

Commercial RE Series 2: existing building commissioning (EBCx)

Best practices - planning and engagement

Ed Rubinstein



Welcome

Today's Workshop Facilitator



Ed Rubinstein has been leading and developing energy management programs and teams for over 25 years, including the University Health Network's award-winning energy and environment team and as a vice-president at a renewable energy company. Ed and his teams have been honoured with numerous awards, including recognition as a member of Clean16.

Agenda

1. What is existing building commissioning (EBCx)?
2. What are the benefits of EBCx?
3. Is your building a good candidate for EBCx?
4. Group activity: is my building a candidate for EBCx?
5. Preparing for a successful EBCx project
6. Group activity: who are my key stakeholders?
7. From planning to project launch
8. Group activity: develop a mini EBCx plan
9. Save on Energy support for EBCx
10. Final takeaways

Workshop learning objectives

- Explain the purpose and benefits of EBCx
- Identify common indicators that a building may be a good candidate for EBCx
- Recognize key stakeholders involved in EBCx projects
- Describe the key steps involved in launching an EBCx project
- Learn more about Save on Energy support for EBCx.

Why EBCx matters

- Many buildings have operational improvement opportunities.
- Returns on investment (ROIs) for operational optimization are often more attractive than capital investment.
- Operational optimization can impact capital investment needs.
- Operational issues often remain hidden for years.

Have you considered implementing an EBCx project or have you already completed one?

What is EBCx?

What is EBCx?

- EBCx is a structured, evidence-based process for investigating, tuning and optimizing building performance so that systems work together as intended and meet current facility needs:
 - Focussed on low/no-cost operational improvements instead of large capital upgrades
 - Ensures buildings operate as intended and meet current facility requirements
 - Incorporates a continuous improvement mindset
 - Often leads to reduced energy waste, improved comfort and safety as well as enhanced reliability



EBCx versus capital upgrades

	EBCx	Capital upgrades
Primary purpose	Optimize performance of existing systems; fix <u>systemic</u> operational issues	Replace, add or modernize equipment and infrastructure
Cost profile	Low-cost or no-cost; typically using operational budget	High cost; requires capital budget and long-term planning
Typical payback	Short (often less than 3 years)	Long (5–20+ years depending on asset)
Disruption level	Minimal; mostly operational adjustments	Moderate to high; construction, shutdowns and/or phased work
Energy savings	Typically 5–20% driven by operational improvements	Large potential savings but dependent on project scale

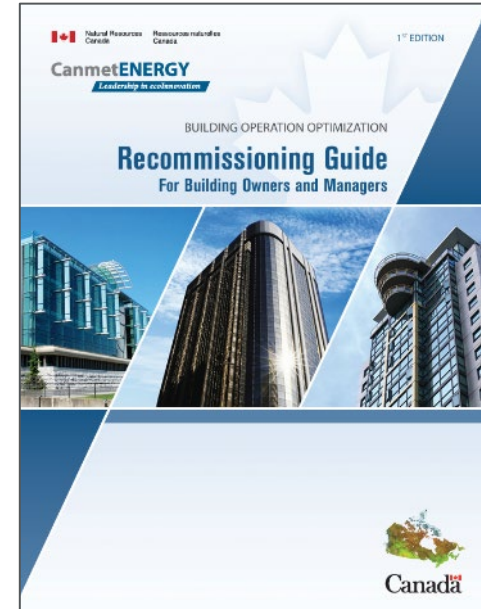
EBCx versus maintenance

	EBCx	Maintenance
Primary purpose	Improve overall building performance by diagnosing and optimizing system operation; fix <u>systemic</u> operational issues	Preserve equipment functionality and reliability through routine tasks and repairs
Focus	Whole-building systems integration, controls logic and operational efficiency	Individual equipment health, wear-and-tear and failure prevention
Cost profile	Low-cost/no-cost operational improvements	Ongoing operational budget; costs vary with equipment age and condition

What are the benefits of EBCx?

