

Decarbonization - Pathway to Net Zero

Operational Strategies to Reduce Emissions

Module 1: Introduction to Carbon and Carbon Emissions

Dev note: All production-ready image/video assets for this Module 1 are located at:

[13. Decarbonization - Pathway to Net Zero > Visuals > For Production > Module 1](#)

(New Slide)

- Navigation Instructions (Please follow Customer Service Module 1 Format)
-

(New Slide)

- Please use the same, general format as the Customer Service certificate, but we have new VO/CC/TOS and a new image as follows.
- Welcome to the Decarbonization - Pathway to Net Zero, Operational Strategies to Reduce Emissions. Certificate Module 1, Introduction to Carbon and Carbon Emissions. Select start to begin
- Short video fades into certificate image

Dev note: This video is for the very beginning where the short video plays and then fades to the Decarbonization certificate image/logo

Video for transition to Certificate logo: Adobe Stock 578505753.mov (11 sec) -

https://drive.google.com/file/d/1ne_eiYYLQRfGiF9LuZ0_QJ2YmVghAUUu/view?usp=drive_link

Decarbonization Certificate logo - 16.Decarbonization--Pathway-to-Net-Zero.png

https://drive.google.com/file/d/1E1roAhmLOMqzCO5FY7gy_fQq0b007LoL/view?usp=drive_link

(New Slide)

- Follow the Customer Service format for this slide, but use the Decarbonization certificate logo/image when the slide opens. Please also bold module 1 and add the aqua arrow pointing to it.
- New VO/CC/TOS:
 - Decarbonization - Pathway to Net Zero, *Operational Strategies to Reduce Emissions*.
 - In this certificate we will cover eight (8) modules:
 - Module 1: Introduction to Carbon and Carbon Emissions
 - Module 2: Climate Change and Resilience
 - Module 3: Equipment, Operations and Carbon Emissions
 - Module 4: Water and Waste Programs
 - Module 5: Carbon Reducing Measures
 - Module 6: Decarbonization Roadmap

- Module 7: Role of the Building Operations Professional
- Module 8: Carbon Reduction Case Studies

(New Slide)

This screen grab is just a placeholder. I need to provide you with the actual image file for the header in the screen grab below. The graphic will appear on a slide with the text below that recognizes the parties involved with this certificate.

Image: [Decarbonization_Banner_2024.jpg](#) (uploaded to Visuals folder)

https://drive.google.com/file/d/1CF6s0Bm1zZsgzWqCqD20rjkNLeDxHloL/view?usp=drive_link

The Decarbonization - Pathway to Net Zero, *Operational Strategies to Reduce Emissions* certificate is part of the Canadian Low Carbon Training Program (LCTP).

Due to rising market demands for low-carbon buildings and retrofits, an important requirement exists related to new skills and knowledge on this important topic.

This new training program is the first of its kind. Funded in part by the Government of Canada and provided at no cost, the LCTP was developed by the Canada Green Building Council (CAGBC) in partnership with these organizations:

- Canadian Construction Association (CCA)
- Climate Risk Institute (CRI)
- Royal Architectural Institute of Canada (RAIC)
- Building Owners and Managers Association (BOMA)
- Real Property Association of Canada (REALPAC)

The LCTP includes specialized training for the key professions of architects, engineers, contractors, and building owners and operators. The comprehensive curriculum provides the foundational knowledge and specialized skills to support an unprecedented market transition towards low-carbon buildings and deep-carbon retrofits.

With this free program, building sector professionals can future-proof their careers by upskilling with the knowledge needed to participate in Canada's transition to a low-carbon economy.

The BOD Program and MEC Real Learning are honoured to support this critical industry training program through the development and delivery of this certificate. Our special thanks go out to BOMA Canada for selecting us as your development partner.

(New Slide)

- **Introduction to Decarbonization - Pathway to Net Zero, *Operational Strategies to Reduce Emissions***

Dev Note: The video plays, then the BOD logo is in the lower right corner and there is no TOS, only VO/CC related to the below text. The video then fades automatically to next slide video called “Learning Objectives”

Video for Intro: Adobe Stock 321840545.mov (28 sec) -

https://drive.google.com/file/d/1sl5lozRzuKMgWP1JD_gCRr5ZMO6aM1g8/view?usp=drive_link

As a Building Operations professional, you are responsible for the general operation of your building, and its carbon emissions. It is important that you understand the difference between operational and embodied carbon, carbon emissions, carbon’s significant impact on the environment, net zero and what is required to get to net zero, the equipment and processes that produce carbon, your building and your company’s decarbonization road map, measures that can reduce carbon emissions, and the requirements associated with operating your building in an energy efficient and low carbon manner, and the role of a Building Operations professional.

Understanding these points will help your organization meet its ESG (Environmental Social, and Governance) mandates and regulatory monitoring and reporting requirements. It is important to note that carbon use must be considered through every stage of a building's life cycle, including construction, operation, decommissioning and demolition or deconstruction.

