BOMA Canada

LESSONS FROM THE NET ZERO CHALLENGE

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BOMA Canada also wishes to recognize all the organizations that participated in the Net Zero Challenge between 2018 and 2020. BOMA Canada sincerely regrets any errors or omissions in the list above, and thanks all our volunteers and contributors for their support.

WELCOME TO OUR REPORT

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DEFFINITIONS

Before we get started, let's take a moment to define some key terms. In the context of this guide here is how we define the following:

Net Zero
Many of the techniques used to work towards net zero Energy and net zero Carbon are the same. Therefore, in this guide the term "net zero" is used to refer to both net zero energy and net zero carbon interchangeably. What distinguishes the two is what is done to either reduce, or offset the emissions generated by, any residual on-site energy use[1].

Net Zero Energy
"Net zero energy" is defined as a building that produces as much energy as it consumes over a consecutive 12-month period, in terms of on-site usage[2].

Net Zero Carbon
A "net zero carbon" building, sometimes also referred to as a "net zero emissions" building, is one that releases net zero greenhouse gas emissions into the atmosphere, over a consecutive 12-month period, from the energy used on-site. This can be achieved by producing energy on-site, procuring carbon free energy or purchasing carbon offsets equal to the annual carbon emissions associated with the energy used on site[3].

Zero-Carbon
A "zero-carbon" building is one that releases net zero greenhouse gas emissions into the atmosphere. This can be achieved by producing energy on-site or procuring carbon-free renewable energy or purchasing carbon offsets in an amount equal to the annual carbon emissions associated with both operations (i.e., the energy used on site) and building materials.

Near Net Zero
A "near net zero building" is a highly energy efficient building that works to minimize its annual energy requirements. Buildings that do not have the ability, upon construction, to be net zero can still incorporate components during initial construction that allow them to transition more easily to net zero energy or net zero carbon in the future.

Carbon Neutral
Becoming "carbon neutral" involves a process known as "offsetting" where any remaining carbon emissions still being produced after emission reduction efforts have been completed released into the atmosphere are balanced out by the removal of an equivalent amount of carbon emissions elsewhere.

1. BOMA-Canada-Net-Zero-Entry-Requirements-Guide.pdf
2. https://www.rdh.com/wp-content/uploads/2019/07/2019-07-23-NAIMA-Canada-Guide-Near-Net-Zero-Residential-Buildings-RDH-Building-Science.pdf
3. https://www.cagbc.org/CAGBC/Zero_Carbon/CAGBC/Zero_Carbon/zero_carbon.aspx?hkey=2b5d1da1-0a13-4037-8673-d24cec008961

GLOSSARY

CIB: Canadian Infrastructure Bank

CO2: Carbon dioxide

Cx: Commissioning

DER: Deep Energy Retrofit

DWH: Domestic Hot Water

DRS: Deep Retrofit Study

EBCx: Existing Building Commissioning

eKwh/ft2/yr: Equivalent kilowatt-hour per square foot per year

eKwh/m2/yr: Equivalent kilowatt-hour per square metre per year

ESG: Environmental, social, and corporate governance standards

EUI: Energy Use Intensity

FDD: Fault Detection and Diagnostics

GHG: Greenhouse gas

GHP: Geothermal heat pump

HVAC: Heating, Ventilation, and Air Conditioning

IDP: Integrated Design Process

kgCO2 e/ft2 /yr: Equivalent kilogram CO2 per square foot per year

kgCO2e/m2/yr: Equivalent kilogram CO2 per square metre per year

NGBR: BOMA Canada's National Green Building Report

NRCan: Natural Resources Canada

NZC: BOMA Canada's Net Zero Challenge

PV: Solar photo-voltaic

RCx: Recommissioning or retro-commissioning

REC: Renewable energy certificate

RNG: Renewable Natural Gas

ROI: Return on investment

TAF: The Atmospheric Fund

FORWARD

To combat the climate change, 196 countries have joined the Paris Agreement aiming to reduce emissions under the United Nations Framework Convention on Climate Change. To align with the Paris Agreement, Canada has committed to reducing its emissions by 40-45% below 2005 levels by 2030 and reaching net zero emissions by 2050[4]. One of the key elements of achieving this target will be to reduce emissions from buildings which currently account for 12% of Canada's national emissions[5].

There are many sources of GHG emissions attributed to buildings. These include the emissions embodied within the building's materials as well as the operational emissions, resulting from waste generation, energy use, and water use. This report will focus specifically on reducing the emissions associated with operational energy since this represents a significant opportunity for building managers/owners and can have a sizable impact on reducing operational expenditures.

Changes which can be made to reduce building emissions include:

1. Design and construct new buildings to be net zero carbon
2. Perform deep retrofits to existing buildings
3. Build on-site renewable energy

Implementing some or all these strategies will help chart a pathway to net zero or near net zero building portfolios. The benefits of a net zero building include reduced operating and management costs, fewer deferred maintenance demands, reduced GHG emissions, increased building resilience, improved occupant comfort and a demonstrated commitment to sustainability and climate action.

The Net Zero Challenge (NZC) was created by BOMA Canada in 2017, in partnership with Prism Engineering Limited. It was developed in response to Natural Resource Canada's (NRCan) call for a method of nationally recognizing buildings that demonstrate high-performance design and operation. The purpose of this recognition program was to showcase what is possible and to help motivate others towards the goal of net zero buildings. Since its inception, there have been three rounds of the Net Zero Challenge with award winners recognized in 2018, 2019 and 2020.

BOMA Canada's Net Zero Challenge Awards recognized organizations that pursued net zero energy and net zero carbon buildings and celebrated their experiences. Award winners demonstrated their outstanding efforts in reducing GHG emissions and improving the efficiency of their buildings. There is much to learn from NZC award applicants and award-winners in each of the three categories: Best in Class, Innovation, and Most Improved.

