JANUARY 11, 2024

Investigation Phase Essentials for Existing Building Commissioning (EBCx) Projects Part 1

*Part 2 scheduled for January 18th

Megan Wallace P. Eng., BPA
Eddy Cloutier P. Eng., BPA
Aurélie Verstraete P.Eng., BPA

ieso Connecting Today. Powering Tomorrow.

SAVE ON ENERGY POWER WHAT'S NEXT

Agenda - Part 1

- Save on Energy program updates
- Planning phase
  - Pre-screening
  - Initial assessment
- Investigation phase
  - Diagnostic monitoring
- Q&A

Agenda - Part 2 session (January 18th)

- Save on Energy program updates
- Investigation phase cont'd
  - Functional testing
  - Document findings
  - Estimate savings and implementation costs
  - Investigation report
  - Implementation methods and hand-off
- Q&A

Save on Energy Capability Building – EBCx resources

- Designed to enhance knowledge and develop skills in organizations and communities to increase awareness and participation in energy-efficiency opportunities across Ontario, including Save on Energy programs
- Our dedicated EBCx resources include:
  - Webinars (*EBCx in a Nutshell*, *Key Measures*)
  - practical guide for building owners and managers
  - information sheets: condos, medical buildings, office buildings and warehouses
  - incentives for ~20 training courses

EBCx resources on Save on Energy website

Save on Energy - EBCx Program

HOW DOES THE PROGRAM WORK?

The EBCx program has three phases with incentives for participants who complete each one.

1. INVESTIGATION PHASE

Hire a CP to investigate your facility and prepare a report setting out a commissioning plan.

INCENTIVE

Up to $0.06/sq. ft., up to $50,000 per facility and/or 75% of the cost of working with a CP

2. IMPLEMENTATION PHASE

Implement the energy-efficiency measures identified in the commissioning plan.

INCENTIVE

$0.03/KWh of confirmed energy savings, up to the lesser of 30% of facility annual electricity consumption or $50,000

3. PERSISTENCE PHASE

Receive training from your CP to maintain savings and monitor your systems for one year after implementation.

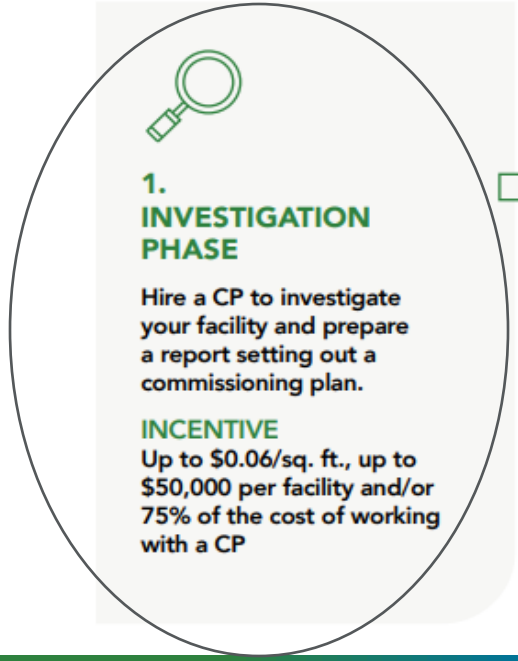
INCENTIVE

$0.03/KWh of confirmed persisting energy savings, up to the lesser of 30% of facility annual electricity consumption or $50,000

Save on Energy – EBCx Program

HOW DOES THE PROGRAM WORK?

The EBCx program has three phases with incentives for participants who complete each one.



1. INVESTIGATION PHASE

Hire a CP to investigate your facility and prepare a report setting out a commissioning plan.

INCENTIVE

Up to $0.06/sq. ft., up to $50,000 per facility and/or 75% of the cost of working with a CP

2. IMPLEMENTATION PHASE

Implement the energy-efficiency measures identified in the commissioning plan.

INCENTIVE

$0.03/KWh of confirmed energy savings, up to the lesser of 30% of facility annual electricity consumption or $50,000

3. PERSISTENCE PHASE

Receive training from your CP to maintain savings and monitor your systems for one year after implementation.

INCENTIVE

$0.03/KWh of confirmed persisting energy savings, up to the lesser of 30% of facility annual electricity consumption or $50,000

Investigation phase

The investigation phase allows the EBCx team to analyze the system operations in detail, carry out diagnostic tests and propose measures to optimize operations. These measures are presented in the Findings Log, an integral part of the Investigation Report.

Investigation activities

Planning/Pre-screening

- Select a building
- Define EBCx objectives
- Define current facility requirements (CFR)
- Define scope and roles

Planning/Initial Assessment

- Review building documentation
- Develop initial EBCx Plan
- Analyze energy data
- Conduct kick-off meeting
- Perform initial walk-through
- Conduct staff interviews
- Document findings (preliminary)
- Meet with owner to focus work for investigation
- Update EBCx Plan and scope

Investigation and report

- Run and analyze trends and monitoring
- Conduct further document review/staff interviews/deeper field inspections
- Conduct functional testing
- Document findings (Findings log)
- Estimate savings and implementation costs
- Investigation report
- Review findings with owner
- Select findings to implement
- Update EBCx Plan for implementation and hand-off

Reference : BCxA – Existing Building Commissioning Best Practices (bcxa.org)

Investigation activities – Planning

Planning/Pre-screening

- Select a building
- Define EBCx objectives
- Define current facility requirements (CFR)
- Define scope and roles

Reference : BCxA – Existing Building Commissioning Best Practices (bcxa.org)

Select a building

Identify best buildings: criteria to consider?

