BUILDINGENERGY BOSTON

Retrocommissioning For Existing Buildings

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New Construction (RCx) vs. Existing Buildings (EBCx)

Different Starting Points

New Construction

- New equipment
- Current drawings
- Defined schedules & set points
- Maintenance staff ready to learn new system
- Assembled team

Existing Building

- Older, poorly-performing equipment
- Lack of drawings
- Multiple layers of change
- Maintenance staff used to running the building ‘as is’
- No assembled team

A Story in 3 Chapters

Chapter 1: Fundamentals of EBCx

Chapter 2: What Does EBCx Entail?

Chapter 3: Developing an EBCx Plan

Today's EBCx Panel

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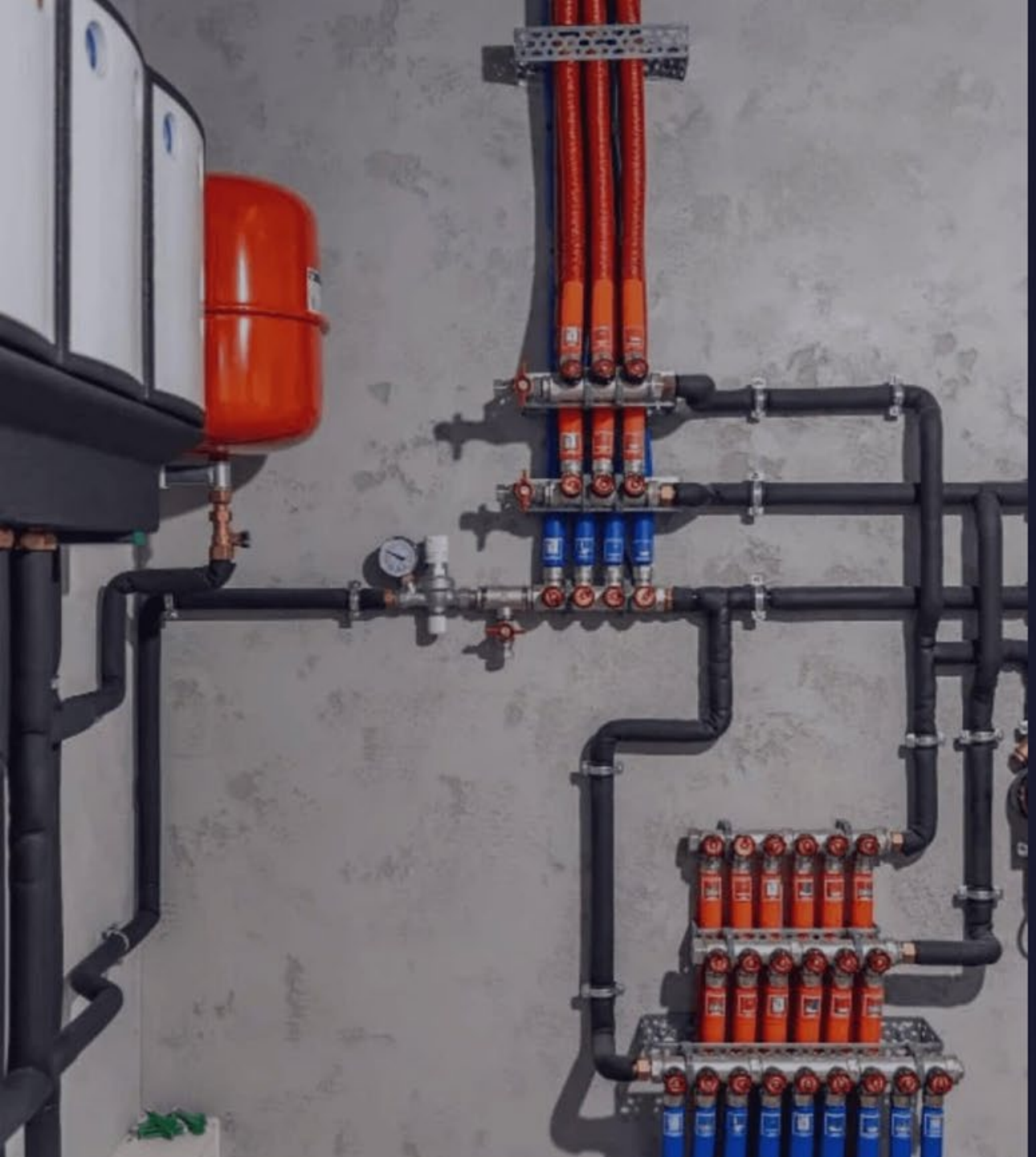
Retrocommissioning For Existing Buildings

CHAPTER 1

Fundamentals of EBCx

Why EBCx matters and how it drives performance

Meta



Most Buildings Are Underperforming

20 –30% Energy Wasted

Due to operational drift, not design flaws.