This report is a product of collaboration between BOMA Canada and Prism Engineering Limited and of generosity from Bullfrog Power. It shares insights and examples from the award program so that the industry can benefit from the lessons learned from applicants and winners, to help them achieve the similar levels of high performance on the path to net zero

Sincerely.

Benjamin Shinewald
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BOMA Canada

Robert Greenwald
Principal and President
Prism Engineering

4. https://www.jll.co.uk/en/views/valuing-net-zero-esg-for-offices
5. http://publications.gc.ca/collections/collection_2021/eccc/En81-4-1-2019-eng.pdf

THE WINNERS

Most Improved

2018 – 4711 Yonge Street

2019 – York Mills Centre

2020 – Royal Centre

Best In Class

2018 – 980 Howe

2019 – Deer Lake Centre II AND 1 Prologis

2020 – Mississauga Gateway Centre

Innovation

2018 – Le 100 Alexis Nihon AND Earth Rangers Centre For Sustainable Technology

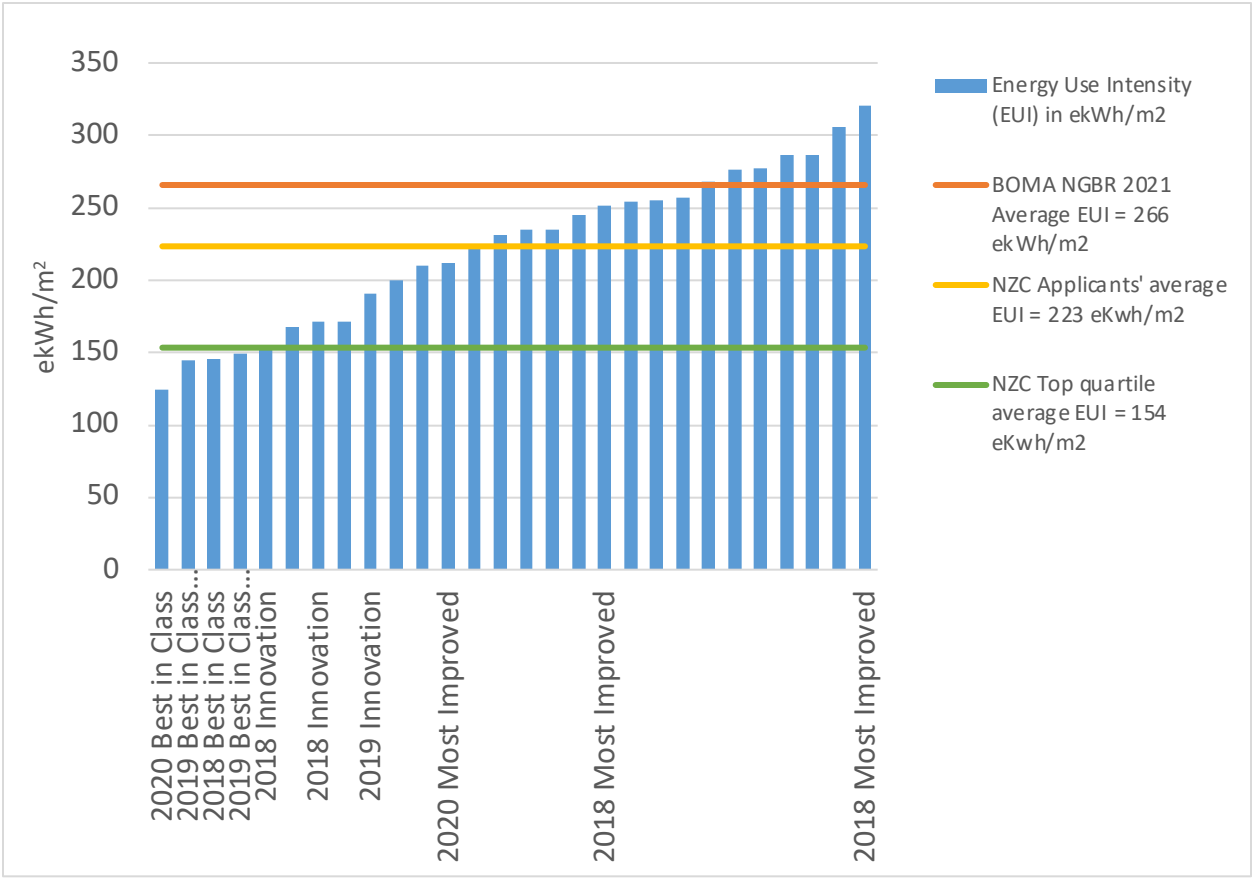
2019 – 777 Dunsmuir

2020 – Sun Life Financial Centre

IMPACTS FROM THE BOMA CANADA NET ZERO CHALLENGE

Energy Intensity Impacts

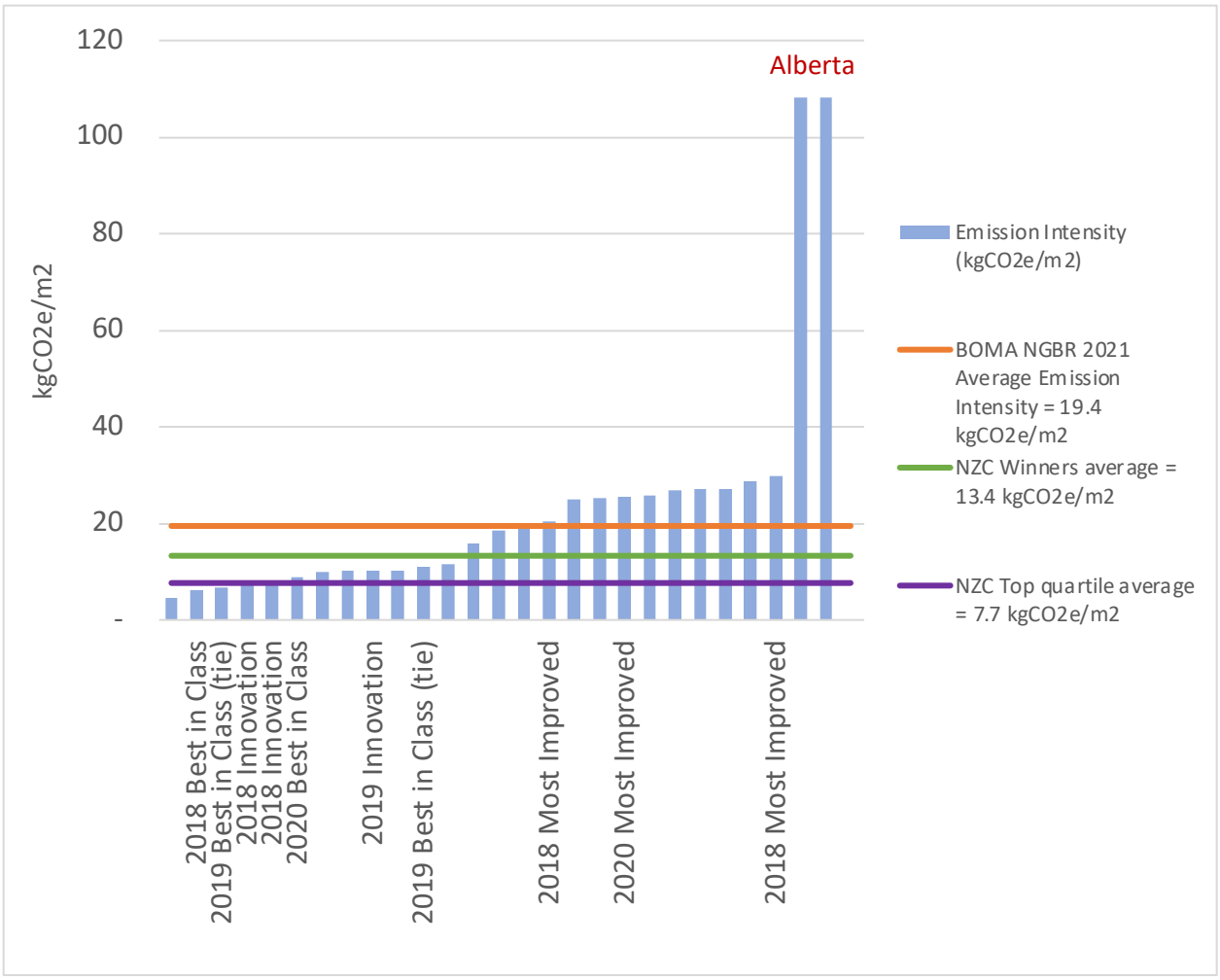
According to the 2021 BOMA BEST National Green Building Report (NGBR): Building on Sustainability, the national average energy use intensity (EUI) for a building that is part of the BOMA BEST program is 266 ekWh/m2/yr (24.7 eKwh/ft2/yr), which is 3% below the national average. What we can see from the Net Zero Challenge, as depicted in the graph below, is that applicants for this award had an average EUI of 223 eKwh/m2/yr, which is 16% less than the BOMA BEST national average and the best performing buildings (those applicants in the top quartile) had an average EUI of 154 eKwh/m2/yr, or 36% below the BOMA BEST national average. Although these buildings have not yet achieved Net Zero, these building owners nevertheless show us that for both new and existing buildings, a significant reduction is possible.



Energy Intensity comparison between BOMA BEST buildings and Net Zero Challenge Participants

Carbon Intensity Impacts

According to the 2021 BOMA BEST National Green Building Report (NGBR): Building on Sustainability, the national average carbon intensity for a building that is part of the BOMA BEST program is 19.4 kgCO2e/m2/yr (1.8 kgCO2 e/ft2 /yr) . What we can see from the Net Zero Challenge, as depicted in the grapg below, is that the winners of this award between 2018 – 2020 had an average carbon