RESET PRINT

# EXISTING BUILDING COMMISSIONING

## (EBCx) PRE-SCREENING TOOL

This EBCx pre-screening tool has been developed to help identify the most appropriate building candidate(s) for existing building commissioning, by evaluating the improvement potential and the readiness of an eventual project. Prioritizing a portfolio of buildings and selecting those with the greatest likelihood for success helps to capitalize on short-term paybacks and support long-term planning. This pre-screening tool is designed to be used at the planning phase of the standardized EBCx process.

Instructions and additional information on how to complete this pre-screening tool are available in the user guide.

Building Name:

Location:

Prepared for:

Building Type:

Number of Floors: Floor Area: ☐ $m^2$ ☐ $ft^2$

Brief Building Description:

Example: This 2002 five-storey commercial office building has the original Building Automation System (BAS), heating, cooling and ventilation system and continues to operate as originally intended but with greater occupancy and extended hours.

Building Annual Energy Use Intensity: GJ/$m^2$

# IMPROVEMENT POTENTIAL FACTOR

## 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

## Mechanical Equipment Characteristics

### Q6

**Method used to control outdoor air (OA) intake**

**0 pts** ☐ Demand controlled ventilation by methods other than $CO_2$ levels

**3 pts** ☐ $CO_2$ level maintained through Demand Controlled Ventilation

**5 pts** ☐ No Demand Controlled Ventilation or fixed percentage of outside air

### Q7

**Economizer types**

**0 pts** ☐ No economizer

**3 pts** ☐ Water or air side economizer

**5 pts** ☐ Water and air side economizers

### Q8

**Air side distribution system type**

**0 pts** ☐ Constant Volume (CV)

**2 pts** ☐ Hybrid system, i.e. a combination of CV (bypass at unit)/Variable Air Volume (VAV) space level

**6 pts** ☐ VAV

### Q9

**Air Handling Unit (AHU) reset strategies**

**1 pts** ☐ Temperature AND static pressure reset used

**3 pts** ☐ Temperature OR static pressure reset used

**6 pts** ☐ No reset used

### Q10

**Heat Recovery**

**0 pts** ☐ No Heat Recovery

**2 pts** ☐ Partial Heat Recovery (Local Unit)

**4 pts** ☐ Heat Recovery (Central System)

### Q11

**Cooling Plant**

**0 pts** ☐ No cooling, district cooling or packaged Direct Expansion (DX) units only

**2 pts** ☐ Custom Air Handling Units (AHUs) or DX coils with outside condenser

**6 pts** ☐ Chilled water system with air cooled condenser or cooling tower

### Q12

**Control strategy for cooling and heating equipment**

**0 pts** ☐ Automated resets of control parameters based on actual loads

**3 pts** ☐ Automated or manual resets based on estimated loads or outdoor air temperatures

**6 pts** ☐ Central system with no resets (fixed setpoints)

## Mechanical Equipment Characteristics

Q13

**Presence of simultaneous heating and cooling**

**0 pts** ☐ Automated controls in place and effectively preventing simultaneous heating and cooling

**3 pts** ☐ Operator manually preventing simultaneous heating and cooling

**7 pts** ☐ Unknown, or controls not preventing simultaneous heating and cooling

Q14

**Heat production system type**

**0 pts** ☐ District heating plant

**2 pts** ☐ Decentralized heating systems

**4 pts** ☐ Building central heating plant

Q15

**Heat distribution type**

**0 pts** ☐ Electric heating only

**2 pts** ☐ Hydronic heating system, perimeter only

**4 pts** ☐ Integrated to packaged units/distributed heat pumps

**6 pts** ☐ Hydronic heating system, perimeter and AHUs

Q16

**Reheat system type**

**0 pts** ☐ No reheat system or reheat with recovered heat

**3 pts** ☐ Hydronic or Electric reheat system

## Building Controls

### Q17

**Level of control(s)**

**0 pts** ☐ Central plant only

**6 pts** ☐ Central plant and Air Handling Units (AHU)

**12 pts** ☐ All equipment including zone-level and/or lighting

### Q18

**Use of automated scheduling**

**0 pts** ☐ Scheduled to match occupancy with an optimum start program in use

**3 pts** ☐ Scheduled to match occupancy

**8 pts** ☐ No automated scheduling used

### Q19

**Control points in manual override**

**0 pts** ☐ No control points in manual override or some, well-documented

**3 pts** ☐ Undocumented scheduling OR setpoints in manual override

**6 pts** ☐ Undocumented scheduling AND setpoints in manual override

### Q20

**Last review of the Sequences of Operation**

**0 pts** ☐ Less than 5 years ago

**2 pts** ☐ Not sure

**4 pts** ☐ More than 5 years ago

# PROJECT READINESS FACTOR

## Building Controls Type and Access

Q21

