Peel Region

NET ZERO EMISSIONS BUILDING STANDARD FOR NEW CONSTRUCTION

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1 A New Corporate Building Standard for Peel

1.1 Background

In 2019, Peel Region declared a climate emergency and approved their 2020-2030 *Climate Change Master Plan* (CCMP). The plan outlines their commitments to reduce corporate *greenhouse gas* (GHG) emissions to 45% below 2010 levels by 2030 and to better prepare services, operations, and infrastructure to handle the impact of increased extreme weather.

As buildings represent 44% of Peel Region's corporate emissions, Peel committed to develop a 'Corporate Net Zero Emissions (NZE) Building Standard' for their new regional buildings and facilities, as well as major renovations and redevelopments. Such a standard would be in line with other peer and member municipalities, including Toronto, Vancouver and Mississauga.

Peel Region recognizes that the implementation of such a standard is fundamental to meeting the current interim corporate emissions reduction target of 45% by 2030 and the longer-term ambition of achieving net zero emissions, as well as to demonstrating leadership in climate action commensurate with the Region's declaration of a climate emergency. The standard also represents an important opportunity to increase the Region's safety and resilience in the face of climate change, reduce operational and maintenance costs, increase staff and occupant health and wellbeing, and support the economic growth of the region.

The NZE Building Standard for New Construction, hereafter referred to as 'the Standard', set outs requirements to ensure all new regional buildings and facilities are designed to achieve net zero carbon emissions.

Table 1.1: Federal, Provincial and Regional Climate Change Targets

	Climate Change Target
Government of Canada	• 17% reduction in GHG emissions below 2005 levels by 2020 • 30% reduction in GHG emissions below 2005 levels by 2030
Province of Ontario	• 30% reduction in GHG emissions below 2005 levels by 2030
Peel Region	• 45% reduction in GHG emissions below 2010 levels by 2030

1.2 Developing the Standard

The development of the Standard was led by a consultant team and Peel's *Office for Climate Change and Energy Management* (OCCEM) with input from a Corporate NZE Building Standard Working Group and direction and final decision making provided by a Steering

Committee. Working Group members included staff from across the four main regional departments involved with planning; Housing Development Office, Public Works, Peel Regional Police and Real Property Asset Management. Steering Group members represented senior leadership within Peel Region.

The following key principles were identified by the Working Group and served to guide the development of the standard:

1. **Emission Reductions:** Ensure GHG emission reductions are achieved. A clear priority for Peel Region is to achieve reductions of 45% by 2030 relative to 2010 levels.
2. **Feasibility:** Consider the business case and the cost of complying with the standard. This includes lifetime costs through construction, operation, and maintenance, as well as co-benefits and their public value.
3. **Resilience:** Support the development of a safe, secure, and connected community, one that is resilient to extreme weather events, is resource efficient and has increased energy security.
4. **Social Equity:** Explore opportunities to incorporate social and equity metrics in support of vulnerable people. This includes affordable housing, reduced chronic homelessness, and enhanced support and services for seniors, including long-term care facilities.
5. **Economic Prosperity:** Explore opportunities to enhance support and services for employment and provide employment opportunities. This can in turn address the inability to afford the cost of living and promote regional economic prosperity.
6. **Relevance:** Address the most common building archetypes in the Region's diverse portfolio for the largest reach. It should also consider recent case studies, the impacts of Covid 19 and recent supply chain issues.
7. **Implementation:** Provide a framework that is easily understood and actionable, rather than just providing aspirational targets.
8. **Alignment:** Integrate with the Region's governance structure and existing processes for the project selection, design, and construction of public buildings. It must also align with existing and upcoming policies and legislation.
9. **Transparency:** Ensure transparency and accountability to increase public trust and quality. This will include the monitoring and verification of building performance in use to ensure buildings perform at the levels specified through the design process.

The development of the Standard was additionally based on a review existing standards, including an evaluation of their ability to meet these key priorities and their overall suitability for Peel Region. Energy and cost modelling was also carried out to compare their different impacts on energy efficiency improvements, carbon emissions reductions, and potential cost increases or decreases across a range of relevant Peel Region archetypes.

1.3 Applying the Standard

The Standard applies to the design and construction of all regional buildings and facilities, including new construction, major renovation and redevelopment.

