JUNE 23, 2022

# Save on Energy Webinar: Building Tune-Up – Existing Building Commissioning (EBCx)

**Presented by the Save on Energy Team**

ieso
Connecting Today.
Powering Tomorrow.

SAVE ON ENERGY
POWER WHAT'S NEXT

# Today's Presenters


Vicki Gagnon: Business Advisor, IESO

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# Agenda

1. Introduction
2. Save on Energy programs and resources
3. Building Tune-Up: EBCx
    - Overview
    - The EBCx Process
    - Activity: EBCx Pre-Screening Interview
4. Questions and discussion

# About the IESO

Reliably operate Ontario's Province-wide system 24/7

Plan for Ontario's future energy needs

Enable competition and create efficient electricity markets

Enable province-wide energy efficiency

Purposefully engage to enable informed decisions

Support innovation

Cybersecurity leadership

Smart Metering Entity

# Save on Energy Programs

Ontario businesses, large and small, have access to incentives for retrofits and other energy-efficiency projects to lower energy costs

- Retrofit Program
- Small Business Program
- Energy Performance Program
- Strategic Energy Management Program
- Training and Financial Support
- Existing Building Commissioning Program

# Retrofit Program

- Commercial, industrial, institutional, multi-residential and agricultural businesses can participate
- Offers financial incentives for equipment upgrades that reduce facility electricity consumption
- Designed to help Ontario businesses save energy, reduce costs and increase productivity

# Retrofit Program – Resources

## Key Documents and Guides

- Visit saveonenergy.ca to download the user guide, worksheets and find key program documents: https://saveonenergy.ca/For-Business-and-Industry/Programs-and-incentives/Retrofit-Program
- Retrofit portal resources and how to videos are also available https://saveonenergy.ca/For-Business-and-Industry/Programs-and-incentives/Retrofit-Program/Resources-and-Support

**Find answers to the most commonly asked Retrofit questions**
https://saveonenergy.ca/For-Business-and-Industry/Programs-and-incentives/Retrofit-Program/FAQs

# Energy Performance Program

- Holistic approach to energy savings: operational + behaviour + capital
- Savings determined by comparing annual metered consumption to the baseline energy model
- **Incentive of $0.04/kWh** paid each year for three years **+ $50/kW adder** for summer peak demand savings (June - August, weekdays)
- **Facilities need to save at least 5%** energy savings (check in after year 2)

# Training and Financial Support

Receive incentives up to 50% of training and certification fees for courses, including:

- Energy Efficient Building Operators (EEBO) 101
- HVAC Optimization for High Performance Sustainable Buildings
- Building Automation System Essentials
- Advanced Building Automation Systems
- Pump System Optimization

To register, visit https://saveonenergy.ca/For-Business-and-Industry/Training-and-support

# Strategic Energy Management

The Strategic Energy Management (SEM) model will provide an enhanced technical support and resources to companies with dedicated energy managers

- SEM will offer organizations greater flexibility and empower them to achieve additional cost savings through increased training opportunities, as well as access to industry tools and resources to support their energy-efficiency projects
- Launching Q1 2023

# Existing Building Commissioning (EBCx)

- Designed to build capability for energy management organizations by training building owners/managers to enhance their facility management practices
- Also provides incentives to building owners to undertake recommissioning services; provides pay-for-performance incentives for savings achieved
- Launching by early 2023

# Existing Building Commissioning (EBCx) Overview

## Three Phases

- Investigation Phase
  - Investigation Report: incentive up to **$0.06/sq ft**, capped at **$50,000**
- Implementation Phase
  - Incentive of **$0.03/kWh** of claimed savings
- Persistence Phase
  - At the end of 12 months, incentive of **$0.03/kWh** of confirmed savings

# EBCx - Eligibility

## Facility Eligibility

- 12 months of consecutive energy data
- Have consumed a minimum of **750,000 kWh** per annum

## Project and Measures Eligibility

- Occupant behavioural measures
- Set point and scheduling optimization
- Air and water balancing
- Other operational and maintenance changes
- Equipment repair and minor replacements

# Save on Energy Updates

- To stay up to date with the latest news and insights about Save on Energy programs, subscribe to the quarterly Save on Energy business newsletter at https://www.saveonenergy.ca/en/Manage-your-subscriptions

# EBCx Overview

# What is EBCx?

EBCx is **systematic process** to improve an existing building's performance

EBCx involves:

- Recalibration of existing equipment (process driven)
- Identifying low/no-cost operational improvements to increase comfort and promote energy savings

The EBCx process must follow a logical step-by-step methodology

**Fundamentally, EBCx is taking what you have and making it better.**

# Why is EBCx Important?

- Building systems are increasingly complex, specialized and integrated, and include computerized HVAC systems and controls
- Systems may not function properly at certain occupancy levels
- Performance and comfort problems increase as components age
- Facility occupancy and use shift over time from the original design parameters

* Mills et al. *Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions*, LBNL, 2009

# EBCx vs. Energy Auditing

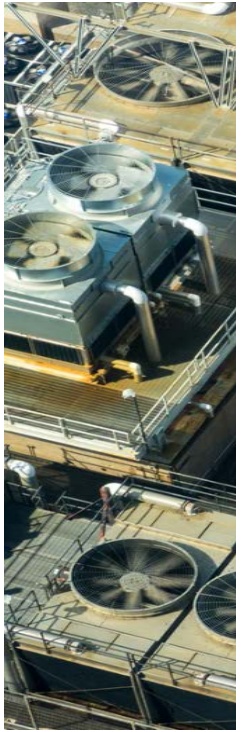
EBCx provides a thorough assessment of the operation of mechanical equipment, lighting, and related controls to improve how the building operates as an integrated system.

| Service | Operations and Maintenance (O&M) Improvements | No-Cost / Low-Cost Savings Opportunities | Capital Retrofit Savings Opportunities |
|---|---|---|---|
| Recommissioning (RCx) | Primary | Primary | Secondary |
| Energy Audit | Secondary | Primary | Primary |

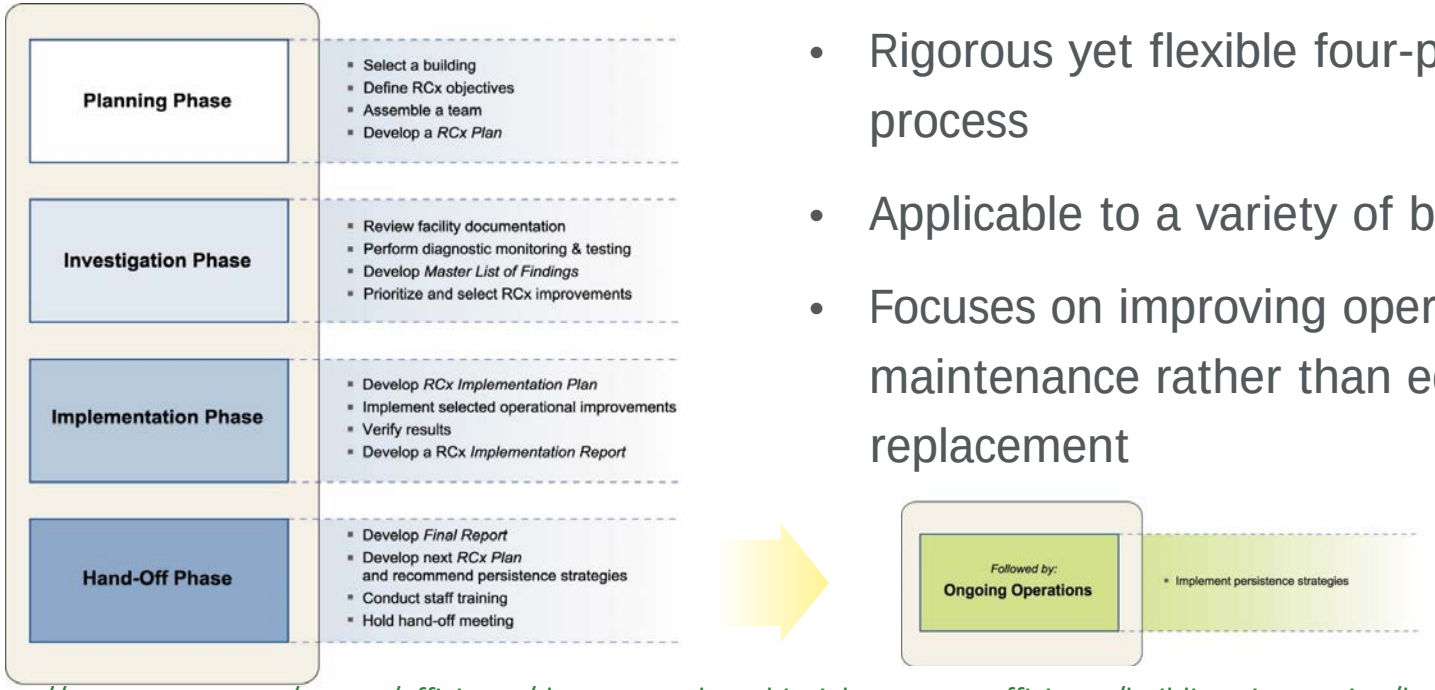
Adapted from: Jim Poulos. *"Existing Building Commissioning,"* ASHRAE Journal, Sept. 2007, pp. 66-78.