intensity of 13.4 kgCO2e/m2/yr which is 31% below the BOMA BEST NGBR average and the best performing buildings (those applicants in the top quartile) had an average carbon intensity of 7.7 kgCO2e/m2/yr which is 60% below the BOMA BEST NGBR average. Again, while these buildings have not yet achieved net zero it is evident that significant reductions in both energy use intensity and carbon intensity are possible.



Carbon Intensity comparison between BOMA BEST buildings and Net Zero Challenge Participants

NET ZERO – A BUSINESS CASE

There are many reasons why investing in net zero energy and net zero carbon objectives make good business sense:

Increased revenue from higher lease rates and/or higher occupancy levels
As environmental, social, and corporate governance (ESG) standards continue to rise, net zero buildings present building owners and managers with the opportunity to charge low-carbon rent premiums to organizations looking to lease "green" spaces, enabling them to meet their corporate climate action targets. In addition to these potential premiums, net zero buildings also tend to retain their value longer than standard building stock[6].

Cost Avoidance

Reduced operating costs

Net zero strategies such as energy efficiency design and retrofits, proper commissioning, and real-time energy monitoring can result in significant savings, both in terms of energy and water consumption and in dollars. Reduced energy consumption can also help to insulate the organization against energy price volatility.

The rising price of carbon

The national carbon pricing framework was introduced in 2019 to encourage Canadians to use greener energy sources. For consumers, the federal price of carbon has increased from $20/tonne of CO2e in 2019, to $40 in 2020 and is rising to $50 in 2022 then increasing by $15 annually until 2030 when it reaches $170. Some organizations even use a carbon price of more than $1,000/tonne. Including the price of carbon, in the business case, will increase the viability of low carbon solutions.

Climate hazard risk reduction

As the hazards associated with climate change continue to increase across Canada, organizations must find ways to adapt their buildings and operations. Not doing so could result in costly damages or service disruptions that could negatively impact operations. Many of the principles included in net zero design have the co-benefit of making the building more resilient to climate hazards thereby reducing this potential risk.