**Type of building control(s)**

**0 pts** ☐ Local controllers or pneumatic

**3 pts** ☐ A combination of pneumatic actuators and Direct Digital Control (DDC)

**6 pts** ☐ DDC

Q22

**Direct Digital Control (DDC) trend and data storage availability**

**-5 pts** ☐ Unavailable

**5 pts** ☐ Available

Q23

**Remote access to the BAS for external consultants**

**0 pts** ☐ No remote access is available

**6 pts** ☐ Remote access is available

## O&M Documentation and Procedure

Q24

**Building documentation**

**-5 pts** ☐ Partially unavailable and/or not up to date

**2 pts** ☐ Majority of documents available and up to date

**5 pts** ☐ Clear, complete and up to date documentation available

Q25

**Energy Management Plan**

**0 pts** ☐ There is no Energy Management Plan in place

**4 pts** ☐ There is an Energy Management Plan in place

Q26

**Type of building maintenance**

**0 pts** ☐ Reactive maintenance, equipment is repaired when defective

**2 pts** ☐ Preventive maintenance programs in place

**4 pts** ☐ Predictive maintenance plan reviewed annually

## Client's Support & Engagement

Q27

**Owner and in-house champion support**

**-5 pts** ☐ Low or no support available

**3 pts** ☐ Good owner support available without an in-house champion

**5 pts** ☐ Excellent owner support available with an in-house champion

Q28

**Commissioning projects budgeting**

**-5 pts** ☐ Organization currently has strict operational and capital budgets that are likely to constrain allocation of funds to feasibly cover commissioning project costs

**5 pts** ☐ Organization has budget flexibility to accommodate both a commissioning investigation and implementation of recommended measures in current financial budgets

Q29

**Building staff capacity**

**0 pts** ☐ No building staff available, but service contractor available

**3 pts** ☐ Building staff can provide operation status

**6 pts** ☐ Building staff can perform some of the Existing Building Commissioning (EBCx) tasks

Q30

**Building controls staff proficiency**

**-5 pts** ☐ No controls staff available

**2 pts** ☐ Onsite staff with limited control capabilities available

**4 pts** ☐ Local control subcontractor or offsite expert available

**6 pts** ☐ Onsite staff with full control capabilities available

Q31

**Degree to which occupants (tenants, general staff) show interest in the building's performance, energy costs and indoor environmental quality**

**0 pts** ☐ Slightly or not interested

**2 pts** ☐ Moderately interested

**4 pts** ☐ Very interested

# EBCX PRE-SCREENING TOOL RESULTS

## Improvement Potential Factor

(Add the results of questions 1 to 20)

| Number of points | Improvement Potential |
|---|---|
| 0 to 29 | Not demonstrated |
| 30 to 59 | Moderate |
| 60 to 79 | High |
| 80 and more | Very High |

Total score

This factor helps you to assess the potential benefit of undertaking a commissioning project in your existing building (and/or to help prioritize such projects within your portfolio). A higher score indicates a stronger need to consider proceeding with a commissioning project.

## Project Readiness Factor

(Add the results of questions 21 to 31)

| Number of points | Project Readiness |
|---|---|
| Less than 15 | Low |
| 15 to 29 | Moderate |
| 30 to 44 | High |
| 45 and more | Very High |

Total score

A project's potential benefit must be weighed against its complexity and costs. This factor therefore helps you to evaluate your organization's readiness to undertake a successful project, with higher scores reflecting a greater readiness. Lower scores suggest a need to first address organizational conditions which could impose significant challenges to the project.