- ❑ Engagement and budget from the owner
- ❑ Engagement from building staff
- ❑ Building documentation available
- ❑ Building Automation System (BAS) – still maintained (not obsolete)?
- ❑ BAS documentation and capacities (trending)
- ❑ Budget for implementation and hand-off
- ❑ Realistic schedule (minimum three seasons)
- ❑ Energy Use Intensity (EUI): energy-efficiency potential?
- ❑ Building systems and equipment in good condition (no extensive repair needed)
- ❑ Building systems and equipment useful life (no major equipment changes)

Financial leverage: Utility incentive programs

Select a building

NRCan EBCx Pre-Screening Tool

RCx Screening Form EN.pdf (canada.ca)

Building Context

Q1 — ENERGY STAR Score or Energy Use Intensity (EUI) Benchmarking

- 0 pts ☐ Score of 65 or higher, or EUI 15% lower than Industry average
- 3 pts ☐ Score between 35 and 65, or EUI similar to Industry average (+-15%)
- 5 pts ☐ Score lower than 35, or EUI 15% higher than Industry average
- 5 pts ☐ Unexplained increase in energy consumption

Q2 — Upcoming major retrofit projects

- 0 pts ☐ One planned within the next 2 years
- 3 pts ☐ None planned within the next 2 years
- 5 pts ☐ None expected in the next 5 years

Q3 — Thermal comfort and Indoor Environmental Quality (IEQ)

- 0 pts ☐ Infrequent occupant complaints about comfort or IEQ
- 1 pts ☐ Typical "hot and cold" calls
- 2 pts ☐ Multiple recurrent complaints about comfort or IEQ

Mechanical Equipment Condition

Q4 — Age of majority of equipment

- 0 pts ☐ More than 12 years OR less than 3 years of remaining useful life
- 2 pts ☐ Less than 12 years OR more than 3 years of remaining useful life

Q5 — HVAC Systems Mechanical problem(s)

- 0 pts ☐ No problem identified
- 1 pts ☐ Infrequent mechanical problems
- 2 pts ☐ Recurrent mechanical problems

Energy use intensity

- EUI calculation (GJ/m² or kWh/ft²)
- EUI: an indicator for benchmarking
- What affects a building's EUI?
  - Building use/type (hospital versus school)
  - Climate
  - Building age, building size, occupancy rate, others.
  - Mechanical/electricial systems efficiency
  - Operational efficiency

Select a building

Building A

- Large office building
- Construction year: 1980
- EUI: 1,5 GJ/m²/yr
- Boiler plant/chiller plant
- No documentation available
- Building Automation System: old platform, not maintained anymore

Building B

- Medium school building
- Construction year: 2010
- EUI: 1,1 GJ/m²
- Innovative/complex mechanical systems and sequences (geothermal, heat recovery)
- Design and construction documentation available
- BAS and remote access available

Benchmarking

NRCan - Survey of Commercial and Institutional Energy Use (SCIEU) - Buildings 2019

Available at:

https://natural-resources.canada.ca/energy-efficiency/energy-star-canada/energy-star-for-buildings/energy-benchmarking-technical-information/building-energy-use-surveys/19454

Table 1 – Building and Establishment characteristics by primary a

Primary activity	Energy intensity[1] GJ/m^2
Buildings survey (excluding establishments)	
Bank branch	0,95
Public safety – police and fire station	0,96
Assisted living facility	1,44
Hotel, motel, hostel, or lodge	1,28
Preschool or daycare	0,98
Primary or secondary school	0,91
Restaurant	2,60
Food or beverage store	1,34
Retail – non-food	1,01
Office space – medical	0,91
Office space – excluding medical	1,05
Recreation centre	1,07
Ice rink	1,15
Place of worship	0,99
Museum or gallery	0,85
Library or archives	1,00
Warehouse	1,04
Vehicle dealership, repair, or storage	1,82
Mixed use[2]	1,36
Others in scope[3]	1,16
Sub-total	**1,29**
Establishments survey	
University buildings	1,95
Other post-secondary buildings	1,91
Hospital buildings	2,67
Sub-total	**2,11**
Total	**1,31**

Benchmarking

BOMA Canada - National Green Building Report 2021

Available at: https://bomacanada.ca/2021-national-green-building-report/

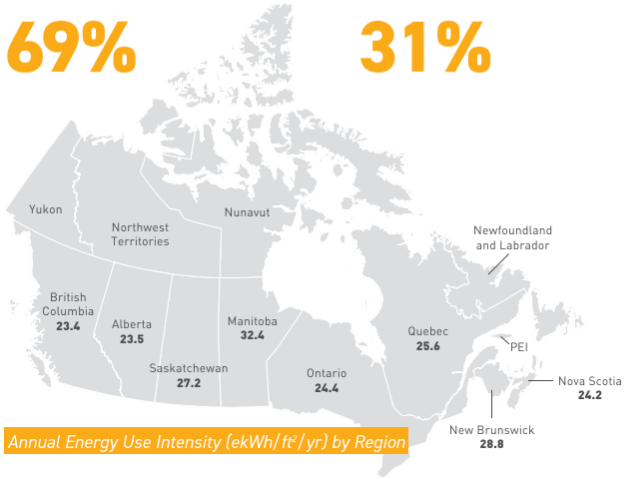
BOMA BEST certified buildings in Ontario :