Regulatory Compliance

Building code changes

Many provinces in Canada have developed, or are in the process of developing, enhanced building codes, such as the BC Energy Step Code, that take energy use and GHG emissions into consideration. As these new building codes are implemented, building owners and managers will have no choice but to comply. By getting started down the path to net zero sooner, building owners and managers can help spread-out the costs of renovations over longer periods of time and start building internal capacity that will make adapting to future building code changes easier and more efficient. For a list of applicable provincial building codes visit: https://www.nrcan.gc.ca/energy-efficiency/buildings/new-buildings/canadas-national-energy-code/energy-code-your-province-territory/20677

6. https://www.jll.co.uk/en/views/valuing-net-zero-esg-for-offices
7. https://www.theglobeandmail.com/canada/article-canada-carbon-tax-explained/

Emission Caps

Jurisdictions in Canada have approached carbon pricing in different ways. The provincial governments of Quebec and Nova Scotia have set laws that cap the number of emissions allowed for companies per year. Quebec has allowed for companies to occasionally trade credits with counterparts in California where emissions reductions are less expensive. Nova Scotia allows a "cap-and-trade" program where companies within the province can buy and sell credits with each other to ensure they are within allowed emissions per year[8].

Financial Support

Incentive funding

Many companies associate the implementation of methods for achieving net zero with spending large amounts of money on construction or retrofits. Taking advantage of the incentives offered by utility companies and governments can significantly reduce project costs. There are currently numerous funding opportunities available at the national, provincial, and municipal levels as well as from utility companies throughout Canada.

Low-interest financing

Provinces and utilities across Canada have used various methods and incentives to encourage net zero within businesses. One such method is low-interest financing and two of the main organizations that take part in such funding are the Canadian Infrastructure Bank (CIB)[9] and The Atmospheric Fund (TAF)[10] :

- CIB is an agency tasked with investing $35 billion of Canadian federal funding into revenue generating infrastructure projects in partnership with the private sector and various levels of government in Canada. They are a valuable resource for funding net zero projects through their Commercial Building Retrofits Program[11].

- TAF is a regional climate agency that invests in low-carbon solutions. TAF funds energy retrofits, low-carbon new construction, and electric mobility in the Greater Toronto and Hamilton areas. TAF is willing to spend up to $20 million per investment, typically 20% of a project opportunity.

8. https://climatechange.novascotia.ca/nova-scotias-cap-trade-program
9. https://cib-bic.ca/wp-content/uploads/2021/03/Retrofit-Program-Summary.pdf
10. https://taf.ca/impact-investing/
11. https://cib-bic.ca/en/partner-with-us/growth-plan/green-infrastructure/

THE PATHWAY TO NET ZERO BUILDINGS

It is important to note that reaching carbon neutrality is not necessarily a linear process. Some organizations may decide to begin with step 6 "offset remaining" to become carbon neutral as quickly as possible and then go back to step 1 to begin looking at ways of reducing their energy use and carbon emissions so that the number of offsets they have to purchase decreases over time. Others may simultaneously look at ways of improving efficiency (step 2) while also electrifying pieces of their building's equipment (step 4). The most important thing is to consider all 6 steps and use them together to move towards net zero.

Existing buildings: The six net zero elements follow a deep retrofit pathway.

Working towards Net Zero through Deep Retrofits

A net zero building retrofit is the process of working with an existing building to make it more energy efficient and reduce the building's environmental impact. Although traditional energy audits have been in use for many years and are valuable in many ways, a more comprehensive approach is called for if an organization is aiming to achieve net zero. That is where Deep Retrofits come in. A Deep Energy and Carbon Retrofit Study (also referred to as deep retrofit studies or DRS) goes far beyond a simple energy audit by focusing on large scale upgrades, significant energy and carbon reductions, and extended return on investment (ROI). Table 1 below compares the key differences between a typical energy audit and a deep retrofit study.

Table 1. A comparison of key differences between a typical energy audit and a deep retrofit study

Characteristics	Energy Audit	Deep Retrofit Study
Measures to minimize waste	Included	Included
Measures to maximize efficiency	Included	Limited Focus
No-cost/low-cost measures	ROI/ Simple Payback	ROI Life Cycle Cost Environmental Impact
Measure investment criteria	Short-medium	Long
Investment outlook	Low	High
Climate impact focus	Limited focus	Included
	Controls improvements - Boiler upgrades - Variable frequency drives on pumps/fans - Lighting upgrades - Heat recovery	Energy and Audit Measures Plus - Fuel Switching - Heat pumps, co-generation - Heat recovery chillers - HVAC redesign - Envelope upgrades - On-site generation - Bio-mass heating

A deep retrofit study seeks to maximize energy efficiency and significantly reduce GHG and carbon emissions. It also looks for ways that an organization can build resilience and self-sufficiency by generating clean renewable energy on-site.

A key objective of a deep retrofit study is to shift the focus of industry practitioners – such as energy consultants, mechanical and electrical engineers, contractors, commissioning authorities and building owners – from short term efficiency upgrades to long term retrofits that reduce climate impact. While an acceptable return on investment for projects identified in an energy audit might be based on positive net present value, an acceptable return on investment for projects identified in a deep retrofit study might be based on a threshold of dollar invested per ton of carbon dioxide saved.

The purpose of a deep retrofit study is to identify available technologies, strategies, and investments required to reduce GHG emissions to meet specific reduction targets. A deep retrofit study may investigate fuel switching to a lower carbon energy source, not just for economic benefits but for the purpose of reducing carbon emissions as well. For heating applications in jurisdictions with a low carbon electrical grid, this typically means changing the heat source from fuel to electricity. On site electrical generation for the purpose of self-sufficiency and to achieve net zero energy would also fall in the scope of a deep retrofit study.