15% Savings Potential

Median whole - building energy reduction.

1.1 Years Simple Payback

One of the fastest ROIs in the industry.

What You Typically Find

COMMON OPERATIONAL FAULTS

Controls Drift

Setpoints and schedules that have been manually overridden and never reset.

Simultaneous Heating & Cooling

Systems fighting each other due to poor sequence logic or sensor error.

Sensor Failures

Broken or uncalibrated sensors driving equipment to run at 100% unnecessarily.

Scheduling Errors

Equipment running 24/7 or during unoccupied hours due to clock drift or bypass.

Why It Pays Off

Tangible Returns Across the Board

15%

Energy Savings

Optimized sequences and schedules directly reduce utility consumption without capital upgrades.

↓ 30%

Fewer Complaints

Proactive tuning prevents hot/cold calls and improves indoor air quality for tenants.

↑ NOI

Asset Value

Lower operating expenses directly increase Net Operating Income and property valuation.

LEED v4.1 O+M

PREREQUISITE

Existing Building Commissioning is mandatory for certification.

ENERGY STAR

SCORE 75+

Requires verified operational performance, not just design intent.

BUILDING ENERGY PERFORMANCE

BUILDING CODE

Requires building performance data, if not decarbonization plan.

SYSTEM DIAGNOSTICS

How Do You Know If Your Building Is Performing?

STATUS: MONITORING

Benchmarking (EUI)

Compare your Energy Use Intensity (kBtu/sf) against peer buildings in the CBECS database.

TARGET: < 50 KBTU/SF

Comfort Complaints

Frequent hot/cold calls are the #1 leading indicator of HVAC control drift and system fighting.

METRIC: CALLS PER MONTH

Utility Trends

Unexplained spikes in consumption often reveal hidden equipment failures or schedule overrides.

ANALYSIS: YEAR - OVER YEAR

BAS Alarm History

A high volume of suppressed or ignored alarms typically masks critical system faults.

STATUS: CRITICAL

Making the Financial Case

EBCx is a low-risk operational expense (OpEx), not a capital project.

$0.27

PER SQ. FT.

Median project cost.

1.1

YEARS PAYBACK

Simple payback period.

15%

ENERGY SAVINGS

Median reduction.

Key Takeaways

The Gap is Real:
Operational drift causes 20–30% energy waste in most buildings.

Proven ROI:
EBCx delivers ~15% savings with a rapid 1.1-year payback.

Market Drivers:
Compliance (EISA, LL87) and Certification (LEED) now mandate it.

Holistic Strategy:
Success requires addressing Energy, Finance, and the Envelope together.

Retrocommissioning For Existing Buildings

CHAPTER 2

What Does EBCx Entail?

The EBCx process explained

WHAT IS EXISTING BUILDING RETRO COMMISSIONING?

Existing Building Commissioning (EBCx) a.k.a Retro-commissioning: *A systematic, data-driven process applied to existing buildings. It evaluates HVAC systems, lighting, and control systems to restore or optimize performance, enhancing energy efficiency, occupant comfort, and equipment life*

What does it do?

It fixes operational issues, inefficient sequences, and maintenance deficiencies that developed over time

BUILDING PERFORMANCE METRICS

Energy Star Portfolio Manager

- 80+ Building types
- Emissions and energy intensity score
- Scoring range is 1-100, where 100 represents the highest performance