Office Buildings Reduce Energy by 25%

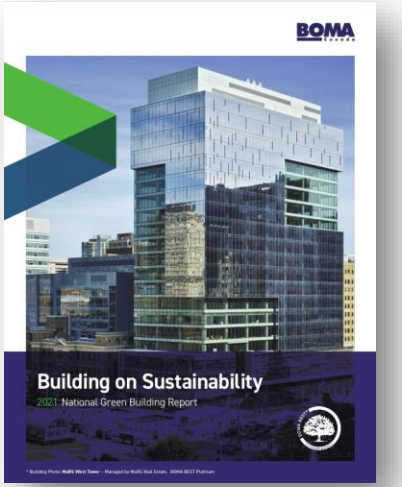
BOMA BEST Office buildings have reduced their energy use by 25% since 2008. They now average 24.7 ekWh/ft²/yr. Which is 3% lower compared to the national average[3]. Of this, approximately

Electricity Consumption[4] **69%**

Gas Consumption[4] **31%**

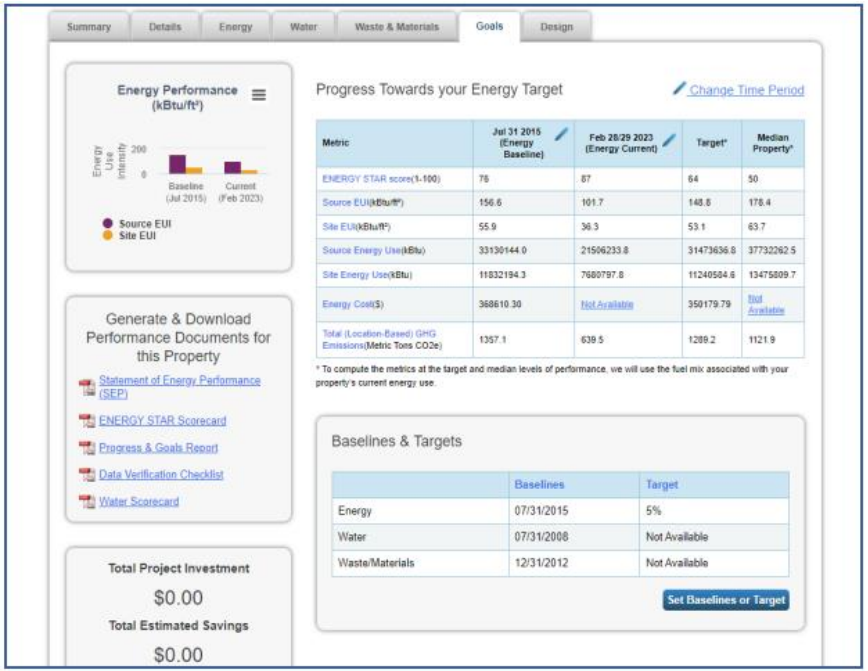


Annual Energy Use Intensity (ekWh/ft²/yr) by Region



Benchmarking

Energy Star Portfolio Manager



EBCx objectives

EBCx projects should focus on one or two primary objectives:

- Resolve O&M issues
- Enhance energy efficiency/reduce environmental footprint
- Reduce operation and energy costs (energy use and demand)
- Improve comfort/indoor environmental quality
- Improve systems performance and control
- Improve O&M staff training and building documentation
- Identify possible capital projects for further investigation

Current facility requirements (CFR)

Review and update CFR to reflect actual requirements.

For each space use :

- Space conditions (temperature, humidity)
- Operating/occupancy hours
- Filtration
- Ventilation/outside air fractions
- Etc.

APPENDIX B - OWNER'S OPERATING REQUIREMENTS – TEMPLATE

Requirement	Typical for Building	Offices	Lobby	Conference Rooms	Computer or Data Storage	Other	Notes
Temperature requirements for cooling and heating seasons							
Humidity requirements							
Dehumidification requirements							
Pressure relationship requirements							
Filtration requirements							
Ventilation requirements							
Air change requirements							
Sound and noise level requirements							
Normal operating schedule for occupancy							
Weekend schedule							
Holiday schedule							

Reference: NRCan CanmetENERGY – Recommissioning Guide For Building Owners and Managers.
Available at: https://natural-resources.canada.ca/sites/nrcan/files/canmetenergy/pdf/fichier.php/codectec/En/2008-167/NRCan_RCx_Guide.pdf

Project scope

Systems, operations and assemblies covered by investigation:

- ✓ Chiller plant/heating plant
- ✓ Domestic hot water
- ✓ Ventilation systems, exhaust systems
- ✓ Variable Air Volume (VAV) boxes, perimeter heating
- ✓ Lighting controls
- ✓ Other mechanical systems (heat pump, pumps, etc.)
- ✓ Building automation system (sequences of operation, setpoints, schedules, graphics, valves, sensors, motorized dampers, alarms, etc.)

Usually excluded from scope: plumbing systems (non-energy systems), fire protection, elevators, sanitary pump, chemical water treatment, etc.

Project scope

With certain considerations :

- Equipment and system complexity
- Building size
- Future renovations in specific areas
- Systems at the end of their useful life
- Known O&M issues
- Limited budget/schedule

… Project scope could also:

- Focus on certain spaces, issues, systems or equipment (chiller plant, for example)
- Select major systems (major ventilation systems)
- Use sampling methods for repetitive systems (VAV boxes)
- Exclude some systems or areas (if short-term renovations/system replacement are scheduled)

Roles and responsibilities

During Planning/Investigation :

- **Cx Provider**: lead EBCx process, identify measures and perform tests
- **Owner**: define objectives and scope, support EBCx process (information, resources)