Possible approaches for enabling deep retrofit studies and projects:

- Bundling high cost and low-cost measures
- Establishing an internal price on carbon to support the business case
- Leveraging non-energy benefits including environmental impact, equipment renewal, leadership by example

A Six-Step Pathway to Net Zero

There are many approaches for undertaking a deep retrofit in a building. Figure 2 proposes a six-step process, aligned with ASHRAE recommendations, developed by Prism Engineering Ltd.

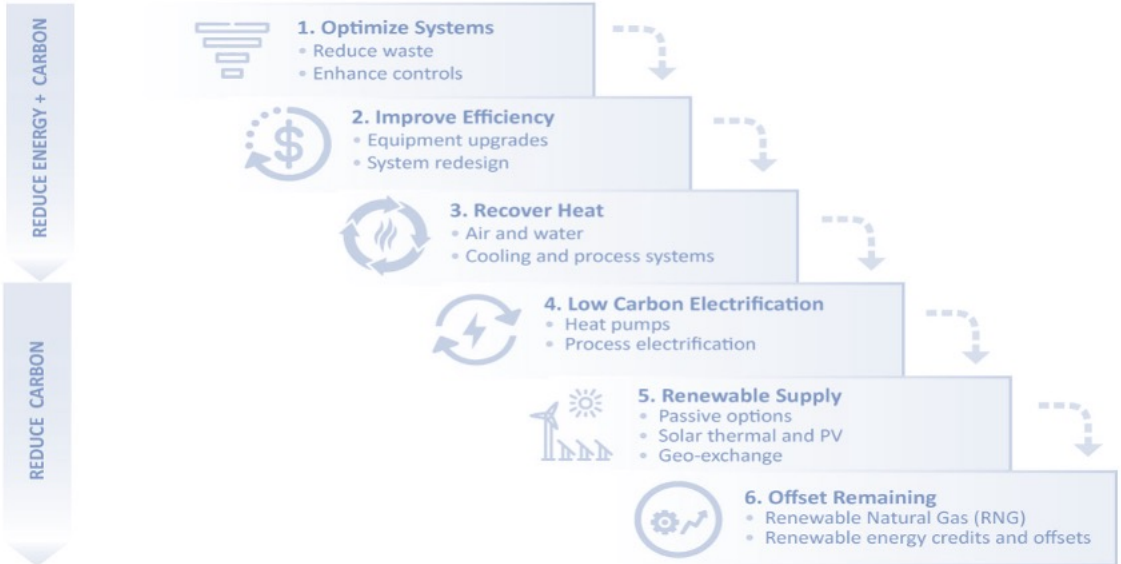


Figure 2. Suggested approach for performing a deep building retrofit[12].

12 Prism Engineering Limited developed the six-step deep building retrofit process described in this Guide

LESSONS LEARNED FROM THE NET ZERO CHALLENGE

Three years of Net Zero Challenge applications have provided a wealth of information on how organizations are approaching net zero for their buildings. What we have found is that organizations fall into one of two categories:

1. Existing Buildings engaged in regular retrofit activities over long periods of time to achieve low energy and emission intensity

2. New Buildings incorporated low energy and emissions goals into the design and followed up with performance optimization and upgrades

Tenant and operator training needs to be ongoing.

Tenant and operator engagement and training are not one-time activities. Over time, building uses change, staff turn over and equipment ages and gets replaced. All these things can impact the way your building operates and the way that your staff and tenants interact with the building and its systems. Implementing a program of regularly scheduled training opportunities for tenants and building operators is a proactive way to help ensure systems are being used, monitored, and maintained correctly.

High efficiency technology doesn't perform on its own. Commissioning and recommissioning are key

Purchasing and installing high efficiency technology is a very important part of net zero building design and operation. However, to get the most out of the equipment installed it is important to have it properly commissioned (or recommissioned in the case of existing buildings) and to then implement a program of ongoing monitoring and optimization to ensure that building systems continue to operate as intended.

Monitoring energy and emissions and providing feedback to tenants and operators yields results

Ongoing monitoring and tracking provide many benefits. First, a baseline can be established, making it possible to identify opportunities for improvement. Second, the effectiveness of different implemented measures can be measured. Third, providing energy use data to tenants and operators helps them to see the impact of their actions. This can help foster a culture of energy efficiency or carbon consciousness and empowers them to make energy efficient choices. This will allow the building manager, operator, and tenants to see how far the organization has come along the journey towards net zero and to celebrate successes along the way. Two examples of commonly used monitoring and feedback mechanisms are:

- Monthly detailed energy and GHG emissions reporting

- Fault Detection and Diagnostics (FDD) software

Staff and tenant engagement can also yield results

Technological improvements are an important part of increasing energy efficiency, but they are not the only part. Using a combined approach that incorporates both people and technology will increase chances of success. Creating opportunities for staff and occupant engagement can help identify opportunities for improvement that may otherwise have gone unnoticed and can help ensure that the systems put in place are being used correctly. Furthermore, staff and tenant engagement can help foster a culture of energy conservation or carbon consciousness that can have positive impacts throughout operations in many ways.

Continue to look for opportunities for building system retrofits

Even systems that are the best of the best at time of install can be outpaced by superior equipment over time. Sometimes the changes in efficiency take many years to become significant enough to justify upgrading a system. In other cases, those changes can occur much more rapidly. Therefore, it is important to regularly evaluate building systems, particularly as they reach end of life, to see if there are better retrofit options now available.

Three years of Net Zero Challenge applications have provided a wealth of information on how organizations are approaching net zero for their buildings. What we have found is that organizations fall into one of two categories:

1. Existing Buildings engaged in regular retrofit activities over long periods of time to achieve low energy and emission intensity

2. New Buildings incorporated low energy and emissions goals into the design and followed up with performance optimization and upgrades

Establish a sustainability program

Having an established sustainability program can help support net zero efforts. It can help to provide added justification for deep retrofit projects that may require significant investments with longer payback periods. It can also help highlight the co-benefits of net zero building technologies and strategies and provide clear direction with regards to how net zero building efforts fit within the organization's overarching sustainability goals.