I2SL/Labs2Zero

- Specific to life sciences

EXISTING BUILDING COMMISSIONING PROCESS

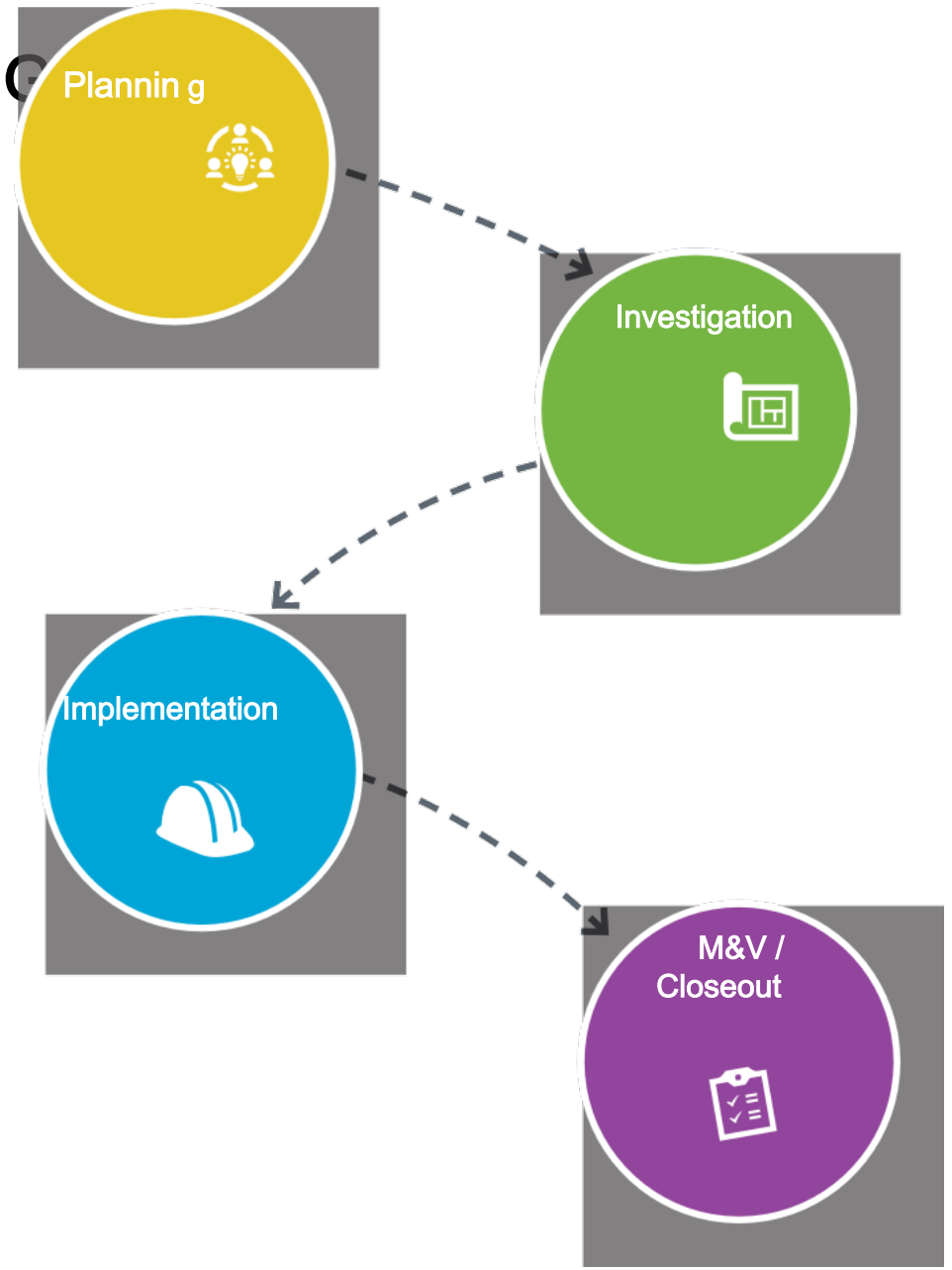
Planning Phase

Investigation Phase

Implementation Phase

Measurement and Verification (M&V)

Closeout / Training



PLANNING PHASE

- Select one or more buildings for EBCx
- Identify project goals:

    a. Zero-Over-Time, 3 Yr ROI, LEED, etc

- EBCx provider is quarterback
- Develop EBCx team i.e facilities, BAS vendor, Mechanical and TAB contractor
- Gather information:

    a. Utility bills, drawings, master plans

Timeline: 3 to 5 weeks

INVESTIGATION PHASE

Site Assessment

a.Inspect equipment, listen and feel.

Staff Interviews

a.Identify hot/cold complaint areas.

b.Equipment with frequent repairs / failures

Review Building Operation

a.Understand original design intent vs current use and occupancy patterns

Timeline: 6 to 8 weeks

Functional Testing

a. Focus on major energy consuming equipment i.e data centers, central plants, AHUs

b. 25% sample of terminal boxes in conjunction with trend reviews

c. Test sequence of operations to identify faulty dampers, actuators, sensors or control valves.

ASHRAE Level 2 Energy Audit

a. Detailed energy and financial analysis

b.Comprehensive report that delivers actionable information for building owner to make informed decisions.