Cx Provider Responsibilities	Owner Activities
Planning Phase	
Meet with Owner to define project	Hire CxP to help update the CFR
Update the Current Facility Requirements (CFR)	Contribute, review, & approve the CFR
	Develop initial budget
DELIVER TO OWNER: Updated CFR	
Initial Assessment Phase	
Review building documentation	Approve EBCx budget
Develop initial EBCx Plan	Review & approve EBCx Plan & scope
Analyze energy data	
Perform initial walk-through	
Conduct staff interviews	
Document findings	
Meet with Owner to focus work for investigation	
DELIVER TO OWNER: Initial EBCx Plan & Scope	
Investigation Phase	
Run & analyze trends & monitoring	Attend commissioning meetings
Conduct deeper field inspections	Coordinate O&M staff involvement
Conduct functional testing	Manage occupant impact/issues
Document findings	
Estimate savings & implementation costs	
Review findings with Owner, select findings to implement	
Update EBCx Plan for implementation & handoff	

Reference : BCxA – Existing Building Commissioning Best Practices (bcxa.org)

Roles and responsibilities

During Implementation/Hand-Off

- **Cx Provider**
- **Owner**

Cx Provider Responsibilities	Owner Activities
Implementation Phase	
Complete additional investigation & engineering	Review and/or approve energy savings estimates
Engage subcontractors, as needed	
Implement selected findings	
Verify performance of ECMs & FIMs	
Adjust energy savings estimates & costs	
DELIVER TO OWNER: Adjusted Cost & Savings Estimates	
Hand-Off Phase	
Facilitate training of building staff	Support facility staff training
Update sequences of operation	Support OCx Plan execution
Update Systems Manual	
Update preventive maintenance procedures	
Implement performance tracking	
Develop ongoing commissioning (OCx) recommendations	
DELIVER TO OWNER: Updated Facility Guide, Final Cx Report, OCx recommendations	

Roles and responsibilities

Facility staff:

- Gather existing documentation
- Prepare a list of known problems/opportunities
- Calibrate sensors and actuators (prior to investigation if possible)
- Perform needed deferred maintenance before EBCx begins
- Help Cx Provider to understand systems operation
- Collaborate with Cx Provider to perform tests
- Perform simple repairs and improvements

Roles and responsibilities

Contractor or manufacturer representatives (as needed):

- Involvement during investigation and/or implementation
- Controls contractor (sensor calibration, controls measures implementation, etc.)
- Testing and balancing specialist
- Service contractor for specific equipment (chillers, boilers)

Investigation activities – Planning

Planning/Pre-screening

- Select a building
- Define EBCx objectives
- Define current facility requirements (CFR)
- Define scope and roles

Planning/Initial Assessment

- Review building documentation
- Develop initial EBCx Plan
- Analyze energy data
- Conduct kick-off meeting
- Perform initial walk-through
- Conduct staff interviews
- Document findings (preliminary)
- Meet with owner to focus work for investigation
- Update EBCx Plan and scope

Reference : BCxA – Existing Building Commissioning Best Practices (bcxa.org)

Building documentation

Facility staff or owner should gather existing documentation prior to the site visit:

- Original design documentation
- Equipment lists (nameplate)
- Shop drawings (chillers, boilers, air handling unit - AHU, pumps, etc.)
- Drawings (controls, mechanical)
- Control system documentation (controls diagrams, sequences of operation)
- TAB (testing, adjusting and balancing) reports
- Previous energy studies

Initial EBCx plan – Table of contents

1. Summary building and systems description
2. Scope (systems covered by EBCx investigation)
3. Preliminary energy analysis
4. Investigation methodology
5. EBCx team (internal and external)
6. Work schedule
7. Deliverables
8. Documentation review

Appendices: Current facility requirements, Diagnostic monitoring plan, etc.

EBCx plan example 1

Summary systems description

coils and perimeter convectors. It is mainly located at the penthouse's mechanical room (10th floor). It is composed of three (3) natural gas fired boilers. Boiler no. 1 has been decommissioned.

HOT WATER BOILERS			
System tag	B-1	B-2	B-3
Brand	[redacted]	[redacted]	[redacted]
Model no.	[redacted]	[redacted]	[redacted]
Capacity input (MBH)	3,000 MBH	3,000 MBH	3,000 MBH
Energy source	Natural gas	Natural gas	Natural gas

3.1.2 Primary pumps are serving boilers and secondary pumps are constant speed pumps.

3.1.3 Two (2) heat exchangers transfer heat from hot water to glycol. Glycol pumps (constant speed) supply heat to air handling units AHU-7, AHU8 and AHU-9.

3.2 Cooling:

3.2.1 Cooling for the building is provided by a central chiller plant with four chillers, one cooling tower, and one dry-cooler, supplying chilled water to air handling units and fan coils. Chiller plant is located at the penthouse's mechanical room (10th floor).

CHILLERS			
System tag	CH-1 (decommissioned)	CH-2	CH-3 / CH-4
Brand	[redacted]	[redacted]	[redacted]
Model no.	[redacted]	[redacted]	[redacted]

Preliminary energy analysis

Table 3: Natural gas – Consumption, cost and GHG emissions

Year	Consumption (m³)	Consumption (GJ)	Energy Cost ($)	Energy Cost ($/GJ)	GHG emissions (tons CO_2 eq)
2018	196,952	7,535	$ 52,924	$ 7.02	374
2019	214,778	8,217	$ 56,353	$ 6.86	408
2020	185,612	7,102	$ 48,489	$ 6.83	352

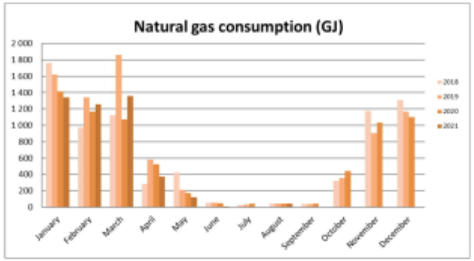


Table 4: Electricity and Natural gas – Consumption, cost and GHG emissions

Year	Consumption (GJ)	Energy Cost ($)	GHG emissions (tons CO_2 eq)