Don't be afraid to keep pushing the envelope

BOMA Canada Net Zero Challenge Award winners implemented some strategies that yielded very positive results:

- Inclusion of energy efficiency & low carbon considerations in tenant guides for suite improvements.
- Installation of sub-metering, to be either used for tenant billing or for the monitoring and verification of energy improvements.
- Installation of on-site renewables or the purchase of renewable energy which some organizations used to reduce their net building emissions to zero.

MOST IMPROVED

The Most Improved Award recognizes buildings that are contributing to helping Canada achieve its climate change objectives by significantly improving their energy performance over their own baseline.

Intent: Improving and maintaining building performance depends on a solid foundation of well-executed management programs, plans, and policies surrounding the building's operations and technologies. This criterion recognizes the importance of day-to-day operations on improving a building's performance.

Criterion Requirements: Applicants must identify and describe the top 3 to 5 strategies believed to have had the most important impact on reducing the building's overall energy and carbon intensity. The strategies listed can be either technology or management-based and must represent the day-to-day, ongoing practices in place at the building that have had a positive impact on energy efficiency.

WINNERS
2018 – 4711 Yonge Street
2019 – York Mills Centre
2020 – Royal Centre

CASE STUDY #1: Tenant Engagement

In addition to structural changes and facility updates, energy savings and carbon emission reductions can also be generated by creating a culture of energy management and sustainability among building occupants. Even excellent equipment can operate poorly or consume a higher-than-average amount of energy if used incorrectly or carelessly. Small conscientious actions undertaken by building operators and occupants can lead to significant energy savings over time. In addition, tenant engagement can have other positive benefits such as improving occupant satisfaction and comfort, increasing awareness about the organization's energy conservation and environmental sustainability commitments, and improving morale. As seen at 4711 Yonge Street, following this holistic approach which incorporates both the technical aspects, and the people aspects of building energy use can result in significant energy and GHG emissions savings.

Award Year: 2018

Building Statistics:

- Energy Use Intensity: 23.3 ekWh/ft2
- Emissions Intensity: 0.0024 tCO2e/ft2
- Energy Star Rating: 87

What did they accomplish?
4711 Yonge Street won BOMA Canada's 2018 Net Zero Challenge Award for Most Improved for achieving an outstanding 30% energy consumption reduction from baseline and for establishing a strongly supported culture of continuous improvement through ongoing benchmarking efforts and the installation of efficient equipment.

Their achievements included:

- A 31% decrease in their EUI
- A significant improvement in their ENERGY STAR score which increased from 45 to 89
- A well-rounded approach of technology and people

How did they do it?
These significant energy reductions were not through a single upgrade but through strong leadership at the property, and a continuing drive to improve performance over 10 years. Menkes makes tenants aware of sustainability initiatives via regular email communication, signage posted in the lobbies, and via the property's social media platforms (Instagram, Facebook, Twitter).

The social media channels were used to establish a direct connection with occupants, providing them with updates on building initiatives such as:

- Summer energy conservation (e.g., where lobby lighting is dimmed on all floors)
- Upcoming events (e.g., Zero Waste BBQ),
- Environmental initiatives (e.g., Vampire Power Campaign, which promote awareness of standby power).

BEST IN CLASS

The Best-in-Class Award recognizes buildings that have made progress towards achieving net zero energy and/or carbon and are leaders in the industry. These buildings will have 12 consecutive months of data displaying extremely efficient levels of consumption, or production, that meets their needs.

WINNERS
2018 – 980 Howe
2019 – Deer Lake Centre II AND 1 Prologis
2020 – Mississauga Gateway Centre

CASE STUDY #2: Optimization & Waste Reduction through (Re)Commissioning

Initial and Ongoing Commissioning

It is very important to properly commission a new net zero building. As seen at 980 Howe, doing so will help ensure that building systems and controls are operating correctly and that the building is achieving the level of performance it was designed to achieve. This quality assurance process involves looking carefully at building systems and equipment and comparing the way they are operating to the way they were designed to operate. Commissioning a net zero building is similar to commissioning a typical building but there are more systems, equipment and technologies in place that must be taken into consideration[13]. Ideally, building managers and operators should then engage in continuous commissioning to ensure that all the systems in the net zero building continue to run optimally. It is an iterative and ongoing process.

Recommissioning

For existing buildings, if continuous commissioning has not been a part of regular building operations and maintenance, then recommissioning can be used to first assess the building and then identify and address any issues found. Recommissioning involves looking closely at building systems and equipment and comparing the way they are currently operating to the way they were intended to operate. This quality assurance process enables building operators to identify equipment malfunctions and opportunities for improvement, followed by implementation.

Commissioning and Recommissioning lead to:

1. Reduced utility costs
2. Reduced GHG emissions
3. Improved building system function
4. Improved building operations and management
5. Extension of equipment life cycle
6. Improved building documentation

13 https://www.paladinoandco.com/blog/commissioning-net-zero-energy-for-new-and-existing-buildings/

Award Year: 2018

Building Statistics:
- Energy Use Intensity: 13.6 ekWh/ft2
- Emissions Intensity: 0.0008 tCO2e/ft2
- Energy Star Rating: 99

What did they accomplish?
980 Howe achieved BOMA Canada's Net Zero Challenge Award for Best in Class by achieving outstanding energy efficiency. This building moves closer to net zero carbon impacts thanks to high efficiency design, staff and tenant engagement, and a thorough building commissioning process.

How did they do it?
During the commissioning stage at 980 Howe, the Building Management Team received hands-on training for all equipment and methods of energy conservation from a team of base building consultants and manufacturers. The manufacturers were engaged to perform a secondary review of the parameters set by the consultants for the building HVAC equipment to fine-tune settings to achieve increased optimization, efficiency and longevity. All equipment is loaded on to the preventative maintenance program which alerts the Building Maintenance team of required preventative maintenance and inspections, ensuring all equipment is regularly maintained and calibrated for optimal performance and efficiency. Staff are encouraged to stay current on all aspects of energy conservation, with courses and training heavily encouraged and subsidized.