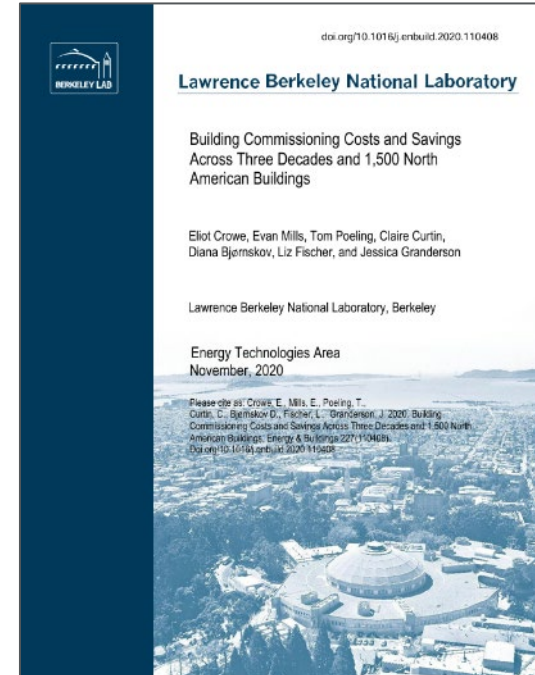
EBCx benefits: reduced energy and operating costs

- Reduced energy costs through waste minimization:
 - 5% to 20% energy savings
 - Lower investment than capital upgrades
- Reduced maintenance costs through equipment and system optimization
- Potential to reduce capital costs:
 - Extended equipment life
 - Equipment right-sizing
- Improved building value



EBCx benefits: reduced energy and operating costs

“Median primary energy savings for commissioning (Cx) projects in existing buildings ranged from 5% for those conducted under utility programs ... and 14% for Cx projects outside of utility programs. ... The median simple payback [period] for existing buildings was 1.7 years.”



EBCx benefits: reduced energy and operating costs

Continuous optimization program results 

RESULTS TO MARCH 2024

Building type	Sample size	Size (ft ²)	Before continuous optimization						Results after implementation				
			Annual utility cost			Annual energy consumption			Implement cost	Energy savings			Simple payback
			Electricity (\$/ft ² -yr)	Fuel (\$/ft ² -yr)	Total (\$/ft ² -yr)	Electricity (kWh/ft ² -yr)	Fuel (MJ/ft ² -yr)	Total (kWh/ft ² -yr)	(\$/ft ²)	Electricity (% kWh)	Fuel (% GJ)	Total (% \$)	Years
			Average	Average	Average	Average	Average	Average	Average	Average	Average	Average	Average
Extended care	16	80,814	\$1.28	\$0.97	\$2.24	14.2	107.5	44.0	\$0.35	4.2%	9.8%	6.7%	2.4
Food retail (e.g. supermarkets, grocery stores)	19	140,023	\$3.74	\$0.40	\$4.13	41.5	44.3	53.8	\$0.02	4.7%	2.7%	4.5%	0.1
Hospital	78	219,091	\$1.92	\$1.06	\$2.98	21.4	117.4	54.0	\$0.23	3.8%	6.6%	4.8%	1.6
Large office	86	238,572	\$2.12	\$0.38	\$2.49	23.5	41.7	35.1	\$0.21	3.4%	9.1%	4.2%	1.9
Medium office	49	67,199	\$1.88	\$0.25	\$2.13	20.9	27.8	28.6	\$0.27	6.3%	12.9%	7.0%	1.8
Multi-unit residential building (MURB)	6	77,834	\$0.62	\$0.10	\$0.72	6.9	10.6	9.9	\$0.06	4.9%	23.6%	7.4%	1.2
Nursing home	10	134,730	\$0.96	\$0.97	\$1.92	10.6	107.5	40.5	\$0.23	1.8%	7.8%	4.8%	2.5
Recreation	24	124,244	\$2.05	\$1.06	\$3.10	22.7	117.4	55.3	\$0.32	5.0%	7.2%	5.7%	1.8
Shopping mall	15	417,618	\$1.27	\$0.68	\$1.95	14.1	75.1	35.0	\$0.07	2.3%	1.4%	2.0%	1.9
University/college	166	123,757	\$1.50	\$0.53	\$2.03	16.7	58.5	32.9	\$0.28	6.3%	12.5%	7.9%	1.8
Other	19	141,312	\$1.90	\$0.55	\$2.45	21.1	60.8	38.0	\$0.20	4.2%	8.5%	5.1%	1.6
Hotel	7	338,025	\$1.85	\$0.35	\$2.20	20.5	38.7	31.3	\$0.23	4.1%	11.1%	5.2%	2.0
School	170	101,729	\$0.62	\$0.37	\$1.00	6.9	41.5	18.5	\$0.17	7.8%	12.4%	9.5%	1.8
Grand total	665	148,574	\$1.63	\$0.55	\$2.18	18.1	60.8	35.0	\$0.21	4.8%	9.1%	5.7%	1.7