EBCx plan example 2

Roles and Responsibilities

Distribution of tasks	
Name/Function	Responsibilities
[redacted] RCx Agent [redacted] Assistant to the RCx Agent	Execute the tasks of the recommissioning process (planning, investigation and analysis, functional testing, identification of measures, energy savings calculations, etc.). Write the recommissioning plan which includes a measurement plan, the investigation report and the final report. Guide the owner with the choices of measures to be implemented.
[redacted] Energy specialist [redacted] Projet Manager	Organize and conduct progress meetings, promote collaboration between the agent and the staff in the building, provide and facilitate access to documentation, and ultimately make decisions regarding the measures to be implemented.
[redacted] Energy specialist	Provide the building energy consumption data to the RCx agent.
[redacted] Construction supervisor [redacted] Construction supervisor	Responsible for access to the building. Help coordinate access to the critical areas.
[redacted] Operations Supervisor	Provide information to the RCx agent about the operation of the building.

Scope

LIST OF SYSTEMS COVERED BY THE RCX [redacted]		
System No	**Technical informations**	**Sectors served**
AHU 1 Basement ventilation system	H Type, VAV, 3 955 L/S*, cooled, heated and humidified	All the buildings
Exhaust VE1,VE2 and VE3	900 L/S*	Washrooms, janitor, shower
HX-1, HX2 and dedicated pumps	1474 Lb/hr	Perimeter heat water network and AHUs
Chiller	25 tons[redacted]	AHU1
IT room DX systems	2 x 5 tons air cooled	IT room

Legend: VAV = Variable air volume, * = Estimated flow

6.2 Investigation of other mechanical systems:

6.2.1 The control systems of approximately 15% of the spaces will be studied and documented. This will be sufficient to determine how the sequences function.

6.2.2 The production and general efficiency of the domestic hot water supply system.

6.2.3 Indoor and outdoor lighting controls.

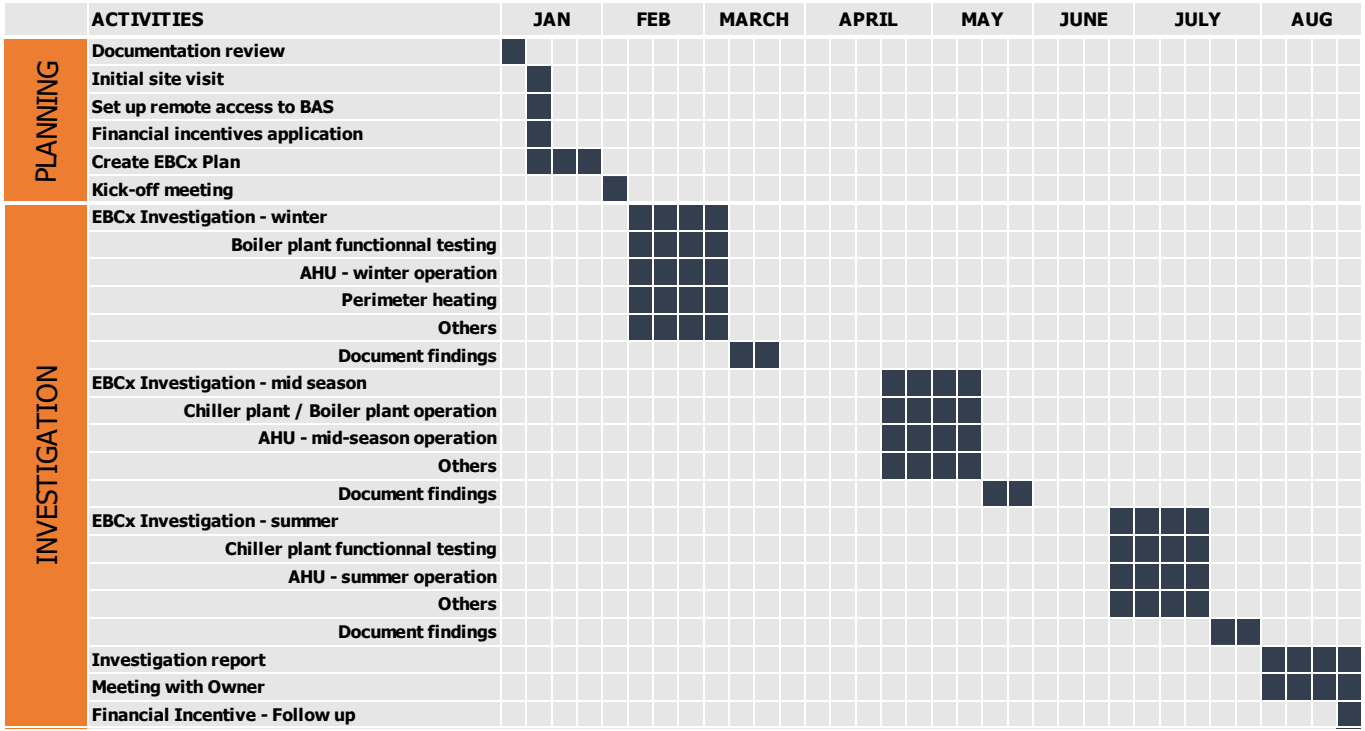
EBCx plan example 3

Diagnostic Monitoring Plan

11.1.8 The following is the "RCX Measuring Table" related to the BAS points to be logged

Main Building RCx Measuring Table – BAS points to be logged				
Technician				
Date				
	Duration of log activation	Time Interval	Done	Date of activation
AHU3A Servery Kitchen				
Supply fan status	14 days	30 min.		
Exhaust fan status 3E	14 days	30 min.		
AHU01 Tent room				
Supply fan status	14 days	30 min.		
Return fan status	14 days	30 min.		
Supply air temperature	7 days	15 min.		
Mixed air temperature	7 days	15 min.		
AHU08a Long Gallery				
Room air temperature	7 days	15 min.		
Supply air temperature	7 days	15 min.		
Supply fan status	14 days	30 min.		
AHU09a Reception room				
Room air temperature	7 days	15 min.		
Supply air temperature	7 days	15 min.		
Mixed air temperature	7 days	15 min.		