BEST IN CLASS
Mississauga Gateway Centre
Mississauga, ON
Triovest Realty Advisors

CASE STUDY #3: Integrating monitoring and tracking into projects

Utility monitoring and tracking

Integrating utility monitoring and tracking into projects helps net zero new and existing buildings track their energy and GHG savings over time. As seen at Mississauga Gateway Centre, monitoring and tracking practices make it easy to identify performance anomalies or changes that can then be acted upon, ensuring the building is always operating at its best.

Here are some of the ways utility monitoring and tracking can benefit your net zero project:

- Provide easy to read summaries of electricity, fuel and water consumption and costs compared to previous periods.
- Identify energy performance for individual accounts and consolidated reports for groups of accounts.
- Identify accounts or locations with high energy use that require investigation (identify problems sooner than quarterly or annual reviews).
- Identify irregularities or errors in utility billings.
- Benchmark performance among sites (where applicable).
- Evaluate environmental impact of utility use (GHG reporting).
- Identify increases in energy use on a meter, site or portfolio basis.
- Calculate energy, cost, and GHG savings achieved from retrofits or initiatives adjusted for the impact variables (typically weather).
- Compare energy use against target performance level.
- Provide feedback to facility staff and occupants to maintain interest and continued participation in energy management.
- Provide summary reporting for budgeting and management reporting.
- Fulfill legislative reporting requirements for GHG emissions.

Submetering

In addition to utility level monitoring and tracking, submetering can useful. Submeters can allow you to drill down and see where in the building, or what building systems, are using the most energy. It can also help alert you to irregularities at a more granular level and, if real-time submetering is used, in a timelier manner. Energy usage spikes from individual areas, tenants, or pieces of equipment may be lost within the aggregate building energy usage data if you rely only on utility level metering. Consequently, operational or equipment issues may take longer to identify and address. Submetering provides a useful tool when trying to optimize building system operations.

Mississauga Gateway Centre

Building Statistics:

- Energy Use Intensity: 125 ekWh/m2
- Emissions Intensity: 8.79 tCO2e/m2
- Energy Star Rating: 99

What did they accomplish?

Mississauga Gateway Centre won BOMA Canada's 2020 Net Zero Challenge Award for Best in Class. Between 2018 – 2020 the Triovest saved an estimated 517,000 kWh of electricity and 336 GJ of natural gas due, in part, to a rigorous energy monitoring and tracking program.

How did they do it?

Triovest implemented an HVAC data analytics service from RYCOM to serve as a fault detection platform, ensuring that the building not only maintains its energy performance but improves on it by providing additional insight into the building's HVAC and metering systems. These insights can then be used to fine tune and optimize building systems. To ensures that they were achieving real and meaningful benefits from the data being extracted and analyzed, Triovest scheduled regular monthly meetings for all stakeholders. During these meeting, all measures identified by the platform were discussed and corrective actions were identified for immediate implementation.

Lessons learned

- Engage all internal stakeholders so that everyone understands how to leverage the platform and data to assist with their KPIs and performance outcomes
- Amend building automation system (BAS) service contracts to require them to work with the fault detection service provider to jointly find, discuss and close out issues.
- Maintain an ongoing list of actions and track from identification through to resolution.
- Scheduled regular meetings and ensure clear communication between the data analytics provider and the building operations team as this is critical to achieving energy savings.

INNOVATION

The Innovation Award recognizes buildings that have put in place exceptional strategies (such as management practices or technologies) that lead to a demonstrable and replicable significant reduction in energy and/or carbon while also providing a return on investment. Innovative uses of traditional technologies or practices that enable the building to generate significant amounts of renewable energy on-site will also be recognized in this award.

Intent: Though many technologies and practices already exist to assist buildings in becoming ultra-efficient and carbon free, it is nevertheless through the implementation of new ideas and by taking risks that we may get there sooner. As such, those building managers and owners who are pushing market transformation by investing in new technologies are rewarded here.

Criterion Requirements: Applicants to the Innovation Award must identify and describe one (1) OR two (2) significant innovative solutions being undertaken at the building that are having (or are expected to have) a positive impact on moving the building towards net zero energy or net zero carbon. Innovations targeting other objectives (e.g. water efficiency) will not be considered.

The definition of innovation used for the purposes of this award is "a new idea, method, or device" (Merriam Webster). As such, applicants are expected to describe solutions related to energy or carbon that are new and pushing the boundaries of what already exists. Since innovation is a constantly moving target, applicants to this award must make the case for why their solution can be considered innovative. Solutions may include several components/strategies/technologies as well as the innovative use of traditional components/strategies/technologies. Initiatives described under Criterion 5 may also be recognized here.

WINNERS

2018 – Le 100 Alexis Nihon / Earth Rangers Centre for Sustainable Technology
2019 – 777 Dunsmuir
2020 – Sun Life Financial Centre

LESSONS LEARNED

CASE STUDY #4: Designing for Net Zero / Near Net Zero buildings

A net zero new building can be constructed to be either net zero energy or net zero carbon. Designing a building with these goals in mind from the outset can help avoid many of the main challenges that come with completing a retrofit to become net zero. Green building standards and alternative design and construction methods such as using an Integrated Design Process can be used to help steer new building construction towards net zero. Some of the potential challenges that can be avoided include high retrofit costs, disruptions to tenants and building operations, and technical constraints such as electrical capacity constraints. operating to the way they were intended to operate. This quality assurance process enables building operators to identify equipment malfunctions and opportunities for improvement, followed by implementation.