- On average, the buildings of operators that completed the implementation phase demonstrate a 5.7% overall cost reduction, with a 1.7-year simple payback period.

(www.bchydro.com/powersmart/business/programs/strategic-energy-management/commercial/continuous-optimization.html)

EBCx benefits: improved safety, comfort and reliability

- Improved air quality
 - Proper air changes
- Improved occupant comfort:
 - Fewer hot/cold complaints
 - Easier to identify faulty sensors and equipment
- Improved lighting for safety and security
- Fewer equipment failures, less reactive maintenance and fewer unplanned shutdowns



Benefits of EBCx

- Many buildings offer significant improvement opportunities that can be addressed through operational optimization rather than major capital investments.



Is your building a good candidate for EBCx?

Clues your building is a good candidate for EBCx

- Rising energy use:
 - Trend analysis
 - Energy demand consumption irregularities (seasonal, daily, weekly, etc.)
- Building occupant complaints:
 - Hot/cold
 - Stale air
 - Pressure imbalances



Clues your building is a good candidate for EBCx

- Equipment anomalies:
 - 24/7 operations (fans, pumps, air-handling units, lights, etc.)
 - Excessive cycling (equipment on/off, dampers opening/closing, etc.)
 - Persistent equipment issues (e.g. failures) even if well maintained
 - Reliance on reactive instead of preventative maintenance



Clues your building is a good candidate for EBCx

- Outdated building automation system (BAS) operations:
 - Manual overrides
 - Excessive alarms
 - Old sequences and/or schedules
 - Lack of optimization
 - Simultaneous heating and cooling



Common characteristics of strong EBCx candidate buildings

- Complex heating, ventilation and air conditioning (HVAC) and other building systems (e.g. for hospitals, laboratories, etc.)
- Large buildings ($>\sim 5,000$ m²)
- Presence of a BAS
- Mechanical equipment is not near end of life and is in good condition
- No major renovations or redevelopment planned
- Building use has changed over time
- Energy use higher than similar type buildings (e.g. Energy Use Index, etc.)

Why do building issues (or EBCx opportunities) often stay hidden?

- Lack of data visibility
- Limited resources such as lack of:
 - Staff and Competencies/training
 - Time
 - Funding
- Missing or incorrect building documentation:
 - As-built drawings
 - As-operated documentation (e.g. sequences, etc.)



Natural Resources Canada EBCx pre-screening tool



Pre-screening tool suite - Natural Resources Canada

(<https://natural-resources.canada.ca/energy-efficiency/building-energy-efficiency/energy-efficiency-existing-buildings/pre-screening-tool-suite>)

Group activity #1

Is my building a candidate for EBCx?

Group activity #1: is my building a candidate for EBCx?