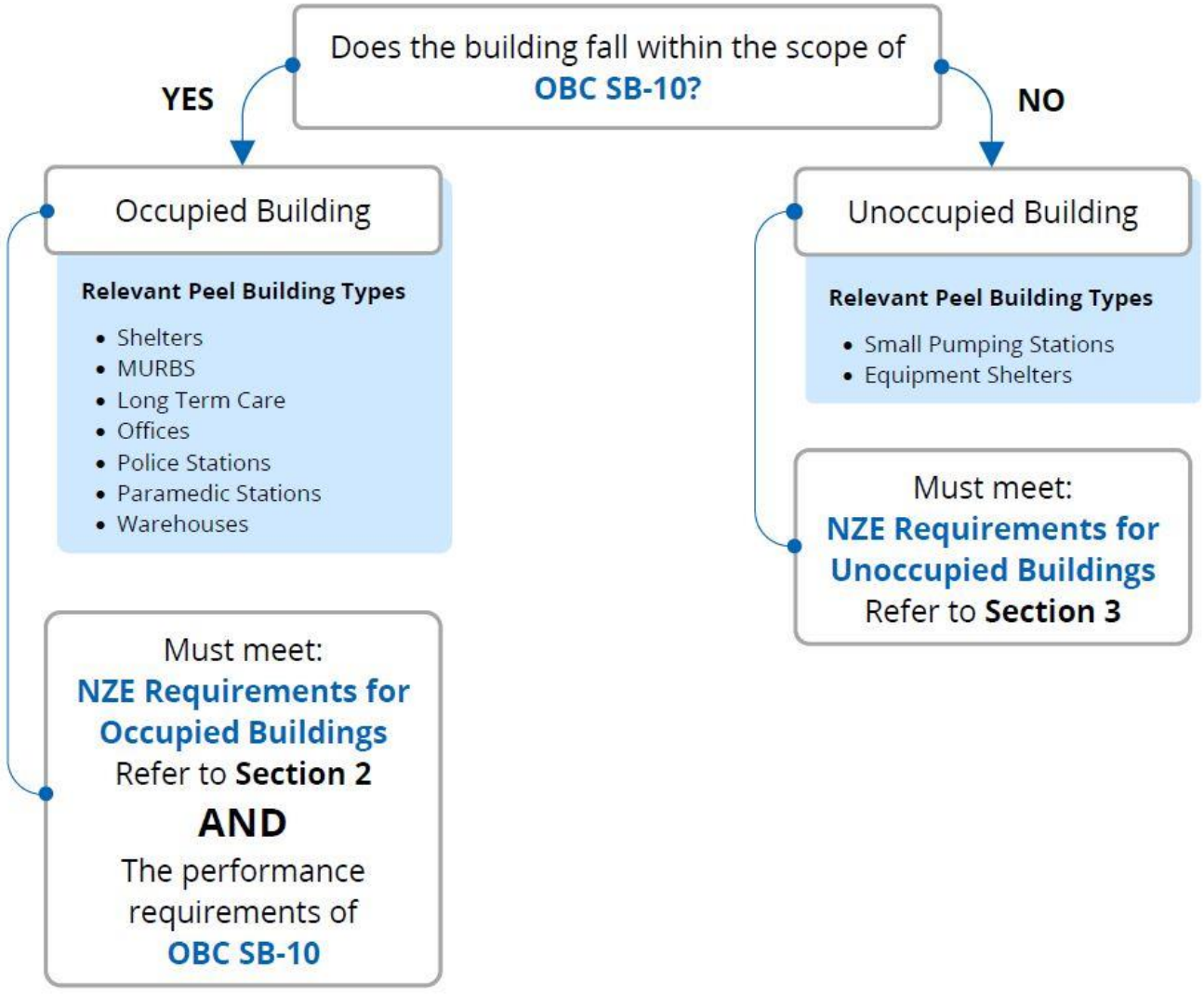
New construction refers to site preparation for, and construction of, entirely new structures and/or significant extensions to existing structures, whether or not the site was previously occupied.

Major renovation refers to any HVAC&R, envelope, and/or interior renovations that require a new certificate of occupancy and/or prevent normal building operations from occurring while they are in process. Proposed changes of use to the building are also considered major renovations.

Redevelopment refers to new construction on previously occupied land, typically after demolishing the existing buildings.

The Standard is separated into two parts: 'NZE Requirements for Occupied Buildings', and 'NZE Requirements for Unoccupied Buildings'. For the purposes of this Standard, all buildings within the scope of the Ontario's Building Code Supplementary Standard SB-10, "Energy Efficiency Requirements" are considered to be occupied buildings.

Figure 1.1: Applying the Standard



2 NZE Requirements for Occupied Buildings

2.1 Overview

The requirements and guidance set out in this chapter apply to the design and construction of all occupied regional buildings and facilities, including new construction, major renovation and redevelopment, as defined in Section 1.3. This includes building types such as shelters, multi-unit residential buildings, offices, paramedic stations and warehouses.

Peel Region's Corporate NZE Building Standard requires the design and construction of all occupied regional buildings and facilities, including new construction, major renovation, and redevelopment, to:

1. **Achieve third-party certification with the latest version of the Canada Green Building Council (CaGBC)'s Zero Carbon Building Design (ZCB-Design) Standard; and**
2. **Meet additional requirements for onsite combustion, thermal**
3. **energy demand intensity, airtightness, energy metering, commissioning, and resilience.**

Following these requirements will promote buildings that are highly energy efficient, with reduced operational costs, improved occupant wellbeing, and enhanced building resilience. Following the CAGBC's ZCB-Design Standard will ensure buildings are designed to achieve net zero emissions, which is fundamental to Peel's corporate emission reductions and reducing the built environment's impact on the climate.