Typical Executive Summary of ECMs

Table 1 - RECOMMENDED ENERGY REDUCTION MEASURES (ECMS) AND OTHER IMPROVEMENTS

ECM Number	Energy Conservation Measures (ECMs)	Estimated Implementation Cost	Estimated Utility Incentives	Estimated Annual Utility Savings			Estimated Annual Cost Avoidance	Simple Payback (yrs)	ROI
				Demand (kW)	Electric (kWh)	Natural Gas (Therms)			
3.1	Unoccupied Setbacks	$65,700	$52,560	0	79,030	35,550	$65,024	0.2	495%
3.2	Chilled Water Plant Optimization	$161,727	$55,068	0	229,450	0	$50,479	2.1	47%
3.3	Add Chiller VFD Supplemental Cooling	$40,000	$34,560	50	144,000	0	$31,680	0.2	582%
3.4	S-10 Supply Temperature Reset	$6,500	$4,200	0	5,000	1,500	$3,110	0.7	135%
3.5	HHW Loop Optimization	$28,008	$22,406	0	1,949	23,752	$32,256	0.2	576%
3.6	Automate MOB FTR Valves	$30,000	$21,729	0	1,462	10,689	$14,645	0.6	177%
3.7	Repair S-12 Casing and Duct Leaks	$6,500	$1,790	0	6,616	101	$1,591	3.0	34%
3.8	OR LED Lighting	$68,000	$30,522	0	101,740	0	$22,383	1.7	60%
Capital Total		*$406,435*	*$222,835*	*50*	*569,247*	*71,592*	*$221,168*	*0.8*	*120%*
				Estimated Current Use:	19,642,080	1,336,756	6,080,222		
				Base Program Impact:	3%	5%	4%		

Estimated Blended Marginal Rates

0.22 $/kWh Electricity
1.34 $/therm Natural Gas

Utility Incentive
$0.24 $/kWh Electricity
$2.00 $/therm Natural Gas

IMPLEMENTATION PHASE

- Select ECMs for implementation
    a. Cross check with facility master plans
- Secure capital funding and leadership support
- Select a consultant for projects requiring engineering support.
- Obtain firm contractor bids
- Finalize local utility incentive offering

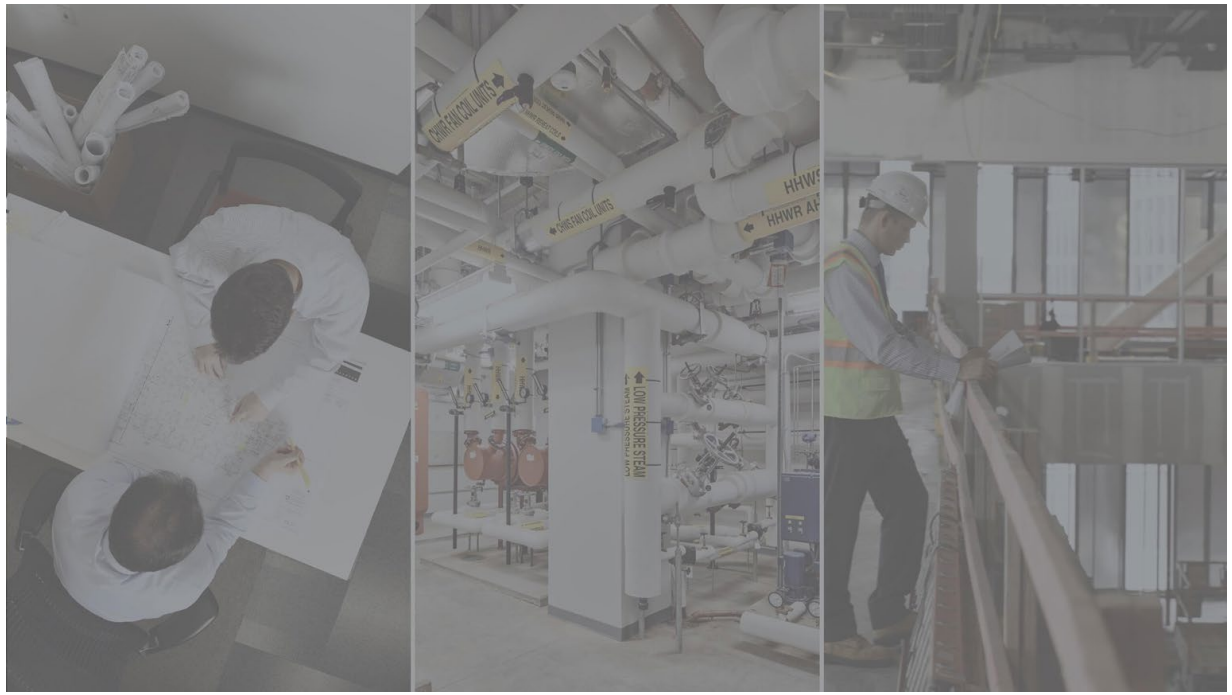
Timeline: 3 to 12 Months depending on scale and complexity.

MEASUREMENT AND VERIFICATION (M&V)

- Verify ECM performance will achieve utility consumption savings
- Review post installation trends
- Update calculations and savings estimates as needed
- Tweak parameters seasonally as needed
- Monitoring Based Cx (MBCx) or Continuous Cx program for persistent building performance / savings over time.

CLOSEOUT / TRAINING

- Complete training with owner staff on changes
- RCx provider submits final reports
- Update As-built drawings, sequence of operation and O&M documentation
- Transfer of knowledge
- Budget to re-commission upgrades every 3 to 5 years for persistent building performance.