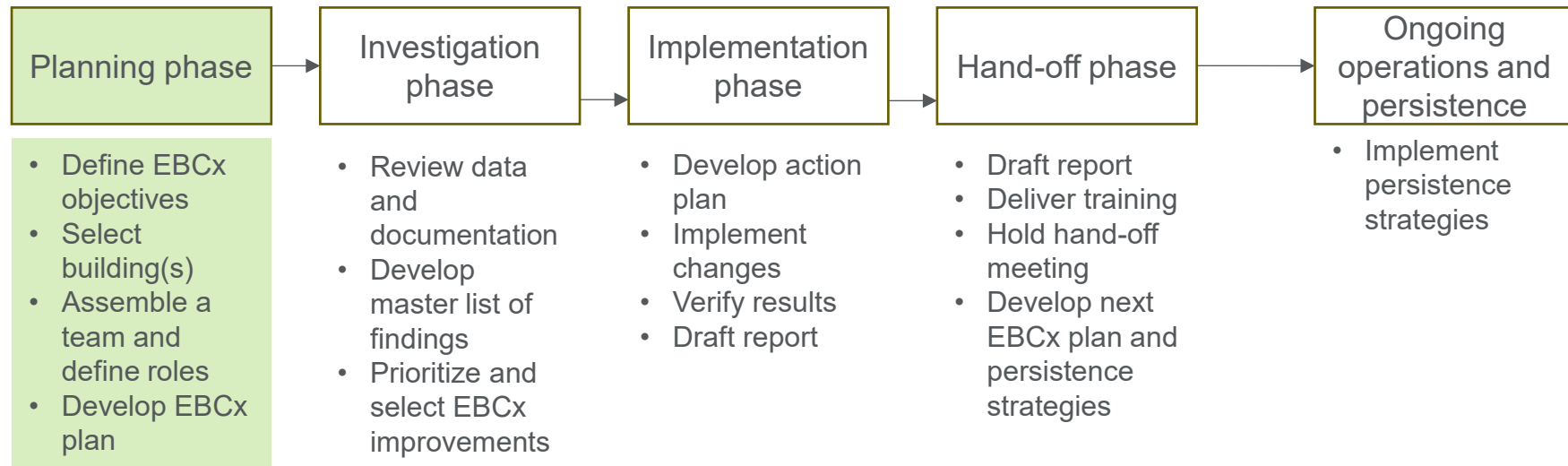
The operations team for a mid-sized office building has noticed recurring comfort complaints (some zones are too warm in winter while others are consistently cold), and energy use has been steadily rising despite no major changes in occupancy. Staff have observed that equipment is often run at unexpected times, and the BAS trend data they can access shows inconsistent schedules and setpoints, although they are not sure how long these have been occurring. They have utility bills for the past two years, basic BAS trends and a list of recent maintenance work.

Group activity #1: is my building a candidate for EBCx?

- What issues do you observe?
- What data and/or information do you have?
- What are some potential EBCx opportunities?
- What additional data and/or information do you need?

Preparing for a successful EBCx project

The EBCx process



Successful projects begin with planning, stakeholder alignment and readiness.

Key stakeholders: building owners and organization leadership

- Support needed:
 - Leadership
 - Budget approval
 - Strategic direction and alignment
- Key drivers:
 - Improved comfort and safety
 - Reduced risk
 - Business case and potential incentives



Key stakeholders: facility management

- Support needed:
 - Directors and managers: operational oversight, resource allocation, strategic direction and alignment
 - Building operators: daily operations, BAS and mechanical room access and knowledge system issues
- Key drivers:
 - Reduced occupant complaints
 - Reduced maintenance costs
 - Lower risk of equipment failure
 - Less reactive maintenance

Key stakeholders: energy/sustainability managers

- Support needed:
 - Utility data and analysis
 - Performance tracking
 - Strategic direction and alignment
 - Incentive applications
- Key drivers:
 - Reduced energy use
 - Sustainability benefits



Key stakeholders: building occupants and tenants

- Support needed:
 - Feedback on comfort and other issues
 - Information on current facility requirements
 - Feedback on potential engagement strategies
 - Feedback on potential impact of EBCx project
- Key drivers:
 - Improved comfort and safety
 - Participation in the process
 - Cost savings and (sometimes) other benefits



Do not forget to engage other potential key stakeholders

- Housekeeping
- Security
- Safety
- Communications
- Retail leasing
- Utilities and funding agencies