2.2 The CaGBC's ZBC-Design Standard

2.2.1 Summary

The CAGBC's ZCB-Design Standard is a framework that guides the design of low-carbon, highly efficient buildings. Projects must demonstrate a zero carbon balance over a 60-year life-cycle, including both embodied carbon and operational carbon, otherwise known as whole life carbon. The ZCB-Design Standard represents a one-time certification and is awarded based on the project's final design, with relevant documentation reviewed by the CaGBC to confirm the requirements have been met.

A complementary standard, The Zero Carbon Building-Performance (ZCB-Performance) Standard allows projects to verify that a zero carbon balance has been achieved following building occupation. Certification is awarded annually based on operating data and in the case of projects that previously achieved ZCB-Design certification, verification of airtightness, and offsetting of the embodied carbon.

2.2.2 Requirements

A summary of the key requirements in the CaGBC's ZCB-Design Standard and ZCB-Performance Standard is provided in the table below. Peel Region's Corporate NZE Building Standard only requires projects to achieve certification with the ZCB-Design Standard (requirements highlighted in blue). Achieving net zero emissions through the use of the ZCB-Performance Standard will be the responsibility of the *Office of Climate Change and Energy Management* (OCCEM), as outlined in Section 4.1.

Table 2.1: Summary of CaGBC's ZCB Requirements

		ZCB-Design v2	ZCB-Performance v2
Carbon	Zero Carbon Balance	**Model zero carbon balance**	Achieve zero carbon balance
	Embodied Carbon	**Report embodied carbon**	Offset embodied carbon
	Refrigerants	**Report total quantity**	Offset any leaks
Energy	RECS and Carbon Offsets	**Provide quote**	Provide proof of purchase
	Onsite Combustion	***Provide transition plan****	Update plan every 5 years
	Energy Efficiency	**Meet one of three approaches**	Report EUI
	Peak Demand	**Report seasonal peaks**	Report seasonal peaks
	Airtightness	**Report and justify modelled value**	Conduct testing

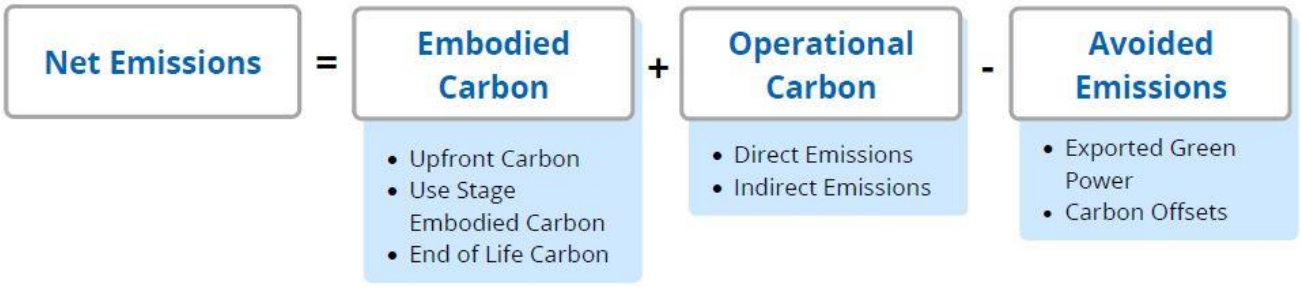
Impact & Innovation	**Apply two strategies**	No requirement
Certification	**One-time certification**	Annual certification

* Peel's Corporate NZE Building Standard requires all projects to be zero combustion, a Zero Carbon Transition Plan under the CaGBC's ZCB-Design Standard Version 2 will not be accepted. Refer to Section 2.3.1 for further details.

As defined in the ZCB-Design Standard, **a Zero Carbon Building is a highly energy efficient building that produces onsite, or procures, carbon-free renewable energy or high-quality carbon offsets in an amount sufficient to offset the annual carbon emissions associated with building materials and operations.**