## Comments and/or Suggested Next Steps

Prepared by:

Email:

Date:


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# Existing Building Commissioning (EBCx) Pre-Screening Tool

# USER GUIDE

## TABLE OF CONTENTS

## INTRODUCTION

The purpose of this guide is to provide insight to existing building commissioning (EBCx) practitioners and stakeholders (owners, property managers, O&M and technical staff) on how to perform an EBCx pre-screening assessment and identify good candidates for EBCx projects.

There is usually room to increase a building's performance regardless of its age, purpose, or size. EBCx is a proven approach to improve energy savings, building performance, occupant comfort and building system reliability, but its potential to yield benefits varies from one building to another. The thirty questions in this checklist – covering various building aspects – have been developed and put together by EBCx experts to evaluate the following two factors:

- The improvement potential of a building;
- The organization's readiness level.

The tool output is intended to help you identify and select building(s) that are good candidates for EBCx. Buildings are very complex, however, and other characteristics and conditions might influence the building owner and/or manager in their decision to go forward with an EBCx project. This tool can thus be useful for assessing the EBCx potential of an individual building or help you to prioritize the need for buildings within a larger portfolio.

Should you require a more refined assessment or support in filling out the tool, an experienced EBCx practitioner can provide assistance in completing a thorough evaluation. Additional information on the building pre-screening selection is available in the Recommissioning Guide for Building Owners and Managers, at **https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/canmetenergy/files/pubs/NRCan_RCx_Guide.pdf**

An FAQ page is also available at the end of the user guide providing additional information.

## GENERAL INSTRUCTIONS

Prior to filling out the questionnaire, reviewing and/or having the following information at hand can help you achieve an accurate assessment of your building's EBCx potential:

- Energy data (i.e. utility bills)
- Comfort and/or complaint reports
- Mechanical equipment condition and characteristics
- Operations overview and building controls
- O&M documentation and procedures
- Organization's support and engagement level

It is also recommended to consult all stakeholders (tenants, facility management, and service provider) in order to gather as much relevant information as possible.

## BUILDING OVERVIEW

This section is located on the first page of the tool and serves to provide general information on the building(s) being assessed. This section will not affect the overall pre-screening assessment. Noting key aspects of the building(s) may be useful in helping owners, managers and engineers manage multiple building assessments.

- **Building Name** (most common name for the building)
- **Location** (building address)
- **Prepared for** (name of the organization and/or person for whom the pre-screening tool is being used)
- **Building Type** (main type of activity or function taking place within a building, representing at least 50 percent of its floor space. Buildings can be classified by activity according to the following 10 types:
  - » Office building (non-medical)
  - » Office building (medical)
  - » Primary or secondary school
  - » Assisted daily care facility and/or residential care facility
  - » Warehouse
  - » Hotel, motel and/or lodge
  - » Hospital
  - » Food and beverage stores (excluding restaurants and bars)
  - » Retail store (non-food)
  - » Other activity or function, or multi-use

- **Number of Floors** (total number of above and below ground floors)
- **Floor Area** (total gross floor area enclosed above or below ground by the exterior walls of a building)
- **Brief Building Description** (brief description of the main attributes and particularities of the building, such as year of construction, occupancy, recent changes, etc.)
- **Building Annual Energy Use Intensity**
  (The energy use intensity (EUI) is a building's energy use as a function of its size or other characteristics. For most commercial and institutional buildings, the EUI is expressed as energy per square metre per year, and is calculated by dividing the total energy consumed by a building in one year by its total gross floor area. The EUI enables the comparison and benchmark of a building with its peer.)

The following table with common conversion factors can be used to calculate a building's EUI.

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | ENERGY SOURCE | NATURAL UNIT | ANNUAL CONSUMPTION | CONVERSION FACTOR | ANNUAL CONSUMPTION IN GJ (*E2 = C2 X D2*) |
| 2 | Electricity | kWh | | 0.0036 GJ/kWh | |
| 3 | Natural Gas | $m^3$ | | 0.03826 GJ/$m^3$ | |
| 4 | Light Fuel Oil | L | | 0.03880 GJ/L | |
| 5 | Heavy Fuel Oil | L | | 0.04250 GJ/L | |
| 6 | Diesel | L | | 0.03830 GJ/L | |
| 7 | Total Energy Use (*sum of E2 to E6*) | | | | |
| 8 | Total Gross Floor Area | $ft^2$ | | 0.09290 $m^2/ft^2$ | |
| 9 | Energy Use Intensity (*EUI = E7 / E8*) | | | | |

## IMPROVEMENT POTENTIAL FACTOR

### Building Context

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

The EUI of a building is calculated by dividing the total amount of energy consumed by the total gross area. A building with an unjustified high EUI or unexplained increases in energy consumption is an obvious indicator of a good EBCx candidate. The benchmarking exercise can be done by comparing a building internally (within a portfolio) or externally.