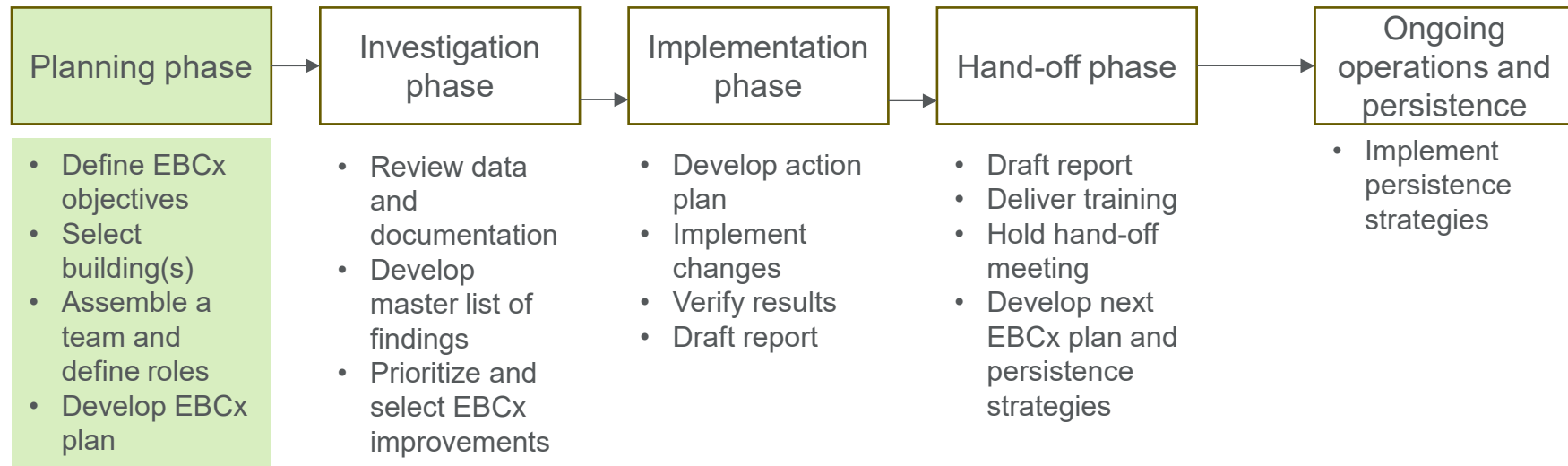


Who are some other key stakeholders to engage with as part of your EBCx project?

Key stakeholders: engagement considerations

- Different drivers mean different strategies and messages for different stakeholders.
- You need to be clear on what (if anything) is required from stakeholders.
- You need to explain how EBCx will impact stakeholders:
 - Benefits
 - Adverse impacts and disruptions
- You need to report back to stakeholders upon EBCx project completion (and sometimes during implementation).

The EBCx process



Successful projects begin with planning, stakeholder alignment and readiness.

EBCx planning activities

- Define EBCx goals and success criteria:
 - What are normal operating parameters?
- Define scope:
 - Which buildings and systems are targeted?
- Identify and engage stakeholders
- Assemble EBCx team:
 - Which departments/individuals should be involved?
 - Who is the EBCx agent?
 - Who is the BAS service provider?
 - What are their roles?



EBCx planning activities

- Define and document roles and responsibilities
 - Project champion
 - EBCx team
 - Leadership
 - Key participating stakeholders
 - Commissioning agent
 - Service provider(s)
- Consider a project charter



image source: <https://www.opexity.com/blog/raci-matrix/>

EBCx planning activities

- Collect documentation:
 - Utility bills
 - BAS trends and sequences
 - Equipment inventories
 - Existing reports, assessments and analysis
- Assess organizational readiness:
 - Leadership support
 - Internal champions
 - Resource availability (staff, time and funding)
 - Data availability



The strongest EBCx projects are supported by engaged stakeholders, clear objectives as well as good building and utility data

- Common challenges:
 - Poor buy-in (at any level in the organization)
 - Incomplete documentation
 - Poor quality (or lack of access to) BAS and other data
 - Limited staff resources and/or competencies
 - Insufficient funding

Which readiness factor is your biggest challenge today?

Group activity #2

Who are my key stakeholders?

Group activity #2: who are my key stakeholders?