Retrocommissioning For Existing Buildings

CHAPTER 3

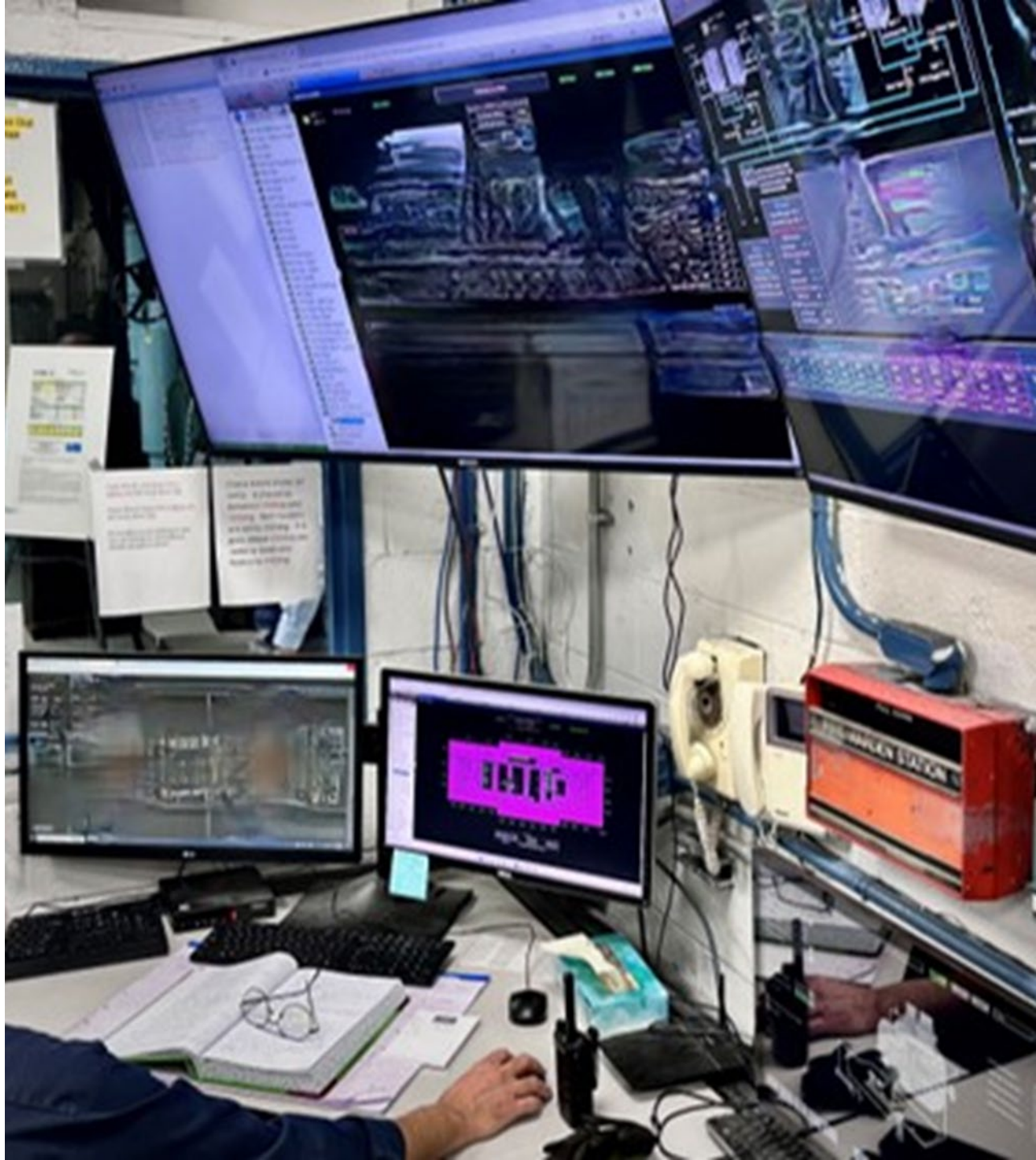
Developing an EBCx Plan

Planning, tips and pitfalls

From Rationale to Action

Existing Building Commissioning is the fastest, low-cost way to reduce energy, improve system reliability, and advance compliance with increasingly stringent building performance standards.

Owners struggle to define scope, build a business case, and translate findings into sustained operational improvements.



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How to Develop the EBCx Scope

A clearly defined scope sets you up for success!

