Cost	Rebate	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI	Asset Value Increase	Annual Energy Savings
\$1.1 mil	\$300,000	88¢	\$900,000	98¢	11 mos.	113%	\$11.25 mil	13.7%

Thrivent Financial Corporate Headquarters

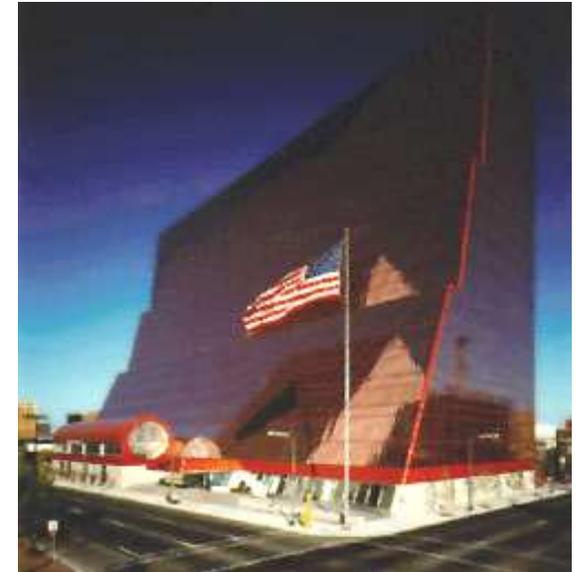


O&M:

- Eliminated short circuits in ventilation system
- Performed floor damper maintenance

Controls:

- Adjusted thermostat for seasonal changes
- Used temperature set-backs for unoccupied areas
- Custom start-up routine
- Improved chilled water pumping control



Cost	Cost / sf	Annual Savings	Annual Savings / sf	Payback	ROI	Asset Value Increase	Annual Energy Savings
\$247,000	47¢	\$140,000	\$1.76	1.8 yrs.	57%	\$1.75 mil	12%

Questions?



Evaluation



Please take a few moments to fill out the polling form. We value your feedback and will use it to improve future trainings.

Thank you!