If the energy use of the building is tracked through Energy Star Portfolio Manager, you can use the ENERGY STAR Score as the benchmarking parameter.

You may, of course, use an alternative benchmarking system, but the principles behind the scoring for this section remain the same – the EBCx potential of any building is likely proportionate to the degree to which its energy intensity is greater than average.

You may still assess your building's performance without a formal benchmarking platform by referring to the average EUI of commercial and institutional buildings, by building type, available via the link below.

EUI reference: **https://www150.statcan.gc.ca/n1/daily-quotidien/160916/dq160916c-eng.pdf**

**Q2 – Upcoming Major Retrofit Projects**

Major retrofit projects can slow down, complicate or interfere with the investigation work during an EBCx project. Therefore, it may be beneficial to complete a major retrofit project before starting an EBCx project. Your building serves as a better candidate for EBCx if no major retrofit is planned within the next few years.

Examples of major building retrofits include tenant retrofit improvement projects, the replacement of one or multiple equipment systems such as central heating or cooling plants, air-handling units, control systems, etc.

**Q3 – Thermal Comfort and Indoor Environment Quality (IEQ)**

Occupant safety and comfort can be impacted from inadequate indoor air quality and temperature, often the result of faulty equipment or control parameters. An EBCx project can evaluate occupants' complaints to potentially locate the problem and resolve the issue.

Examples of complaints from occupants: hot or cold zone temperatures, uncomfortable drafts, loud sounds from diffusers, high or low light intensities, strange odours, humidity issues.

## Mechanical Equipment Condition

**Q4 – Age of Equipment**

The remaining useful life of HVAC equipment will depend on its runtime and physical condition. Benefits from improving the operation of outdated equipment without any retrofit/replacement is limited during an EBCx project. Equipment and systems that are under 12 years old or are several years from the end of their useful life and that are well maintained are ideal. However, the age of equipment represents less of an issue if the equipment has been well maintained. For buildings with older equipment, it may be beneficial for the owner to evaluate the physical condition of major equipment, through an Energy Audit, before committing to an EBCx project.

**Q5 – Mechanical Problem(s) with HVAC Systems**

When equipment and systems are well maintained, there should not be any evidence of excessive deferred electrical and mechanical maintenance issues. However, recurrent mechanical problems are an indication that the root cause has been neither identified nor fixed. EBCx can evaluate these problems and potentially improve the equipment or systems, resulting into energy savings, increased equipment life cycle and improved occupant comfort.

## Mechanical Equipment Characteristics

**Q6 – Method Used to Control Outdoor Air (OA) Intake**

Air distribution systems are designed to draw in OA as per building codes. These code requirements usually assume full occupancy, but occupancy is variable in reality, so OA intake also needs to vary. The method to control OA intake may have a significant impact on the energy needed from ventilation systems to condition that air, thus impacting the building's EBCx potential.

**Q7 – Economizer Types**

Economizers increase the efficiency of a building's cooling system by utilizing the energy available from outside air.

A water-side economizer refers to dry coolers or cooling towers that can be used (in certain conditions) to produce useful cooling without the chiller running.

An air-side economizer, however, produces useful cooling by bringing excess outside air into the building (thus reducing the amount of recirculated air and required mechanical cooling).

If the proper mechanical and control components are available, an economizer tune-up can increase the overall savings potential.

**Q8 – Air-Side Distribution System Type**

Generally, air distribution systems will come in three configurations: Constant Volume (CV), Variable Air Volume (VAV) or hybrid system containing both. These systems will vary in complexity, size and control.