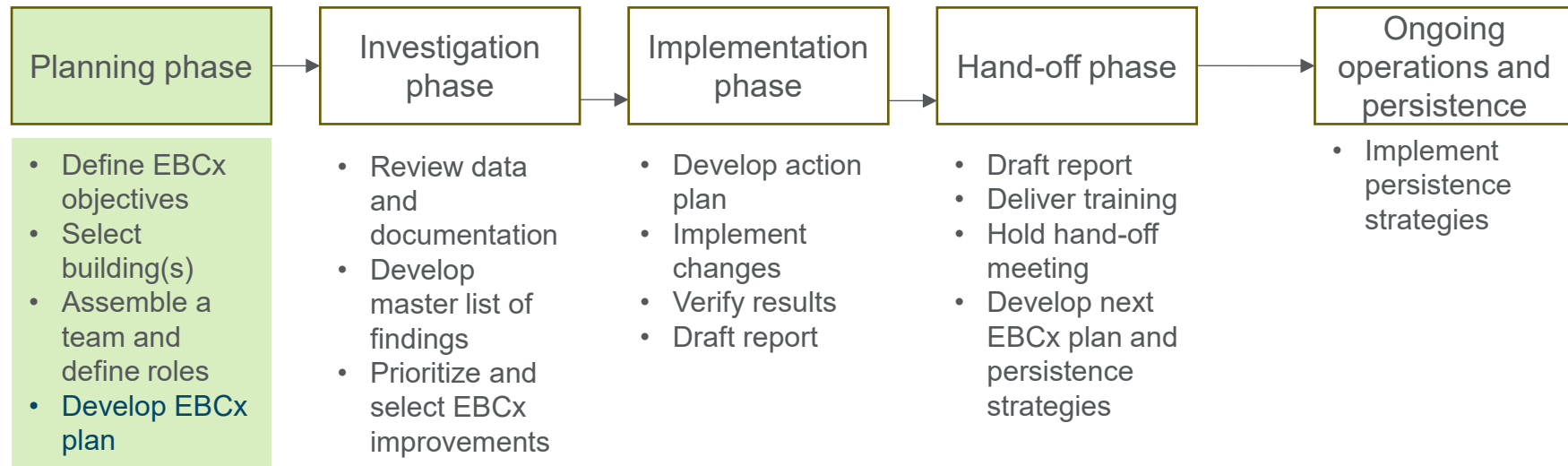
Thinking about the buildings where you work:

- Who are the key stakeholders?
- What role will they play (EBCx team, collaborator, etc.) in the project?
- How/when will you engage with them?
- What support will they need?
- What are some potential barriers? How can you overcome them?

From planning to project launch

Turning readiness into action

The EBCx process



A structured EBCx plan reduces risk and increases the likelihood of success.

Retaining a commissioning agent: procurement considerations

- Budget available
- Scope of work:
 - Which buildings/systems under which conditions
 - Tie back to EBCx goals and success criteria
 - Timelines and milestones
 - Testing plans and reporting
- Support required/available for commissioning agent:
 - Resource requirements
- Proposal evaluation criteria:
 - Proponent qualifications



Key elements of an EBCx plan

- General building information
- Facility use and requirements
- Building and system descriptions
- Utility data, description and analysis (energy balance)
- Goals
- Scope: buildings, systems and equipment
- Investigation methods
- Success criteria for normal operations
- EBCx team, roles and responsibilities
- Key contacts and contact information
- Schedule, timelines and milestones
- Deliverables
- Project hand-off
- Training

Common EBCx measures

- Occupant/tenant behaviour change:
 - Awareness, training and engagement
- Equipment scheduling:
 - Align with building occupancy and activities
 - Daily versus seasonal, including seasonal shutdowns
- Optimize BAS sequences:
 - Ensure interlocking equipment is included
- Optimize air and hydronic supply temperatures resets
- Eliminate simultaneous heating a cooling



Common EBCx measures

- Optimize ventilation rates:
 - Fresh versus mixed air rates
 - Convert constant air volume systems into variable air volume systems
 - Static pressure resets
 - Balance air flows
 - Add sensors and/or variable speed drives
- Address passing valves and failed dampers:
 - Ensure proper operation
- Calibrate sensors:
 - Repair, replace and/or add as needed

Group activity #3

Develop a mini EBCx plan

Group activity #3: develop a mini EBCx plan

Choose a building system (e.g. lighting, HVAC, etc.):

- What parameters will you investigate?
- Who are your key stakeholders? What are their roles?
- What is the first step you will take?