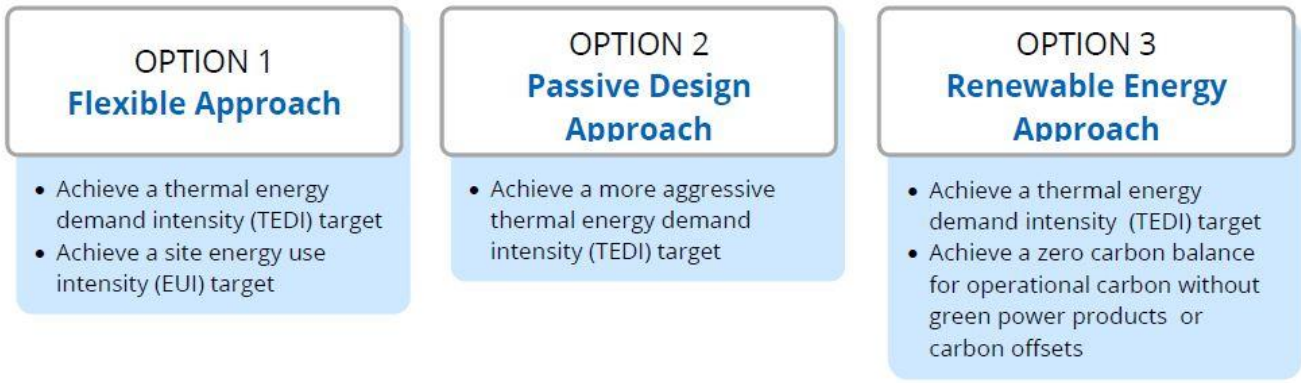
To achieve certification with the ZCB-Design Standard projects must demonstrate a carbon balance of zero or better. The carbon balance is the net emissions that result from sources and sinks of carbon emissions, calculated as show in Figure 2.1.

Figure 2.1: Calculating a Zero Carbon Balance



The ZCB-Design Standard requires a high-level of energy efficiency. To provide flexibility it allows projects teams the choose between three approaches to demonstrate energy efficiency, as illustrated in Figure 2.2.

Figure 2.2: ZCB-Design Standard's Energy Requirement Approaches



Thermal Energy Demand Intensity (TEDI) is the annual heat loss from a building's envelope and ventilation after accounting for all passive heat gains and losses, per unit of modelled floor area.

Energy Use Intensity (EUI) is the sum of all site energy (not source energy) consumed onsite (e.g., electricity, natural gas, district heat), including all process loads, divided by the building gross floor area. EUI is reported in kWh/m^2/year.

Refer to latest version of CaGBC's ZCB-Design Standard for the full set of requirements.

2.3 Additional Requirements

2.3.1 Zero Combustion

2.3.1.1 Intent

To eliminate onsite combustion and use of fossil fuels for heating and hot water and reduce greenhouse gas emissions associated with building operations.

2.3.1.2 Background

Requirements within the ZCB-Design Standard do not completely restrict onsite combustion for heating and hot water. While projects may submit Transition Plans that show how combustion-based systems can be replaced with low-emissions equipment in the future, these plans do not guarantee that such systems will eventually be removed. Similarly, while combustion-based systems may be designed to only operate at extreme cold temperatures, this does not guarantee that they will not be used outside of this threshold during occupancy.

To avoid unnecessary emissions associated with building operations, all projects are required to be zero combustion, regardless of the approach taken to fulfill the energy requirements (e.g. the approach taken to fulfilling TEDI requirements) of the ZCB-Design Standard.

A potential exception to this requirement will be if the use of non-combustion systems beyond the threshold of -10°C triggers the need for an electrical service upgrade when it would otherwise not have been required. In this event, project teams must present a business case for using onsite combustion beyond the threshold of -10°C if they wish to use combustion systems.

2.3.1.3 Requirements and Deliverables

Table 2.2: Zero Combustion Requirements and Deliverables

Zero Combustion
Requirements
• Do not include combustion-based systems for heating and hot water
Deliverables
• Mechanical drawings and specifications (issued for construction) demonstrating that no combustion-based systems are used onsite

2.3.1.4 Resources

- BC Housing. (2019.) *BC Energy Step Code: Design Guide.*

2.3.2 Thermal Energy Demand Intensity

2.3.2.1 Intent

To promote buildings that are energy efficient with reduced operating costs, while improving thermal comfort of occupants and enhancing building resilience.

2.3.2.2 Background

Setting and achieving a thermal energy demand intensity (TEDI) target ensures that buildings are designed to reduce overall heating demand using passive design measures, including higher quality envelopes, careful window placement, and thoughtful massing. A building with an improved TEDI improves occupant comfort, increases building resilience, and lowers operating costs.

To ensure overall heating demand is reduced, all projects are required to meet a TEDI of 32 kWh/m^2.yr, regardless of the approach taken to fulfill the energy requirements of the ZCB-Design Standard.

Note: A TEDI higher than 32 kWh/m^2.yr may be accepted for projects that have particularly high infiltration or ventilation rates due to their use type (e.g., yard buildings or garage facilities with large bay doors), provided that a detailed TEDI analysis demonstrates that their particular use circumstances prevent them from achieving the target, and that measures have been implemented in the design to minimize the TEDI as much as possible.