On one hand, a CV system is low cost and basic in design, but offers less potential for improvement during an EBCx project due to the limited amount of adjustable control parameters. On the other hand, significant savings can be achieved by converting a CV system to a VAV system (retrofit project).

EBCx tends to uncover more low/no-cost potential savings on VAV or hybrid systems as they allow for adjusting the airflow, temperature and pressure based on the actual needs of the space.

**Q9 – Air Handling Unit (AHU) Reset Strategies**

AHU operating temperatures and pressures can be reset based on different parameters (actual loads, outside air temperature, etc.) in order to reduce energy consumption. If not already implemented, those strategies can represent a significant potential for energy savings.

In a case where various reset strategies are used for different AHUs, you may select the answer that represents the majority of systems.

**Q10 – Heat Recovery**

The efficiency of heat recovery systems can be significantly reduced if they are not operated or controlled optimally.

Improving the efficiency of these systems through EBCx is often possible. Additionally, a centralized heat recovery system tends to offer more potential for improvement at a lower cost – and while requiring less effort – than local systems.

**Q11 – Cooling Plants**

Cooling plants are composed of mechanical systems, integrated controls and operational parameters that are unique to every building. Savings potential can exist depending on the type and configuration of the equipment and control parameters being used.

For example, chilled water systems with an air-cooled condenser or cooling tower tend to offer more potential for improvement through an EBCx project because they contain more adjustable parameters than other types of systems.

**Q12 – Control Strategy for Cooling and Heating Equipment**

Different control strategies can be applied to cooling and heating equipment, therefore impacting their energy efficiency.

An automated reset of control parameters such as temperature and/or pressure set points based on actual loads is the most efficient strategy to optimize the energy consumption of cooling and heating systems.

In a case where different strategies are used for heating and cooling systems, you may choose the conservative answer that attributes fewer points.

**Q13 – Presence of Simultaneous Heating and Cooling**

Preventing simultaneous heating and cooling is one of the biggest challenges in building operation, seeing as it is often unnoticeable. For example, without proper controls, a terminal box could be delivering cold air while the baseboard in the same zone is providing heat. An EBCx agent can analyze operational trends, energy consumption data and control programs to identify issues and implement strategies to prevent simultaneous heating and cooling.

**Q14 – Heat Production System Type**

Boilers and heat pumps can be integrated into a central heating plant, or operate locally, to serve independent zones. The savings potential will vary depending on the type and configuration of equipment installed and the control parameters used. For example, central heating plants tend to offer more potential for improvement through an EBCx project because they contain more adjustable parameters than other types of systems.

**Q15 – Heat Distribution Type**

Heat distribution types vary from one building to the next. While some will consider an all-electric perimeter heating system, others will integrate hybrid systems containing hot water for perimeter heating, and indirect gas burners or heat pumps for air distribution heating.

Hydronic heating systems with heating coils in the AHUs usually show greater potential for optimization than perimeter-only systems. Distributed packaged units or heat pumps also show some potential but require a higher level of effort during an EBCx investigation.

Note that EBCx is still relevant for electric heating systems. While these systems present less potential for energy efficiency, control strategies for peak demand control might offer significant cost savings depending on the electricity tariff structure.

**Q16 – Reheat System Type**

Reheat systems are normally located at the zone level and can provide additional heating without adding a load on the air distribution system. They can potentially improve performance and efficiency, but improperly implemented reheat strategies and controls often end up being a source of energy waste. EBCx can identify and correct such situations.

## Building Controls

**Q17 – Level of Control(s)**

The level of controls in a building refers to the degree of communication between any mechanical equipment. Better control capabilities usually equate to greater savings potential. For instance, a building with integrated controls at the zone level can benefit from the zone's feedback to automatically adjust and optimize the air distribution system. The appropriate amount of air at the right temperature will improve occupant comfort while using the most minimal amount of energy possible. The EBCx savings potential will depend heavily on the building's control capabilities.

**Q18 – Use of Automated Scheduling**

Automated scheduling refers to the use of control logic to start and stop a system or equipment. By regulating and optimizing equipment runtime, saving opportunities can be possible – from both an energy and a maintenance standpoint – all with low implementation costs. In addition, reducing run times also translates into extending the equipment's useful life.