# Indicators That You May Need EBCx

- Inappropriate equipment schedules
- Operator frequently overrides controls
- Air supplies taped shut by occupants
- Plug-in heaters or portable fans in the spaces
- Simultaneous or unnecessary heating/cooling
- Poor building pressurization
- Unusual noises from mechanical equipment
- Indoor air quality issues
- Frequent occupant comfort complaints



# Existing Building Commissioning Process




- Rigorous yet flexible four-phase process
- Applicable to a variety of buildings
- Focuses on improving operation and maintenance rather than equipment replacement

https://www.nrcan.gc.ca/energy/efficiency/data-research-and-insights-energy-efficiency/buildings-innovation/building-optimization/recommissioning/EBCx-guide/3795

# Typical EBCx Costs, Savings and Payback

| | Range | Median | |
|---|---|---|---|
| **Project Cost** | $0.15-0.60/ft$^2$ | $0.30/ft$^2$ | $3.23/m$^2$ |
| **Annual Cost Savings** | $0.10-0.78/ft$^2$ | $0.29//ft$^2$ | $3.12/m$^2$ |
| **Energy Savings (%)** | 9%-31% | 16% | |
| **Payback Period** | 0.4-2.4 years | 1.1 years | |

Source: Mills et al. *Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions*, LBNL, 2009.

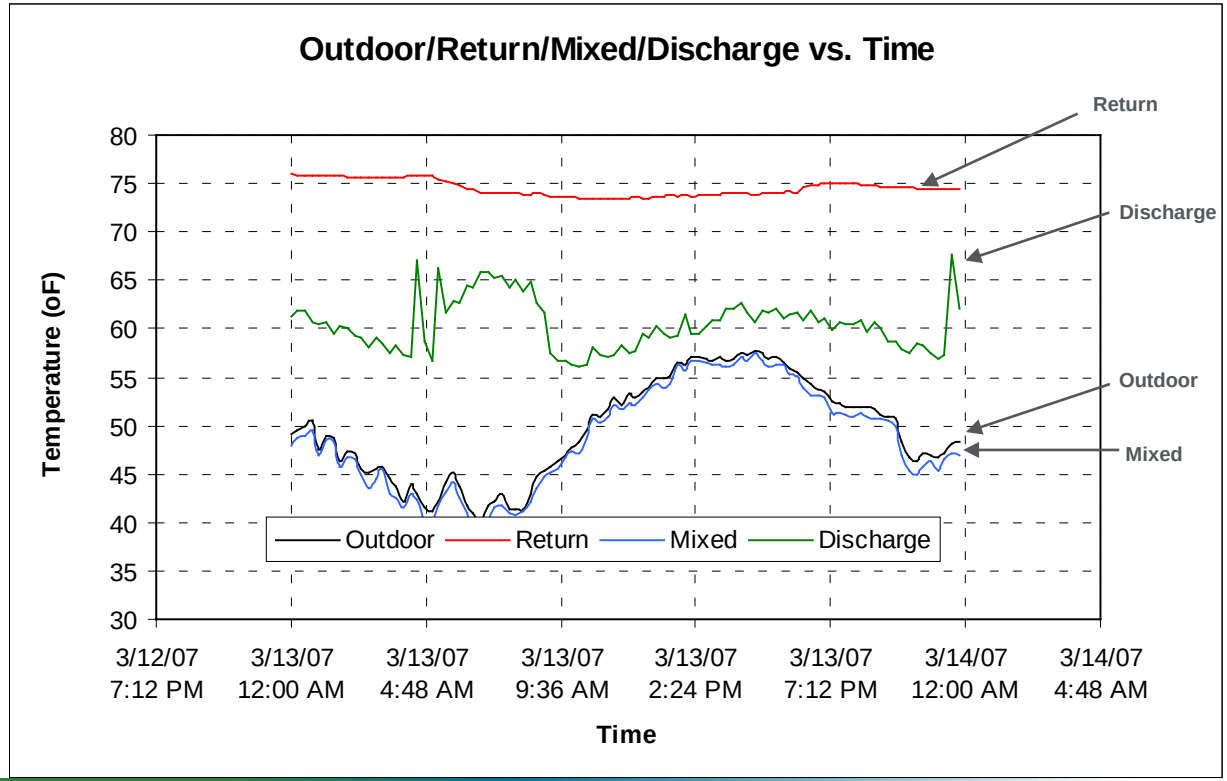
# Typical Opportunities Found During an EBCx