2.3.2.3 Requirements and Deliverables

Table 2.3: TEDI Requirements and Deliverables

TEDI
Requirements
• Meet a thermal energy demand intensity (TEDI) of 32 kWh/m2.yr
Deliverables
• Energy Model Report summarizing key modelling inputs, outputs and assumptions including a description of the strategies used to reduce heating demand and the modelled TEDI

2.3.2.4 Resources

For helpful examples of how to design energy-efficient buildings, visit the following links:

- Canada Green Building Council (CaGBC). (2015). *Guidance for Energy Modelling Compliance Documentation in LEED® Canada.*
    - Energy Model Reports must contain, at a minimum, the information listed in Part 1 of this document.
- Canada Green Building Council (CaGBC). (2022). *Zero Carbon Building – Energy Modelling Guideline.*
- BC Hydro. (2021). *Building Envelope Thermal Bridging Guide.*
- BC Housing. (2018). *Guide to Low Thermal Energy Demand for Large Buildings.*
- Ontario Building Code. (2017). *Supplementary Standard SB-10 "Energy Efficiency Requirements".*

2.3.3 Airtightness

2.3.3.1 Intent

To ensure that the air barrier systems of building envelope systems are constructed and perform as per the design intent, given that airtightness has significant impact on overall energy and thermal performance.

2.3.3.2 Background

Airtightness tests evaluate the leakiness of a building's envelope by measuring the pressure difference across the enclosure. Air leakage can lead to heat loss, condensation, and increased costs. Airtightness tests are typically conducted using a piece of equipment called a blower door and are often referred to as blower door tests. For smaller buildings, the test may only need one blower door, while a large building requires a coordinated effort with multiple blower doors. The information gathered can highlight the location of

imperfect seals and large holes, which can be addressed by building operators for improved performance.

Ensuring a building's airtightness is a key step in ensuring energy efficiency targets are met, as such all projects must conduct a whole-building airtightness test prior to occupancy.

2.3.3.3 Requirements and Deliverables

Table 2.4: Airtightness Requirements and Deliverables

Airtightness
Requirements
• Conduct a whole-building airtightness test prior to occupancy
Deliverables
At 50% Construction Documents stage: • Contract with an airtightness testing provider • Produce drawings and indicative detail showing the air barrier system • Submit an airtightness testing plan describing the project's approach to achieving improved airtightness, proposed testing procedure, and related quality assurance and quality control activities **At project completion:** • Submit an airtightness testing report

2.3.3.4 Resources

For additional guidance on airtightness testing, visit the following links and resources:

- BC Housing. (2017). *Illustrated Guide to Achieving Airtight Buildings.*
- US Army Corps of Engineers (USACE). (2012). *Air Leakage Test Protocol for Building Envelopes.*
- ASTM International. (2018). *ASTM E3158-18 – Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building.*
- ASTM International. (2019). *ASTM E779-19 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.*
- ASTM International. (2017). *ASTM E1827-11 – Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door*

2.3.4 Energy Metering

2.3.4.1 Intent

To ensure that buildings are provided with sufficient metering to facilitate ongoing measurement and tracking of energy usage by the building systems.

2.3.4.2 Background

The need for energy metering is predicated on the fact that to effectively manage energy use, it must first be measured. Comprehensive energy metering can show gaps between projected and actual efficiency performance, which is a vital component of energy management. By comparing the measurements from sub-meters to an established benchmark for that building type, operators can identify and remedy poorly performing buildings, reduce wasted energy, and decrease operating costs. Metering is also required to understand how to meet operational energy use with green power and carbon offsets, fundamental to achieving a zero carbon balance. Meter readings can be used just for internal use or shared at wider scale for benchmarking purposes or participation in green building certification programs.

Peel Region's Corporate NZE Building Standard requires all projects to include sub-meters for all significant energy end-uses.

2.3.4.3 Requirements and Deliverables

Table 2.5: Energy Metering and Benchmarking Requirements and Deliverables

Energy Metering and Benchmarking
Requirements
• Install electricity and/or thermal sub-meters for all energy end-uses that represent more than 10% of the building's total energy consumption. All major process loads, such equipment at a works yard, shall be sub-metered separately.
Deliverables
• Mechanical and electrical drawings and specifications (issued for construction) indicating the provision of electricity and thermal sub-meters. • A metering plan listing all meters along with type, energy source metered, diagrams, and/or references to design documentation

2.3.4.4 Resources

For additional guidance on metering, visit the following links and resources:

- US Green Building Council (USGBC). (2018). *LEED v4 Reference Guide – Building Design and Construction.*
- Efficiency Valuation Organization (EVO). (2022). *International Performance Measurement and Verification Protocol (IPMVP).*
- Government of Ontario. *Report energy and water use in large buildings* [online].

2.3.5 Commissioning

2.3.5.1 Intent

To ensure that all systems and components of a building are designed, installed, tested, operated and maintained according to operational requirements.

2.3.5.2 Background

The commissioning process is a systematic process that documents and verifies that all building systems operate as designed in accordance with the owner's operational requirements. More extensive commissioning can also ensure that operational and maintenance materials are adequate and building staff have received adequate training on the operations and maintenance of building systems. Commissioning is increasingly important in higher performance buildings, as newer systems and technologies can require finer tuning to ensure their proper function.