- Identify a project champion
- Explicitly list the problem you are trying to solve
- Clearly defined scope - analysis and deliverables
- Expectations of savings vs. implementation support
- Scope specific to implementation support and progress tracking

You will need

- Building drawings
- Sequence of Operations
- BMS trending capability (sensors, valves, etc.)
- Energy use data by source

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EBCx Scope

Low/No Cost Items

Retro-Commissioning Measures (RCM)

- Deficiencies identified through testing, inspections, calibrations
- Classified as RCMs or Observations based on energy impact
- RCMs can be no cost or low cost
- Measure categories – insulation, AHU damper Control, leaks, valve controls, sensor calibration, overridden SOO, etc.

Energy Conservation Measures (ECM)

- Recommended measures to improve performance beyond the current design and operations - ASHRAE 36 guidelines
- Focus on low-cost measures
- Quantify energy & cost savings, and implementation costs to prioritize ECMs

Long-term CapEx Planning

Long-term Decarbonization Roadmap

- High-level review of pathways to decarbonize the building
- Option for phased approach
- ROM costs based on other similar studies

Best Practices for Owners and Operators

Budget and Prioritize Scope

- Budget for the Scope and Pursue Incentives
- Prioritize High-Impact & High-Risk Assets
- Focus on Deferred Maintenance & Upgrades

Engage Stakeholders

- Consultant and Operators - One Team
- The Project Champions Streamlines Engagement
- Operators are involved throughout

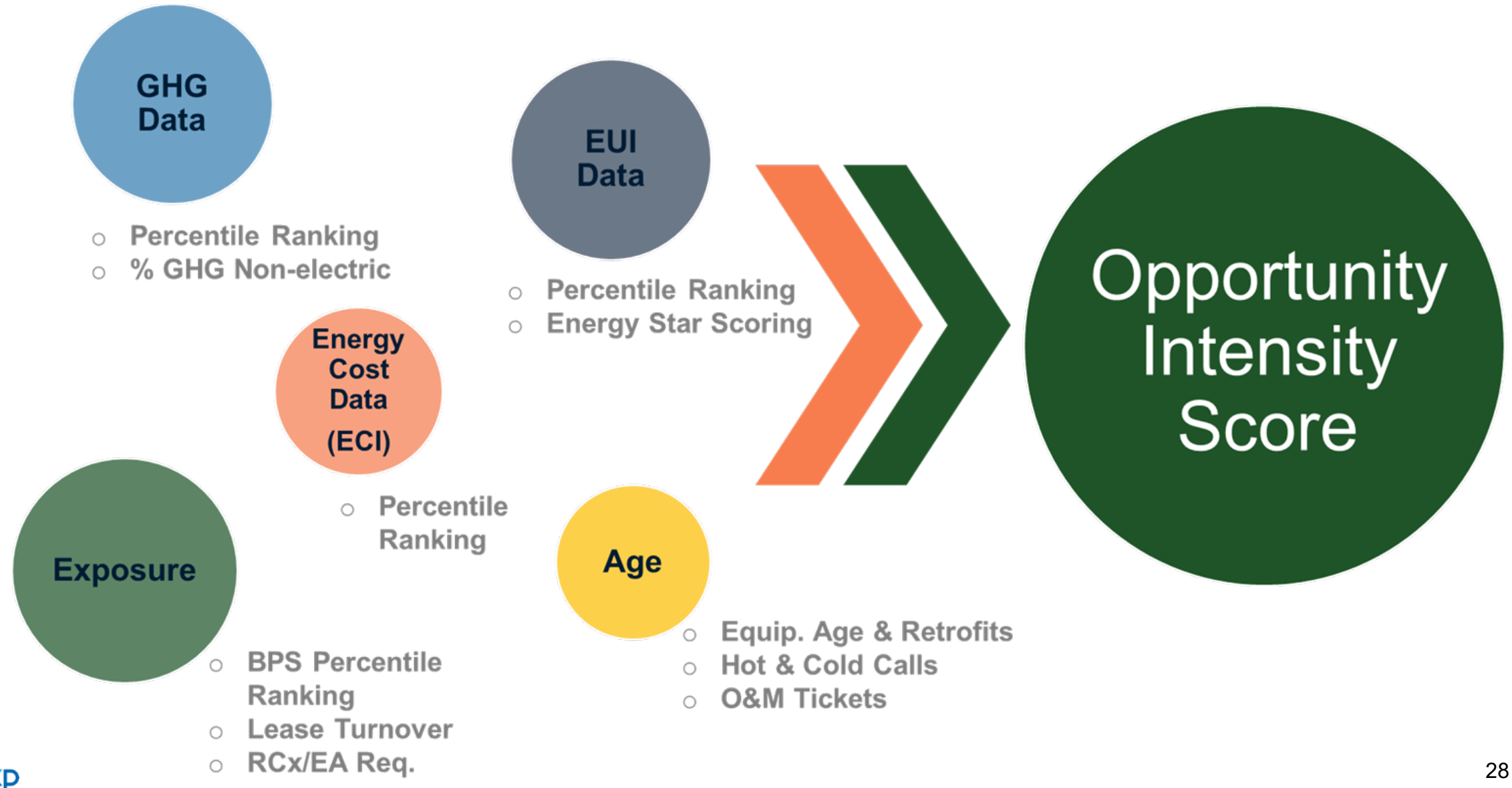
Track and Resolve Issues

- Monitor Implementation Progress
- Resolve High-Impact Issues First
- Report on % Resolved and Lessons Learned