- Sub-optimal scheduling
- Simultaneous or unnecessary heating/cooling
- Deferred maintenance issues
- Ineffective free cooling
- Fans and pumps not operating at optimal efficiency
- Piping that seems inappropriately hot or cold
- Unusual noises from mechanical equipment
- Equipment operating sequences that are out of sync or otherwise incorrect

# EBCx is more than BAS & Controls


# Where’s My Doorstop?

# Trending: Outdoor Air Damper Stuck Fully Open



# Top Ten List of EBCx Measures

1. Reduce equipment runtime
2. Optimize economizer operation
3. Eliminate simultaneous heating and cooling
4. Optimize supply air temperature
5. Optimize zone/setback temperature set points
6. Eliminate unnecessary lighting hours
7. Optimize ventilation rates
8. Volume control for pumps and fans
9. Add/optimize chilled water temperature reset
10. Eliminate passing (leaky) valves


https://www.bchydro.com/powersmart/business/programs/continuous-optimization/program-results.html

# Activity: Pre-Screening Using the NRCan Tool

# Pre-Screening Using the NRCan Tool

**Special Guest!**

Chris Shilton
Senior Project Manager
CityHousing Hamilton

# Phase 1: Planning

# Current Facility Requirements (CFR)

EBCx is **not aimed** at bringing the building back to its design intent

The project team must identify current operational requirements **(CFR)** that will serve as a target for all EBCx interventions

The requirement document usually includes:

- Requirements for comfort
- Requirements for temperature and humidity
- Requirements for air quality
- Operational requirements (e.g., schedules)

CFR must be prepared by the agent and approved by the owner

# Sample CFR

***Current Facility Requirements – Sample Document***

The following information was obtained from interviews with the Facility Manager and Operation's Staff:

| Requirement | Typical for Building | Offices | Lobby | Conference Rooms | Computer or Data Storage | Other: Cafe | Notes |
|---|---|---|---|---|---|---|---|
| **Temperature requirements for cooling and heating seasons** | Occupied: 72°F +/- 2°F<br>Unocc. Summer: 78-80°F<br>Unocc. Winter: 70°F | Same | Same | Same | 67 degrees at all times | | |
| **Humidity requirements** | No direct humidity control by building systems, possible of tenant systems | | | | 50 percent | | |
| **Dehumidification requirements** | None | | | | 50 percent | | |
| **Pressure relationship requirements** | (+) 0.04 diff. pres. Between building interior and outside environment | | | | | (-) 0.02 diff. pres. Between print shop and corridor | |
| **Filtration Requirements** | 2" 30% pleated pre-filter – changed as needed.<br>20" 90-95% bag – changed once per year. | | | | | | |
| **Ventilation requirements** | 25% outdoor air | Same | Same | Same | Same | Separate MUA system | |
| **Air change requirements** | N/A | | | | | | |
| **Sound and noise level requirements** | N/A | N/A | N/A | N/A | N/A | | |
| **Normal operating schedule for occupancy** | M-F = 6am-6pm | | 24 hours, 7 days a week | | | | Equipment is operating 1 hour prior to occupancy |
| **Weekend schedule** | Sat = 8am-1pm<br>Sun = N/A | | | | | | |
| **Holiday schedule** | Same as Sunday | | | | | | |
| **Process and office equipment status during evening/night time hours** | 100-300 tons of FC units with chiller water coils serving equipment loads | Same | Same | Same | Same | | |
| **Process and office equipment status during holiday hours** | Same as evening and night time hours | Same | Same | Same | Same | | |
| **Process and office equipment status during scheduled maintenance shutdowns** | Same as evening and night time hours | Same | Same | Same | Same | | |
| **Cleaning schedules** | M-F = 6am-2:30pm | | | | | | |
| **Lighting Levels** | 50 fc | | 40 fc | | | 70 fc | |
| **Other Requirements: Parking Garage Lighting** | All week days and Sat: 5am to 9pm<br>Sundays and Holidays the lights are off and the Garage is locked | | | | | | |