Save on Energy support for EBCx

Save on Energy EBCx program: overview

- EBCx process delivered by an accredited commissioning agent:
 - Identify potential energy conservation measures
 - Work with participants to implement recommended improvements
- Financial support:
 - Investigation phase: up to \$0.06/ft² building area, to a maximum of \$50,000 per application or 75% of costs paid to commissioning agent
 - Implementation phase: \$0.03/kWh confirmed energy savings to a maximum of \$50,000 or 30% of annual facility energy consumption (whichever is lowest)
 - Persistence phase: \$0.03/kWh confirmed energy savings persisting after 12 months, to a maximum of \$50,000 or 30% of annual facility energy consumption (whichever is lowest)

Save on Energy EBCx program: eligibility requirements

- Minimum of 12 months of consecutive energy data required with baseline model meeting IESO measurement and verification guidelines
- Minimum annual electricity consumption of 750,000 kWh/year (excluding energy consumed in industrial and manufacturing processes)
- Must be connected to the IESO-controlled grid or distribution system
- Cannot:
 - Have undertaken a commissioning exercise in the last two years
 - Be participating in building certification that requires EBCx

Save on Energy EBCx program: project requirements

- The EBCx project must include one of the following:
 - Occupant behaviour measures
 - Air and water balancing
 - Other operational and maintenance changes
 - Equipment repairs and minor replacements



EBCx Success Story - A University Campus in Toronto

- Total incentive provided (all stages): \$25,264
- Verified implementation savings: \$588,590
- Baseline energy usage: \$4,928,737
- Verified savings compared to baseline: 12%
- Measures implemented:
 - HVAC scheduling optimization
 - Chilled water and hot water system optimization
 - AHU trim and respond
 - AHU glycol heating
 - In-floor heating



Final takeaways

Final takeaways

- Many buildings have EBCx opportunities.
- EBCx benefits can include reduced energy, maintenance and operational costs, improved occupant comfort and safety.
- Successful EBCx projects begin with planning, stakeholder alignment and readiness.
- A structured EBCx plan reduces risk and improves the likelihood of success.

What are your next steps?

Thank you!

Questions?

Stay connected with tools and resource

- Virtual one-on-one coaching: [post-webinar support intake form](#) for tailored support for organizations to manage energy resources effectively
- Monthly bulletin: [sign up](#) to receive monthly training updates on all Save on Energy training and support for new tools and resources
- [Live training calendar](#): visit this page to easily register for upcoming events and workshops
- [Training and support webpage](#): visit this page to access all training and support materials

Post-webinar support

One-on-one coaching: tailored support for managing energy resources effectively

[Post-webinar support intake form](#)

Coaching sessions conducted virtually: phone, video calls and email

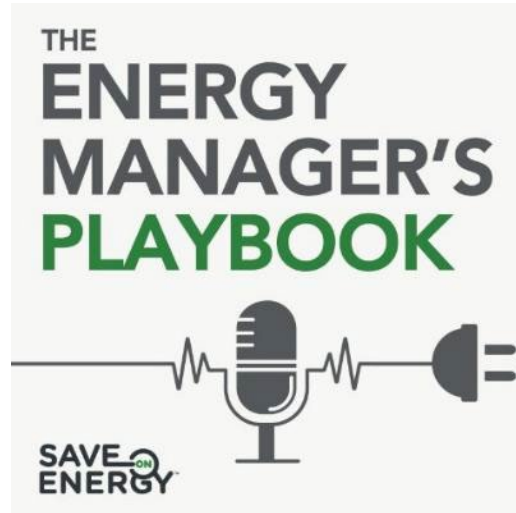
Designed for organizations, new or old, seeking guidance

Mentorship and technical support



- Participants of the Community Energy Specialist training have access to one year of free mentorship.
- To schedule a session, send an email to one of our experts with a description of the support you are looking for:
 - Shayne Hill s.hill@indigenouseaware.com
 - Brooklyn Glass b.glass@keepersofthecircle.com

A podcast by Save on Energy: The Energy Manager's Playbook



Tune in on your preferred platform:
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Thank you

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