Work schedule example

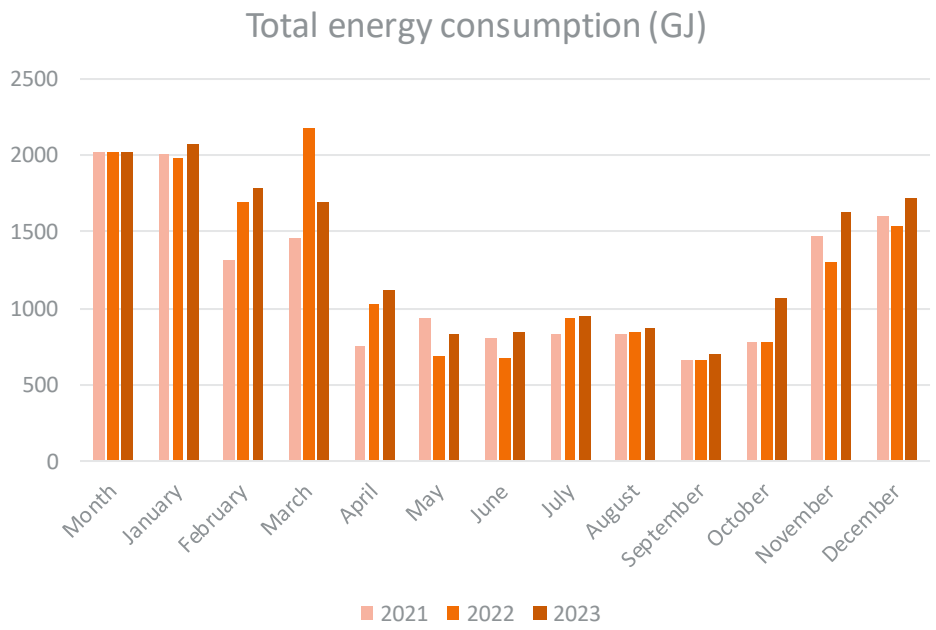


Analyze energy data

Minimum input: 36 months of historical consumption (utility bills, all energy sources).

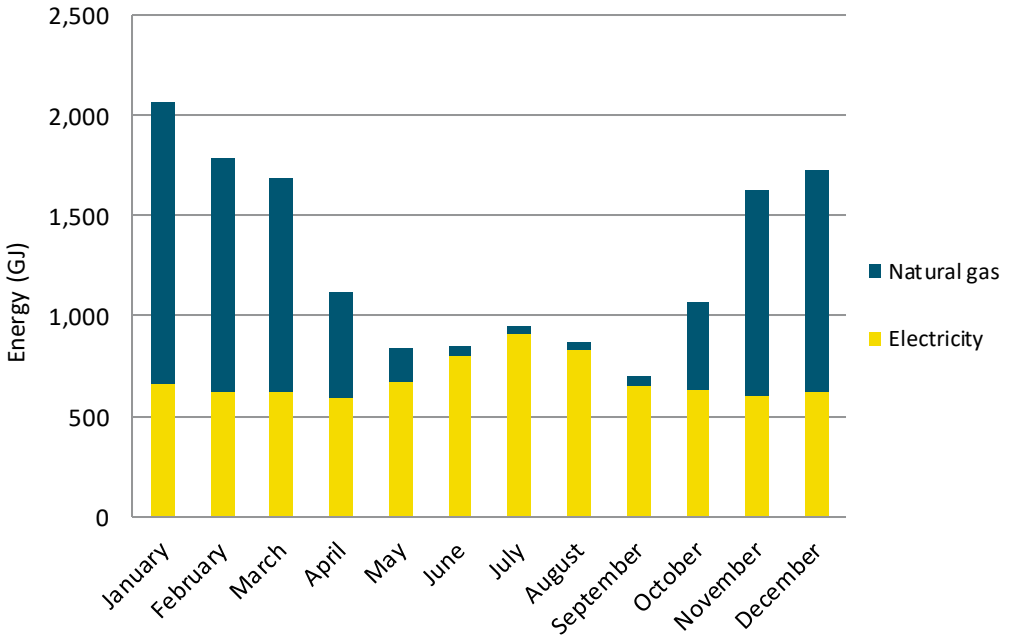
Is there a rising trend over recent years?