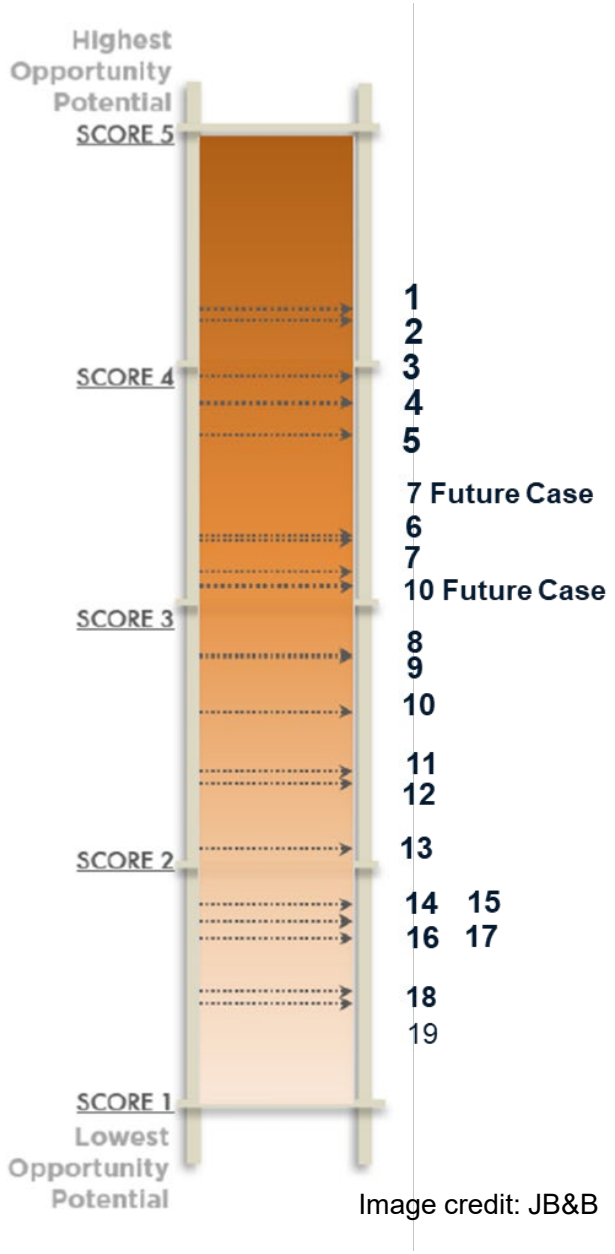
Support Capital Planning

- Integrate Findings with Capital Budgets
- Drive Cost-Effective Investments

How to Identify Which Buildings Need EBCx - Asset Prioritization



Case Study: Opportunity Intensity Scoring Results



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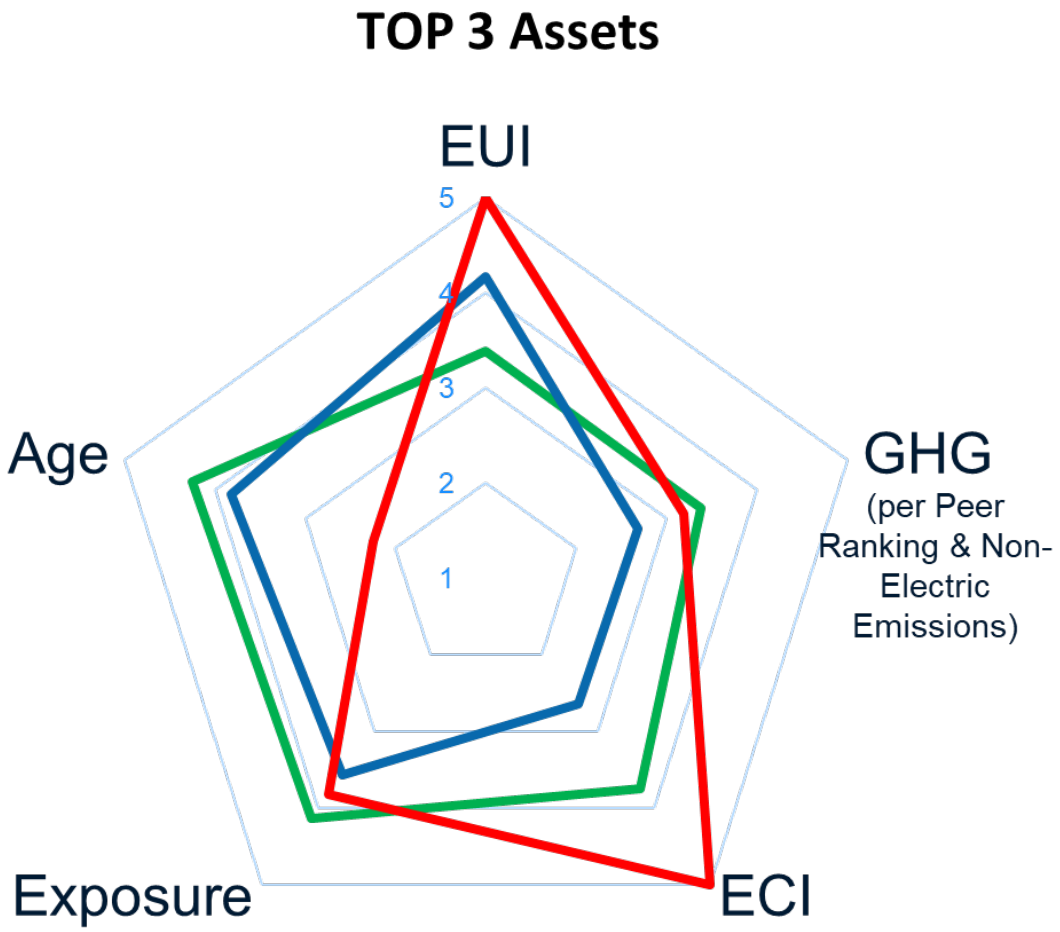

EBCx Measure	Updated O&M Practice	Details	Frequency
OA Damper Auto Control	Routine Walkthroughs	Check damper positions on dedicated recurring walkthroughs, calling the BMS operator to confirm damper positions match.	**Bi-annual**
	Damper Override Testing	At each damper, have the BMS operator force override position to fully closed and fully open and confirm the damper physically matched the command.	**Bi-Annual**
Valve Control	Routine Walkthroughs	Check valve position on dedicated recurring walkthroughs, calling the BMS operator to confirm valve positions match.	**Bi-Annual**
	Valve Override Testing	The BMS operator force override position fully closed and fully open and confirm the valve physically matches the command.	**Bi-Annual**
Sensor Calibration	In-house/External Calibration Checks	With a calibrated device, check the accuracy of each sensor. If outside acceptable bounds, record and calibrate/replace. **Prioritize - static pressure, differential pressure, supply temperature, OA temperature**	**Annual**
BMS Programming	High-level Override Checks	Check for and release user overrides on individual graphic pages (schedule, setpoints, fan speeds, etc.)	**Seasonal**
		Using timers on overrides necessary for occupant comfort	**Seasonal**
	Scan BMS Graphics	Quick scan to note any issues on local/BMS display	**Weekly**

Identify the Performance Gap

Common Pitfalls