**Q19 – Control Points in Manual Override**

Building operators can temporarily override their HVAC equipment and override control points manually through the automation system. A good practice is to document every override issue. Improper documentation will lead to forgotten overrides and potential energy waste.

**Q20 – Most Recent Review of the Sequences of Operation**

The sequences of operation of equipment or systems can become inefficient over time as the building evolves. If the sequences of operation have not been reviewed in the past 5 years, it is likely that an EBCx project will be able to identify improvement potential.

## PROJECT READINESS FACTOR

### Building Controls Type and Access

**Q21 – Type of Building Controls**

Some buildings contain only pneumatic controls, which rely on compressed air and do not compute calculations or compile historical trend data, as opposed to direct digital control (DDC) systems. Without adequate trending and data storage capability, the installation of portable data loggers may be necessary, which can add time and expenses to the EBCx project.

**Q22 – Direct Digital Control (DDC) Trends and Data Storage Availability***

Data monitoring is a critical element of EBCx. It is one of the most important aspects that distinguishes EBCx from an energy audit. Operational data of the various building systems – during a certain timeframe – provides insight into the building's behaviour under different conditions, allowing the diagnostic of abnormal operation. Furthermore, as data availability increases, the diagnostic quality will improve, which can lead to additional saving opportunities. In general, to get the most out of EBCx, the DDC system should be able to trend and store large amounts of data at short frequencies (2 minutes or less) for long periods of time without slowing down the normal control functions.

* CRITICAL: Having access to trending and data storage capabilities is considered a critical element of the organization's readiness level.

**Q23 – Remote Access to Control System for External Consultants**

If the building has a modern automation system, chances are that this system can be accessed remotely. Providing the EBCx agents with read-only remote access to the automation system will save them valuable time and increase the quality of the measures identified during the EBCx investigation.

### O&M Documentation and Procedure

**Q24 – Building Documentation***

When scoping an EBCx project, it is important to understand what building documentation is available. Clear and up-to-date documentation expedites the investigation phase of a project. Buildings that lack good documentation, especially in regards to the mechanical and control systems, can drive costs up if the EBCx provider has to spend time gathering and recreating critical information in order to assess system operation. Important building documentation includes, but is not limited to, the following:

- Energy and water data or utility bills for the past three years
- As-built mechanical and electrical drawings, including piping and riser diagrams
- As-built control system documentation
  - » Points list
  - » Sequences of operation
  - » User's manual
  - » Control drawings with as-built sensor locations
- Testing, adjusting and balancing reports
- Systems manual or O&M Manuals

Other useful documentation:

- » An equipment list with nameplate information and dates of installation
- » Pump and fan curves
- » Copy of current service contracts
- » Equipment warranties still in effect

Missing or out-of-date building documentation should not necessarily eliminate a building from being considered as EBCx candidates. However, in the interest of cost-effectiveness, owners may first wish to conduct the EBCx project in their buildings having complete and well-organized documentation in order to expedite the investigation process.

* CRITICAL: Having access to up-to-date documentation is considered a critical element of the organization's readiness level.

**Q25 – Energy Management Plan**

Having an energy management plan or program in place provides a structured system to address an organization's commitment to improving energy efficiency. An energy management plan is an indication of engagement toward energy management practices, which translates into a higher likelihood for a successful EBCx project.

**Q26 – Type of Building Maintenance**

Building operators ensure the well-being of the building and its mechanical equipment. Three types of building maintenance exist: reactive, preventive and predictive.

Reactive maintenance refers to repairing equipment only when it is defective. Preventive maintenance requires following a strategy and a routine to avoid any equipment failure. Predictive maintenance is the art of monitoring parameters (controls and engineering) during normal operation, and identifying deviations in performance, which can lead to potential equipment failures. Well-maintained systems will allow the consultant to focus on identifying EBCx measures, as opposed to addressing maintenance issues.

## Client's Support & Engagement

**Q27 – Owner and In-House Champion Support***

There is probably not a more important combination that will lead to a project's success than having an involved, supportive owner along with a technically savvy in-house champion. Throughout the project, they set expectations, assign building staff to assist the EBCx provider, perform maintenance items and participate in the EBCx process, ensuring the project keeps moving forward. However, owners are often absent or distracted by other important tasks, making it difficult to gauge their level of interest in an EBCx project. Therefore, a critical factor to a project's success is an in-house champion – such as an energy manager or facility manager – who is willing to work as a facilitator to get what needs to be done accomplished in a timely manner. In any case, an owner's investment history in energy efficiency and sound O&M practices is an indicator of a progressive management philosophy and commitment to improving building operations. An owner's track record allows to more easily judge the level of engagement and willingness when it comes to supporting the EBCx process.