Award Year: 2018

Building Statistics:
- Energy Use Intensity: 19.4 ekWh/ft2
- Emissions Intensity: 0.0025 tCO2e/ft2
- Energy Star Rating: 87

What did they accomplish?
The Earth Rangers Centre won BOMA Canada's 2018 Net Zero Challenge Award for Innovation by showcasing leading-edge sustainable building technology and management practices. It is one of the first Canadian buildings to achieve an Energy Star Certification. Though it is a small facility, it incorporates many innovative features! The Earth Rangers Center is an example of a facility that was designed to include many net zero components.

How did they do it?
The Earth Ranger Center's building design included:
- Extensive controls system (including sub-metering and monitoring and data center management)
- Extensive use of solar thermal and solar photo-voltaic solutions
- Site wide water treatment plan
- Geothermal applications
- High thermal mass
- Earth tubes

Award Year: 2018

CASE STUDY #5: Working towards Net Zero on an Existing Building

A net zero building retrofit is the process of working with an existing building to make it more energy efficient and reduce the building's environmental impact. Although traditional energy audits have been in use for many years and are valuable in many ways, a more comprehensive approach is called for if an organization is aiming to achieve net Zero. That is where Deep Retrofits come in. A Deep Energy and Carbon Retrofit Study (also referred to as deep retrofit studies or DRS) goes far beyond a simple energy audit by focusing on large scale upgrades, significant energy and carbon reductions, and extended return on investment (ROI).

Building Statistics:

- Energy Use Intensity: 14.4 ekWh/ft2
- Emissions Intensity: 0.001 tCO2e/ft2
- Energy Star Rating: 95

What did they accomplish?

Le 100 Alexis Nihon won BOMA Canada's 2018 Net Zero Challenge Award for Innovation by demonstrating that older buildings can achieve excellent energy efficiency thanks to the use of exceptional management practices and technologies. As shown at Le 100 Alexis Nihon, a well laid out program of ongoing energy retrofits can result in significant energy savings over time.

Their achievements included:

- Low energy consumption, with an energy use intensity (EUI) of 14.4 ekWh/ft2
- Approximately ¾ of the energy used in the building was electricity sourced from a near renewable grid
- Low absolute energy impact despite being a relatively large building at ~ 300,000 ft2.

How did they do it?

These significant energy reductions were achieved through a comprehensive program of ongoing energy retrofits that included 3 keys to success:

- Look at passive design options first
- Upgrade systems at end of life
- Operate systems efficiently

Award Year: 2018

CASE STUDY #6: Generate Renewable Energy On-site

Building Statistics:

- Energy Use Intensity: 191 ekWh/m2
- Emissions Intensity: 10.15 tCO2e/m2
- Energy Star Rating: N/A

What did they accomplish?

777 Dunsmuir won BOMA Canada's 2019 Net Zero Challenge Award for Innovation. They installed a geo-exchange in the existing parkade to reduce district energy steam use by 85% and reduce carbon emissions by 900 tons of CO2. Additionally, a 195,000 ft2 retail area underneath the property was tied into the geo-exchange system, allowing energy sharing between buildings and extending the positive impact (carbon reduction) of the technology.

How did they do it?

Cadillac Fairview worked with drilling and coring industry experts from Fēnix to undertake the world's first geo retrofit of an existing building using a novel piece of equipment created, modified, tested and built to enable low headroom geo-exchange drilling. This equipment and novel drilling method were used to drill 30 - 400 ft deep boreholes into the existing parkade and install geo-exchange distribution piping which allows Cadillac Fairview to harvest the rejected heat from the building and store it underground until it is needed.

Lessons learned

- The building and process would have benefited from a significantly larger commissioning scope, extending throughout the entire first year of the building's operation. Others wishing to implement such an initiative should budget and plan for additional commissioning, at minimum 6-8 months post installation.
- Invest in a comprehensive training and check- in program for the operations staff right from the first day of operation, including building specific training.
- Real-time fault detection is key for commissioning and system optimization.
- Central to the continuous performance and savings associated with this project is Cadillac Fairview's program of regular performance checks, commissioning follow-up and real-time monitoring.

AWARDS CRITERION

1. BOMA BEST Energy Section Score

Applicants must complete the Energy Section of the BOMA BEST assessment, specifically sub-sections 1.1 to 1.5 (Demonstration of intent, Assessment, Operations and Maintenance, Systems, and Innovation).

2. Energy Use Intensity

Applicants must identify a 12-month current performance period and provide complete, actual, energy consumption data for this period. The 12-month period must represent consumption at the building post-occupancy and commissioning.

3. Absolute Energy Impact

Applicants do not need to provide any additional information for this criterion, judges will calculate the score based on data submitted in previous criteria.

4. Carbon Emission Intensity

Although it is not required, applicants may wish to purchase renewable energy certificates (RECs) or high-quality carbon offsets to displace up to 100% of the building's emissions during the current performance period.

5. Operations and Systems

Applicants must identify and describe the top 3 to 5 strategies believed to have had the most important impact on reducing the building's overall energy and carbon intensity. The strategies listed can be either technology or management-based and must represent the day-to-day, ongoing practices in place at the building that have had a positive impact on energy efficiency.

6. Replicability

Applicants must describe the learning experiences gained from putting in place at least one (1) project, technology or process (maximum of 3 initiatives) that sought to improve energy efficiency or carbon intensity at the building. Within reason, there is no time frame limit for when the project was implemented. The project/technology/practice described can be the same as one described in criteria 5 or 7.

7. Innovation

Applicants to the Innovation Award must identify and describe one (1) OR two (2) significant innovative solutions being undertaken at the building that are having (or are expected to have) a positive impact on moving the building towards net zero energy or net zero carbon. Innovations targeting other objectives (e.g. water efficiency) will not be considered.

8. Improvement Against Baseline

In Criterion 2, applicants are asked to identify a 12-month current performance period. In this criterion (Criterion 8), applicants must also identify a 12-month period representing the baseline performance. The baseline and current performance periods will be compared against each other to determine the improvement against baseline.

LESSONS FROM THE BOMA CANADA NET ZERO CHALLENGE

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