- Climate conditions (cooling/heating degree days used for normalization)
- Occupancy rate
- Renovation/expansion
- Change in space use or operating hours



Analyze energy data (cont'd)

- Choose a baseline year (for future energy savings calculations)
- Perform an energy inventory: heating, cooling, fans, lighting, etc.
- Analyze demand data and peak demand



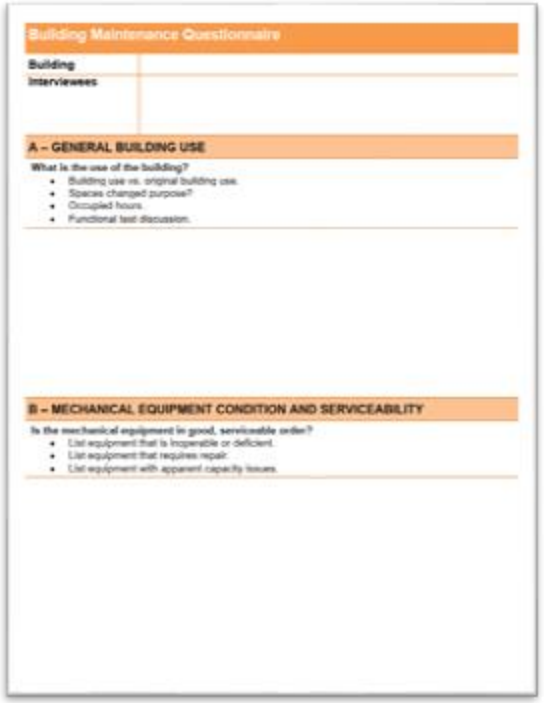
Initial site walk-through

- Walk-through of tenant floors
- Walk-through of all major mechanical rooms (central plant, major AHU)
- General condition of equipment
- BAS review (graphics, trending and archiving capacities, sequences of operation)
- Calibration and maintenance required prior to investigation?

Facility staff interview

Document known operational issues and improvement opportunities

- **General building use**: changes in space use, occupied hours, etc.
- **Mechanical/electrical equipment and materials condition**
  - Equipment inoperable/deficient/repair required? Capacity issues?
  - Materials require repair (piping, ductwork, valves, etc.)?
- **Mechanical equipment control**
  - BAS: adequate control/monitoring? Terminal system control? Space temperature control?
- **Lighting** control satisfactory?
- **Planned replacement or renovations?**


Building Maintenance Questionnaire

Building

Interviewees

A – GENERAL BUILDING USE

What is the use of the building?

- Building use vs. original building use.
- Spaces changed purpose?
- Occupied hours
- Functional test discussion.

B – MECHANICAL EQUIPMENT CONDITION AND SERVICEABILITY

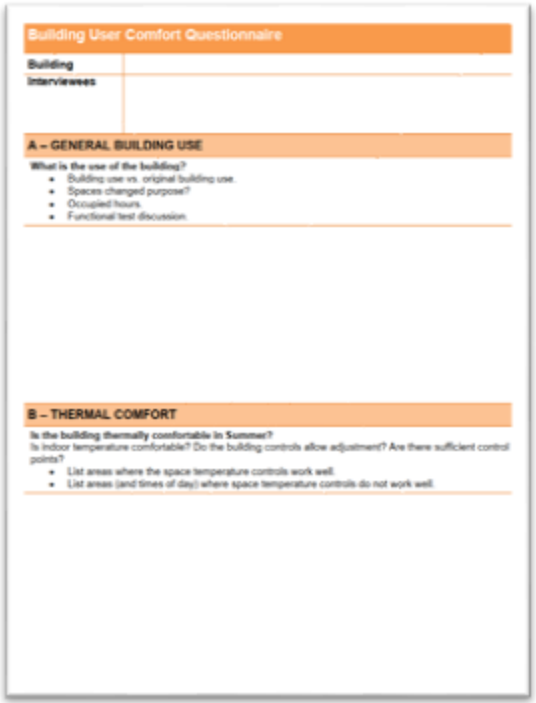
Is the mechanical equipment in good, serviceable order?

- List equipment that is inoperable or deficient.
- List equipment that requires repair.
- List equipment with apparent capacity issues.

Building occupant interview (if applicable)

Consider involving occupants when EBCx objectives include thermal comfort

- **General building use**
  - Spaces changed purpose?
- **Thermal comfort (winter/summer)**
  - Areas/times of day space temperature controls do not work well?
- **Indoor air quality**
  - Areas where indoor air quality is poor?
- **Lighting**
  - Areas where increased control should be considered?



Building User Comfort Questionnaire

Building

Interviewees

A – GENERAL BUILDING USE

What is the use of the building?

- Building use vs. original building use.
- Spaces changed purpose?
- Occupied hours.
- Functional test discussion.

B – THERMAL COMFORT

Is the building thermally comfortable in Summer?

Is indoor temperature comfortable? Do the building controls allow adjustment? Are there sufficient control points?

- List areas where the space temperature controls work well.
- List areas (and times of day) where space temperature controls do not work well.

Investigation activities – Investigation and report

Planning/Pre-screening

- Select a building
- Define EBCx objectives
- Define current facility requirements (CFR)
- Define scope and roles

Planning/Initial Assessment

- Review building documentation
- Develop initial EBCx Plan
- Analyze energy data
- Conduct kick-off meeting
- Perform initial walk-through
- Conduct staff interviews
- Document findings (preliminary)
- Meet with owner to focus work for investigation
- Update EBCx Plan and scope

Investigation and report

- Run and analyze trends and monitoring
- Conduct further document review/staff interviews/deeper field inspections
- Conduct functional testing
- Document findings (Findings log)
- Estimate savings and implementation costs
- Investigation report
- Review findings with owner
- Select findings to implement
- Update EBCx Plan for implementation and hand-off