* CRITICAL: Having the owner's engagement with an in-house champion for the EBCx project is considered a critical element of the organization's readiness level.

**Q28 – Commissioning Project Budgeting***

A commitment to periodic recommissioning should be considered as an essential element in your building's management plan, and thus be appropriately budgeted for. However, EBCx invariably leads to a combination of purely operational adjustments and equipment upgrades or other (usually minor) capital expenditures. This can be problematic for organizations which adhere to a strict distinction between their capital and operational budgets; EBCx projects may end up "falling in the cracks" between these categories. The initiation of effective EBCx projects therefore depends on the organization's willingness to accommodate the operational/capital mix of EBCx recommendations.

* CRITICAL: Having access to funds to cover commissioning project costs is considered a critical element of the organization's readiness level.

**Q29 – Capacity of Operational Staff**

Having internal staff available to provide information about the building's control and mechanical systems will facilitate the investigation process. Having internal staff available to perform some of the EBCx tasks (e.g. help set up the trend logs, implement some of the less complicated measures, etc.) can significantly reduce implementation costs and increase the likelihood of savings persistency. Additionally, a well-trained and proactive O&M team will tend to work more effectively during the investigation and to maintain the EBCx benefits.

**Q30 – Proficiency of Control Staff**

The building automation system (BAS) is a complex tool that can be mastered by the building's operating team. Proper knowledge of the BAS will benefit the building in many ways and provide additional savings potential during an EBCx project. A lack of knowledge, however, will create a heavy dependence on external control providers, and can affect the complexity and/or depth of the investigation.

* CRITICAL: Having access to a resource with control capabilities is considered a critical element of the organization's readiness level.

**Q31 – Occupants' Interest in the Building's Performance (Energy Costs, Comfort, etc.)**

Occupants (tenants, general staff) showing interest in the building's energy costs and indoor environmental quality (IEQ) tend to endorse an owner-led initiative towards improving energy costs and comfort levels. Shared interest between the owner and the tenants may lead to a greater likelihood of success for EBCx projects.

# EBCX PRE-SCREENING TOOL RESULTS

The questionnaire's scoring system will determine two distinctive factors: 1) the improvement potential factor for carrying out an EBCx project in a building; 2) the project readiness factor. The totals from these two factors should not be combined to form one single score.

## Improvement Potential Factor

This factor provides an assessment of the building's improvement potential through an EBCx project. A high or very high factor (score of 60 or higher) demonstrates greater opportunity to capitalize on short-term paybacks. Candidate buildings with a moderate factor (score between 30 and 59) may present less potential for improvement, whereas buildings for which the improvement potential is not demonstrated (score below 30) should consider pursuing an Energy Audit or other energy projects prior to advancing the EBCx process.

## Project Readiness Factor

This factor helps you to evaluate your organization's readiness to undertake a successful project. The complexity and/or cost of an EBCx project can vary greatly depending on your organization's readiness. A high or very high factor (score of 30 or higher) indicates the organization has the management systems in place to allow for a smooth EBCx process and delivery. Candidate buildings with a moderate factor (score between 15 and 29) may indicate a more complex and/or costly EBCx project, whereas buildings with a project readiness factor that is low (score below 15) should consider reviewing their management systems prior to advancing the EBCx process.

## Comments and/or Suggested Next Steps

Based on the answers provided throughout the tool and the final scores, indicate your recommendations for next steps, as well as any other relevant information and/or comments.

Once a building is identified as a candidate for EBCx, the building owner needs to define the objectives and the project scope. Owners looking to take advantage of the provider's expertise early in the process may want to plan the selection process through a Request for Proposal (RFP) or a Request for Qualification (RFQ). Further details on these steps are available in chapters 4 and 5 of the *Recommissioning Guide for Building Owners and Managers*.