- ❑ Treating EBCx as “just a report” to check it off the list
- ❑ Overscoping without the regard to staff capacity
- ❑ Treating it as a consultant being hired to “fix the issues”.
- ❑ Focusing only on savings and ignoring operational risk
- ❑ Failing to close the loop on implementation and verification
- ❑ In a portfolio, failing to prioritize buildings

Questions?
Comments?

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Building Performance Exchange

Learn more and subscribe for email updates by visiting buildingperformance.exchange

A statewide resource for people and organizations seeking to enhance performance and reduce carbon pollution in larger existing buildings.

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Extra Slides

RCx Equipment Sampling

Retro-Commissioning

The process of confirming that the energy systems in an existing building are installed as per the design intentions, functionally tested, and capable of being operated and maintained, according to the owner's operational needs.

Equipment	Quantity	Sample
Heating and Ventilation Units (above 5,000 CFM)	1	100%
Air Handling Units (above 5,000 CFM)	25	100%
Fans (above 5 HP)	4	100%
HVAC Pumps (above 5 HP)	37	100%
HVAC Plate-and-frame Heat Exchangers (serving over 10,000 SF)	6	100%
HVAC Shell-and-Tube Heat Exchangers (serving over 10,000 SF)	10	100%
Cooling Towers	5	100%

Equipment	Quantity	Sample
Perimeter Induction Unit Control Valves	45 Floors	10% (5 Floors)
Steam Reheat Coil Control Valves	4	100%
Electric Centrifugal Chillers	3	100%
Domestic Water Pumps	7	100%
Domestic Hot Water Heaters	8	100%
Steam Pressure-Reducing Valve Stations	4	100%
Lighting Controls	- All Common Areas - 20% of Owner-Occupied Areas	10%

Quantity specific to a Building