Peel Region's Corporate NZE Building Standard requires all projects to be commissioned following best practice guidelines.

Complete the commissioning process (CxP) activities for mechanical, electrical, plumbing, and renewable energy systems and assemblies in accordance with ASHRAE Standard 202-2018, ASHRAE Guideline 0–2019, and ASHRAE Guideline 1.1–2007, as they relate to energy, water and indoor environmental quality. Refer to the 2020 GSA Commissioning Guide for more information. The commissioning agent may be a qualified employee of the region, an independent consultant, or an employee of the design or construction firm who is not part of the project's design or construction team.

2.3.5.3 Requirements and Deliverables

Table 2.6: Commissioning Requirements and Deliverables

Commissioning
Requirements
• Commission the building following best practice guidelines
Deliverables
• Requirements as per ASHARE guidelines

2.3.5.4 Resources

For additional resources related to best practices for building commissioning, visit the following links:

- ASHRAE Standards Committee. (2018). *ASHRAE Standard 202-2018 – Commissioning Process for Buildings and Systems.*
- ASHRAE Standards Committee. (2019). *ASHRAE Guideline 0-2019 – The Commissioning Process.*
- ASHRAE Standards Committee. (2007). *ASHRAE Guideline 1.1-2007 – HVAC&R Technical Requirements for the Commissioning Process.*
- US GSA. (2020). *GSA Commissioning Guide.*
- National Institute of Building Sciences (NIBS). (2012). *NIBS Guideline 3-2012 – Exterior Enclosure Technical Requirements for the Commissioning Process*.
- Lawrence Berkeley National Laboratory. (2017). *Monitoring-Based Commissioning Plan Template.*
- CSA Group. (2021). *CSA Standard Z320-11 (R2021) – Building Commissioning.*

2.3.6 Resilience

2.3.6.1 Intent

To improve building resilience and flexibility, maintaining critical operations and functions, in response to climate change and an increase in extreme weather events.

2.3.6.2 Background

Improving building resilience to climate change impacts is becoming more important as projected increases in the incidence of heat waves, ice storms, and other extreme weather events. Many of these events are accompanied by power outages, leaving the communities without electricity. In particular, buildings owned and operated by the region can act as

important refuge centres for the community, including vulnerable populations such as seniors and people with pre-existing health conditions, during these events.

Peel Region's Corporate NZE Building Standard requires design teams to conduct a climate risk assessment and ensure the project's resilience to key climate hazards.

2.3.6.3 Requirements and Deliverables

Table 2.7: Resilience Requirements and Deliverables

Resilience
Requirements
• Conduct a climate resilience risk assessment that identifies the main hazards of concern, their expected impacts on the project, and the strategies that will be used to mitigate those impacts in project design. • Carry out energy modelling using future climate weather files (2050 and 2080) and report findings. • Provide 72 hours of back-up power and thermal energy to a central refuge area and to essential building systems as per the City of Toronto's Minimum Backup Power Guidelines for MURBs. • Ensure cooling is provided for all residential units.
Deliverables
• A Climate Risk Assessment memo, including details on sources of climate and other data used in the assessment, the climate risk assessment methodology used, extreme, high and medium risks identified, and strategies recommended for inclusion in design • An energy modelling report/memo with the findings of the future climate modelling analysis including: heating and cooling energy use results (current weather, 2050 and 2080), number of hours that occupied spaces are outside of the acceptable comfort range defined in ASHRAE 55-2010 (current weather, 2050 and 2080), an analysis of the expected peak cooling loads in 2050 and 2080 relative to current design, recommendations to future-proof the current design to mitigate risk of future overheating (e.g., space allowances to increase system cooling capacity in the future, prepare façade for future shading structures).

2.3.6.4 Resources

For helpful examples of how to design more resilient buildings, visit the following links:

- City of Toronto. (2016). *Minimum Backup Power Guidelines for MURBs.*

- BC Housing. (2019). *BC Energy Step Code: Design Guide Supplement S3 on Overheating and Air Quality.*
- PIEVC Program Partnership. *PIEVC High Level Screening Guide* [online].
- BC Housing. *Mobilizing Building Adaptation and Resilience* [online].

3 NZE Requirements for Unoccupied Building

3.1 Overview

Peel Region's Corporate NZE Building Standard requires the design and construction of all unoccupied regional buildings and facilities, including new construction, major renovation and redevelopment, to meet a set of additional requirements for building envelope, HVAC, and lighting (in addition to any relevant design standards).

The requirements for building envelope, HVAC and lighting detailed in this standard are applicable to all unoccupied buildings owned by Peel and should be used in conjunction with relevant design standards (such as the Sewage Pumping Station Design Standards), the Ontario Building Code (OBC), the National Building Code (NBC) and Canadian Standards Association (CSA).