Note that a thorough EBCx project typically takes at least nine months to complete since it is considered a best practice to investigate building operations during summer, at least one shoulder season, and winter conditions.

# FREQUENTLY ASKED QUESTIONS (FAQ)

**1.0 My team operates our systems efficiently with typical comfort complaints, but systems are well maintained. Why should I consider EBCx?**

*A good starting point is to use the energy and/or water use intensity and compare your building with industry standards. In addition, NRCan's pre-screening tool provides an objective, easy-to-use score. The EBCx experience has demonstrated on numerous occasions that improvements are available when addressed systematically.*

**2.0 How can the risk of wasting money be alleviated when investing in an EBCx project?**

*A great tool is the Measurement and Verification (M&V) Plan coupled with data directly from the utility bill and meter. Since utility rates can rise, weather can change, and other factors may impact your utility costs, it is important to look at both use and cost. If tools such as CUSUM show an increase in use, it is time to step in and understand the reason why.*

**3.0 Why can we not do this in-house? What value is there to bringing in external EBCx agents only to teach them how our own building operates?**

*Operating teams are stretched too thin with multiple requests and must focus on day-to-day challenges. The luxury of time needed to set up functional tests is often not available. Also, operators may not have the proper training to complete a thorough investigation and/or to undertake Measurement and Verification. Proceeding with an external EBCx agent brings value to the organization by supporting and training the operating team in improving building operation.*

**4.0 EBCx savings are being generated by many small improvements that are not possible to track and may not appear on my utility bill. How can I be sure that the payback is real?**

*Tools that input energy consumption allow for the use to be evaluated against dependent and independent variables. The best example is the relationship between natural gas and weather. The amount of natural gas used will increase or decrease based on outside temperature, but is very often 'over used' or excessively used during unoccupied periods. Energy management tools are available to accurately assess the real need VS overly conservative behaviours.*

*An EBCx agent will ensure that at least 3 conditions are in place to evaluate and measure utility use:*

**i.** *Energy consumption management software and/or M&V plan;*

**ii.** *A significant number of EBCx measures implemented to see at least a 5% reduction;*

**iii.** *Training and persistence strategies so the operation, management and administration teams are coordinated and working together.*

**5.0 I just completed an Energy Audit and it did not generate any savings. So why should I spend more money on an EBCx project?**

*An audit and an EBCx project are carried out for very different reasons. While an audit identifies energy efficiency measures by understanding the building and its energy use, it does not however reduce energy consumption. An audit is an effective tool for understanding and quantifying retrofit opportunities so that projects can proceed with the support of clear expectations of cost and savings potential.*

*In comparison, Existing Building Commissioning (EBCx) allows for saving energy and/or improving performance, through operational and behavioural improvements that are not capital-intensive and that are based on the current needs of the building.*

**6.0 How important is it to follow a standardized EBCx approach (i.e. NRCan's 4-Phase RCx process)?**

*Following a standardized approach ensures the process is effectively followed and documented. It also helps maintain benefits that have evolved over multiple projects.*

**7.0 What are the "Top 10" EBCx opportunities?**

**1.)** *Matching schedules (HVAC & lighting) with the building's current needs*
**2.)** *Optimizing outside air (OA) requirements*
**3.)** *Preventing simultaneous heating and cooling*
**4.)** *Ensuring pumps are not throttled and using variable frequency drive (VFD) where appropriate*
**5.)** *Optimizing supply air temperature*
**6.)** *Selecting and calibrating critical sensors*
**7.)** *Reviewing sequences of operation*
**8.)** *Optimizing control of economizers*
**9.)** *Validating proper system functions (e.g. valves, flow controls, etc.)*
**10.)** *Engaging and supporting operations with the tools and training needed*

## REFERENCES


- CanmetENERGY's Advanced RCx Course, ISBN: 978-1-100-90417-7, cat.: MI 54-18/2008F-PDF, NRCan, Nov. 2008.
- RETScreen Expert Software, available at**: https://www.nrcan.gc.ca/maps-tools-publications/tools/data-analysis-software-modelling/retscreen/7465.**
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- Lia Webster, Matthew ibbs, Ani Duttagupta. Effects of Project Screening Criteria on RCx Energy Savings, Nexant, Inc., NCBC 2007.