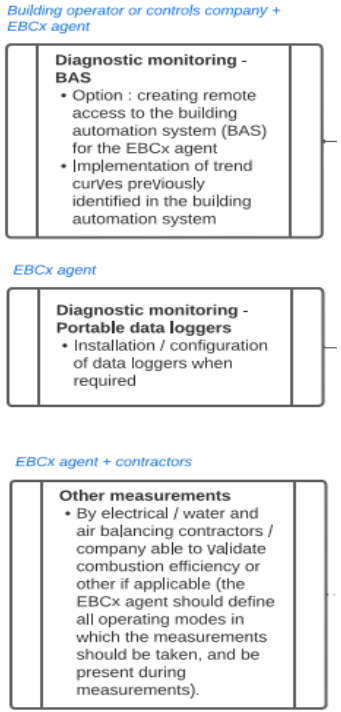
Reference : BCxA – Existing Building Commissioning Best Practices (bcxa.org)

Investigation methodology

- Additional documentation review/staff interview
- Deeper on-site inspections/night walk
- Diagnostic monitoring
  - Run and analyze trends and monitoring to identify operational issues and opportunities
- Functional testing
  - Perform system testing to confirm actual operation and identify improvements

Diagnostic monitoring plan

- General objective: Capture system performance under various conditions using BAS and/or data loggers to identify EBCx opportunities
- Guide for in-house deployment or controls contractor



Diagnostic monitoring plan cont'd

Which metrics should be included in the monitoring plan?

- Energy consumption (meters and sub-meters)
- Operating parameters
  - Air/water temperature, air flow/water flow rates, static pressure
  - Setpoints that changes, command, status, valve/damper modulation
  - Amperage, rotation speed for pumps/fans, etc.
- Outdoor conditions (temperature, humidity)
- Indoor conditions (temperature, humidity, CO_2 level)

Diagnostic monitoring plan cont'd

What information should be included?

- Objective of data recording
- Sequence to be verified
- Points to be recorded
- Trend length and data interval required

For portable data loggers:

- Name of the person in charge
- Equipment info
- Data logger location, start/end dates, and status

Diagnostic monitoring plan example 1

Purpose:

Review AHU-1 operation.

Sequence to be verified:

Heating valve modulate to reach discharge air temperature setpoint. Heating valve is closed when AHU is OFF.

Setpoint is reset from 15°C to 21°C depending on outdoor conditions.

Point description	Point tag	Units	Frequency
Discharge air temperature setpoint	DAT_AHU1_SP	°C	5 min
Mixing air temperature (before heating coil)	MAT_AHU1	°C	5 min
Discharge air temperature value	DAT_AHU1	°C	5 min
Heating valve modulation	MOD_HV	%	5 min
Fan status	AHU1_STATUS	ON/OFF	Change of value

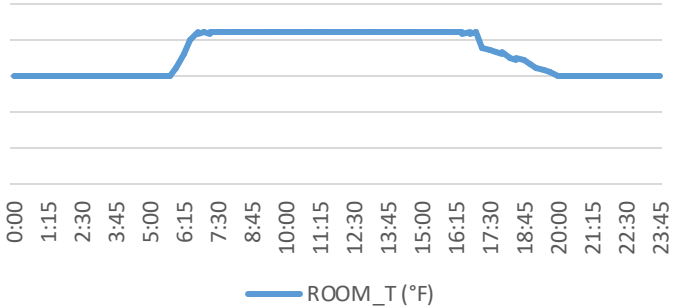
Diagnostic monitoring plan example 2

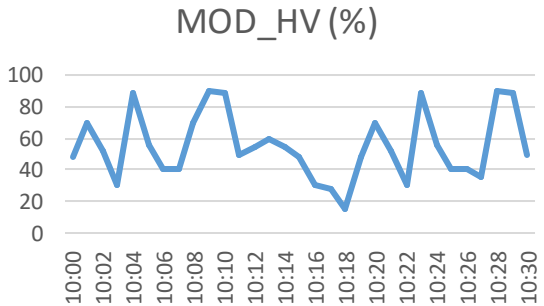
System or equipment	BAS points	Trend length / interval	Objectives
Boilers 01-CBT-CH1 et 01-CBT-CH2	Points to trend : T outdoor T hot water return Start-stop CH1 Start-stop CH2 T out CH1 T out CH2 T supply hot water	1 week 15 minutes interval, except for start-stop (COV – change of value).	Validate network temperatures are maintained. Validate compliance with design and/or modulation requirements as a function of outdoor temperature. Validate the operating stability of supplied temperatures. Validate that the boilers are not short-cycling.

Diagnostic monitoring with BAS

- Verify indoor conditions (15 min sampling frequency)
- Verify heating valve modulation and PID control loop (1- or 2-minute sampling frequency)

With a 15-minute interval you will miss the peak!





Diagnostic monitoring with portable data loggers

- Lux meter
- Pressure meter
- Digital thermometer
- Infrared gun
- Infrared camera
- Indoor air quality meter







Diagnostic monitoring with portable data loggers

Other measurements (usually done by third party/authorized personnel)

- Electrical measurements
- Liquid flow (ultrasonic flowmeter)
- Air flow (balometer)
- Combustion efficiency testing for boilers

Discussion

Save on Energy resources

Questions: trainingandsupport@ieso.ca

Calendar of live training events: https://saveonenergytraining.ca/

Information, events, courses: https://saveonenergy.ca/For-Business-and-Industry/Training-and-support

Save on Energy EBCx program: https://saveonenergy.ca/For-Business-and-Industry/Programs-and-incentives/Existing-Building-Commissioning-Program

Thank you!

Stay in the know

Sign up for Save on Energy's quarterly business and residential newsletters

trainingandsupport@ieso.ca

@SaveOnEnergyOnt

facebook.com/SaveOnEnergyOntario

linkedin.com/showcase/
SaveOnEnergy-Ontario

ieso
Connecting Today.
Powering Tomorrow.

SAVE ON ENERGY
POWER WHAT'S NEXT