Following these requirements will promote buildings and facilities that are more energy efficient and that have lower carbon emissions.

3.2 Requirements

Table 3.1: Requirements for Unoccupied Building

Unoccupied Buildings
Building Envelope

• Buildings that have heating systems should meet the envelope performance requirements in OBC SB-10 for either heated or semi-heated buildings, as applicable. Projects can choose to demonstrate compliance either via the prescriptive or the trade-off compliance path.
• Envelope components included in this requirement include:
  ○ Above-ground opaque building assemblies
  ○ Walls
  ○ Roofs
  ○ Floors
  ○ Fenestration
  ○ Doors and access hatches
  ○ Building assemblies in contact with the ground
  ○ Walls
  ○ Roofs
  ○ Floors
• Buildings that have no heating systems are exempt from the above requirements.

HVAC

Space Heating

- Heating energy source should be electric (either direct or heat pump based) unless fuel combustion is required for specific project reasons.
- In spaces that require mechanical cooling (see Air Conditioning section), heating should be provided via heat pump-based systems. When cooling is provided to a system (e.g., electrical or controls panel) rather than a space, the requirement for heat pump-based heating does not apply.
- In spaces that do not require mechanical cooling, heating can be provided via electric resistors.

Air Conditioning

- Supply and exhaust fans should be considered as a primary means of cooling spaces whenever feasible.
- Provide air conditioning for Type III and IV electrical and control rooms. Account for the heat radiated from all electrical equipment as part of the design.
- Heating and cooling set points should reference operational requirements and must comply with any specific design set points provided in other applicable design standards.
- Assess the need for dehumidification systems for process areas to control condensation and control corrosion from a life-cycle-cost perspective.
- When air conditioning is provided, equipment efficiency should meet minimum requirements in OBC SB-10.

Lighting

- Interior and exterior lighting design should meet the maximum lighting power density allowances in OBC SB-10.
- Lighting controls should comply with the requirements in OBC SB-10.

4 Compliance and Implementation

This standard is to be used by both Peel staff and project teams. The following section outlines the roles and responsibilities of Peel's *Office of Climate Change and Energy Management (*OCCEM), project managers, and the project team, as well as the key steps involved in implementing the Standard.

4.1 Roles and Responsibilities

Roles and responsibilities are outlined for three core actors needed for the successful achievement of the Standard.

OCCEM: The Office of Climate Change and Energy Management is Peel Region's Corporate Services Department that ensures Peel is prepared to proactively respond to climate change impacts and reduce greenhouse gas emissions. They are responsible for:

- Providing support to Project Managers in the implementation of the Policy
- Ensuring project managers are familiar with the Corporate NZE Building Standard
- Participating in the integrated design process (IDP), by providing input on design strategies and feasibility including a review of the outputs of the energy model and life cycle costing
- Liaising with the project team and the Canada Green Building Council (CaGBC) as required
- Collecting and managing annual performance data for all buildings and facilities

Program Owners/Departments: The various departments at Peel are responsible for planning and implementing capital building projects. They are responsible for:

- Adopting and implementing the Policy whenever planning for a new facility or major renovation or redevelopment
- Providing direction to Project Manager to adopt the Standard
- Including full costing to meet the standard as part of the capital budget plan for each project

Project Managers: Peel employee(s) who will lead the delivery of the project and are responsible for decision making surrounding budget allocation for capital projects and/or facilities' operating expenses. They are responsible for:

- Ensuring the Corporate NZE Building Standard is implemented in the design and construction of all regional buildings and facilities
- Including requirements of the Standard in the procurement process
- Bringing together project teams and promoting the adoption of integrated design process (IDP)

Project Teams: All design team members are responsible for ensuring project designs efficiently and effectively achieve the requirements of the standard, including architects,

structural engineers, mechanical and electrical engineers, and others. Project teams should include a consultant or appointed member of the project team to be the **NZE Standard Lead**, responsible for the administrative requirements of the Corporate NZE Building Standard , in particular the requirements of certification with CaGBC's ZCB-Design Standard and the first year of certification with the CaGBC's ZCB-Performance Standard. A Life Cycle Assessment (LCA) consultant will also be required to meet the embodied carbon requirements of the Standard.

4.2 Using an Integrated Design Process (IDP)

Meeting the requirements of the Standard while avoiding additional costs can be greatly facilitated through the use of an *integrated design process* (IDP). IDP is a collaborative process that brings together all stakeholders who will be involved throughout a project to facilitate the design, construction, operation and occupancy of high-performance buildings.

Within conventional design processes, design making is often quite linear and does not include all stakeholders in key decisions. An architect decides on overall building form and appearance, an engineer decides what systems are needed, and a general contractor constructs the building, with operations then handed over to a separate party once construction is complete. In IDP, a building is approached more holistically.