# The EBCx Plan Should Include

1. Objectives and scope of the project
2. Current Facility Requirements
3. Building description
4. Energy balance (summary per energy source)
5. List of systems and equipment targeted by the EBCx
6. Description of energy systems
7. Scope and methods of investigation
8. Team members and division of tasks
9. Establish a list of deliverables
10. Timeline and, optionally, cost of investigation

# Phase 2: Investigation

# Investigation Phase

The four pillars of EBCx investigation:

1. Pre-functional checks: ensure mechanical and control components operate adequately.
2. Monitoring plans: use BAS/EMS and data loggers to find issues – low cost approach, well documented.
3. Functional tests: verify if the system and equipment performance are what they should be
4. On-site inspections – boots on the ground!

# Building Investigation – Walk-through and Interviews

Whom to interview?

- HVAC O&M team
- Staff responsible for the control system O&M
- Central plant operators

Goal: understand operations and detect known problems

- Comfort issues, complaints log
- Discrepencies between systems' operations and occupancy
- Poor systems configuration
- Simultaneous heating and cooling
- Air and steam leaks

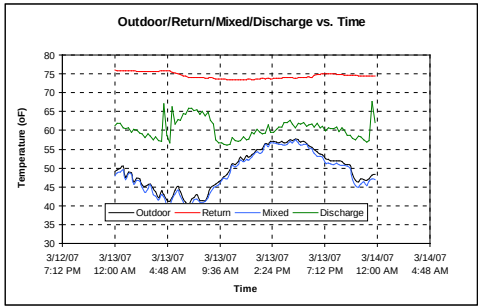
# Method of Investigation – Pre-Functional Checks

- The purpose of pre-functional checks is to verify the proper operation of components and BAS sensors – among others – prior to performing any diagnostic monitoring or functional tests on systems
- Pre-functional checks must be done early on during the investigation phase
- Checks identify deferred maintenance issues – low cost and high return method of investigation

# Method of Investigation – Monitoring Plans

Prepared by the EBCx agent and serve as a guide for completing measurements when building personnel or control contractors participate in this task

- Used to plan and structure the monitoring of mechanical systems operation
- Cover both portable recording instruments and the central control system
- Collected data is used to analyze current building operation

# Method of Investigation – Functional Tests

Functional tests are used in an EBCx project to:

- assess a system's performance
- diagnose a possible issue
- test proposed measures
- quantify possible savings

Best approach when monitoring and spot measurements cannot be used to identify potential issues

https://www.csemag.com/articles/commissioning-and-the-technology-evolution/

# Method of Investigation – Site Visit

- Confirm known issues and detect unknown issues
- Compare operational requirements to systems operation paramet
- Identify additional investigation requirements:
- Functional tests
- Monitoring data and trends analysis
- Can be combined with staff interviews
- Requires the same type of preparation
- Assess all the mechanical and electrical rooms
- Visit all floor areas

# Phase 3: Implementation

# Selecting an Implementation Approach

## Options

- Turn-key
- EBCx provider led/assisted
- Owner-led

## Timetable

- Implement immediately
- Staged to meet budget constraints

# Recommissioning Implementation Plan

- Defines and organizes approved recommendations for implementation
- Describes required results
- Specifies roles and responsibilities
- Identifies timeline for implementation
- Includes verification requirements and monitoring requirements
- Outlines training and ongoing activities for operators

# Phase 4: Hand-off and Persistence

# Hand-off and Persistence

- Hand-off meeting
- Maintain effective building documentation
- Offer ongoing training and coaching to building staff
- Maintain efficient operating performance
- Track performance
- Plan for ongoing commissioning and periodic EBCx
- Celebrate success!

# Must Have: Facility Staff Training

- Verifies understanding of EBCx measures implemented
- Offers opportunity to improve O&M practices
- Confirms staff roles and responsibilities going forward
- Helps ensure that the benefits of EBCx persist

# Conclusions

1. EBCx is a systematic process that optimizes comfort and energy savings in existing buildings
2. EBCx projects generally entail short paybacks and result in significant energy savings and non-energy benefits
3. EBCx helps to sustain energy and non-energy benefits

# Thank you

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