In an IDP, all stakeholders form an interdisciplinary team is formed at the outset of the project to explore, test, and evaluate design strategies to find those with the greatest potential . Throughout this process, members of the team actively communicate and offer differing viewpoints, looking for synergies and trade-offs in the preliminary stages of building design. For example, minimizing the windows on one side of a building might reduce the scale of HVAC equipment required, which could free up funds for other aspects of the project. It is unlikely that the professionals would have identified these synergies if working separately.

Utilizing an IDP can lower costs by reducing wasted time and materials and maximizing resource efficiency through the design and construction periods. Project teams can also avoid unnecessary design draft iterations, shortening delivery times, and gain valuable insight into what materials will eventually be needed, allowing time to order specialty products and minimize waste. While a project team may spend more time in the design stage of a project, the upfront cost can be more than offset as identified synergies can result in:

- Lower initial capital costs
- Fewer change orders
- Fewer delays in construction
- Reduced long term operating costs

The owner and project manager should reach out to all stakeholders to bring together a project team for the IDP. Team members often include:

- Owners and/or the owner's representative
- Architects
- Construction managers
- Civil engineers
- Landscape architects
- Mechanical and electrical engineers
- Specialized consultants (acoustics, lighting, ecology)
- Building commissioning professionals
- Building occupant representatives
- Building maintenance and operation representatives
- IDP facilitators

5 Appendix A – Glossary

Avoided Emissions: Carbon offsets and renewable energy used to balance embodied and operation carbon emissions, as defined by the Canada Green Building Council.

Airtightness: A measure of the air leakage through a building's envelope.

Carbon Offset: A credit for reductions in greenhouse gas emissions that occur somewhere else and that can be purchased to compensate for the emissions of a company or project. High quality carbon offsets include third party verification of emissions reductions as well as additionality, longevity, and leakage criteria.

Climate Risk Assessment: Climate risk assessments identify the likelihood of future climate hazards and their potential impacts for cities and their communities.

Combustion-based : The chemical process of burning via a substance (fuel) reacting rapidly with oxygen and giving off heat.

Commissioning: A systematic process that documents and verifies that all systems and components of a building are designed, installed, tested, operated and maintained according to operational requirements.

Embodied Carbon: Carbon emissions associated with materials and construction processes throughout the whole life cycle of a building.

Energy Metering: Ongoing measurement and tracking of energy consumption and fuel usage.

Energy Modelling: The process of simulating a buildings energy performance using a 3D computational model.

Energy Use Intensity (EUI): The sum of all site energy (not source energy) consumed on site (e.g., electricity, natural gas, district heat), including all process loads, divided by the building modelled floor area.

Greenhouse Gases (GHGs): Gases that absorb and emit radiant energy within the thermal infrared range. The accumulation of greenhouse gases in the atmosphere causes the greenhouse effect and contribute to planetary warming and climate change.

HVAC&R: Heating, Ventilation, Air Conditioning and Refrigeration

Integrated Design Process (IDP): A collaborative process that that brings together all stakeholders who will be involved throughout a project to facilitate the design, construction, operation and occupancy of high-performance buildings.

Life-Cycle Assessment (LCA): As defined by ISO 14040, LCA is a systematic set of procedures for compiling and examining the inputs and outputs of materials and energy, and the associated environmental impacts directly attributable to a building, infrastructure, product, or material throughout its life-cycle.

Major Renovation refers to any HVAC&R, envelope, and/or interior renovations that require a new certificate of occupancy and/or prevent normal building operations from occurring while they are in process. Proposed changes of use to the building are also considered major renovations.

Net Zero Emissions (NZE): Refer to Zero Carbon Balance

New Construction refers to site preparation for, and construction of, entirely new structures and/or significant extensions to existing structures whether or not the site was previously occupied.

Operational Carbon: The emissions associated with the energy used to operate a building.

Redevelopment: refers to new construction on previously occupied land, typically after demolishing the existing buildings.

Renewable Energy Certificate (REC): An authorized electronic or paper representation of the environmental attributes associated with the generation of 1 MWh of renewable energy.

Renewable Energy: A source of energy that is replenished through natural process or using sustainable management policies such that it is not depleted at current levels of consumption. Examples include solar and wind energy used for power generation and solar energy used for heating. Air-source and ground-source (geo-exchange) heat pump systems do not constitute renewable energy systems.

Resilience: The ability and flexibility to maintain critical building operations and functions, in response to climate change and an increase in extreme weather events.

Thermal Energy Demand Intensity (TEDI): The annual heat loss from a building's envelope and ventilation after accounting for all passive heat gains and losses, per unit of modelled floor area.

Zero Carbon Balance: When the net emissions associated with embodied carbon, operational carbon and avoided emissions are zero or less over the life of a building.

Zero Carbon Building (ZCB): A highly energy-efficient building that produces onsite, or procures, carbon-free renewable energy [or high-quality carbon offsets] in an amount sufficient to offset the annual carbon emissions associated with building operations.