From an energy efficiency perspective, organizations in the commercial real estate industry have been actively involved for decades, reducing energy costs and consumption. Today, energy efficiency still remains very important, but carbon and greenhouse gas emissions that negatively impact the climate are at the forefront and are fully integrated as part of energy efficiency.

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Learning Objectives

Dev Note: The learning objective video starts, the certificate name is at the top and the module number and name is directly below, following the format of Customer Service. The title and subtitle then fade as the learning objectives come on screen based on voice prompts

Video for Learning Objectives: Adobe Stock 256582395.mov (29 sec) -

https://drive.google.com/file/d/19YKepND-xzxUXvc12C-0qQaNhuJyoz8i/view?usp=drive_link

- Welcome to Module 1: Introduction to Carbon and Carbon Emissions, the first of eight modules that make up our Decarbonization - Pathway to Net Zero, *Operational Strategies to Reduce Emissions* certificate.
- This first module will provide a detailed summary of carbon, carbon emissions, greenhouse gases (GHGs), decarbonization, net zero, net zero building classifications and terms, and climate action plans and summits. This module will provide important information for Building Operations professionals who are instrumental in identifying carbon reducing measures and overseeing them.
- This module will help you understand:
 - LO 1: Common terms and definitions for carbon, carbon emissions, and greenhouse gasses (GHGs).
 - LO 2: The difference between embodied and operational carbon.
 - and
 - LO 3: Decarbonization, net zero building classification and terms, climate action plans and summits, and how this information applies to your building and role.

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Image suggestion: Shutterstock 2289944191 -

https://drive.google.com/file/d/1SqfwJDD4F9UhwgomXhgt1SqJSq9VdtF5/view?usp=drive_link

What is Carbon?

Carbon is defined as a non-metallic element occurring naturally as diamond, graphite and charcoal, and in all organic compounds.

Carbon is naturally released through processes such as the respiration and decomposition of organisms. However, carbon can also be released through more harmful means, such as the burning of fossil fuels, which have damaging effects on Earth's atmosphere. Carbon is a short-hand term for CO₂ and other gases.

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Image suggestion: Adobe Stock 703319493 - [https://drive.google.com/file/d/1euG-](https://drive.google.com/file/d/1euG-FxJFxEIw5NtHSs6k03f0e4YRBwJ/view?usp=drive_link)

[FxJFxEIw5NtHSs6k03f0e4YRBwJ/view?usp=drive_link](https://drive.google.com/file/d/1euG-FxJFxEIw5NtHSs6k03f0e4YRBwJ/view?usp=drive_link)

What are Greenhouse Gases (GHGs)?

Greenhouse gases are gaseous constituents (substances) of the atmosphere, both natural and anthropogenic (man-made), that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect.

The effects of greenhouse gases include the trapping of heat within Earth's atmosphere, which in turn leads to global warming. Additionally, changes to the chemical composition of the atmosphere, such as through increased levels of carbon dioxide, have been shown to cause more extreme weather events and rainfall patterns.

The main contributors to GHG emissions include:

- Construction processes
- Energy consumption
- Methane emissions
- Refrigerant leakage and disposal.

Image suggestion: Adobe Stock 462557114 - [Artwork here](#) / [Click here for image preview only](#)

Carbon Dioxide (CO₂) is part of a group of gases referred to as GHGs (greenhouse gases). In addition to CO₂, this group of gases also includes methane (CH₄); nitrous oxide (N₂O); nitrogen trifluoride (NF₃); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF₆).

For the purposes of this certificate, we will mostly address Carbon emissions (CO₂), but we will touch upon the following GHGs that are primarily associated with the operations of buildings:

- Methane or CH₄: Byproduct of burning natural gas.
- Nitrous Oxide or N₂O: Byproduct of burning natural gas.
- Hydrofluorocarbons or HFCs: Refrigerants that once released into the atmosphere become a greenhouse gas.

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Image: Canada GHG emissions by economic sector 2019.jpg https://drive.google.com/file/d/1j4IJQ_6-0EQZAudbT3NDmqXXwKAKqO0p/view?usp=drive_link

Breakdown of Canada's Greenhouse Gas Emissions

We know that buildings are a significant source of greenhouse emissions and that we need to do our part to lower our carbon output, but buildings are not the highest source of emissions. This pie chart from Environment and Climate Change Canada provides a breakdown of Canada's greenhouse gas (GHG) emissions in 2019 through seven economic sectors:

1. Oil and Gas
2. Electricity
3. Transport
4. Heavy Industry
5. Buildings
6. Agriculture
7. Waste & Others

- a. The total GHG emissions equals 730 megatonnes of carbon dioxide equivalent (Mt CO₂ eq).

Add a bumper...

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Air pollution by smoke coming out of factory chimney - CO₂ and greenhouse gas emissions

Image Suggestion: Adobe Stock 511664639-

https://drive.google.com/file/d/1Lrn2CXFonMa5Z6zHoCex9xe5SYFMpdkf/view?usp=drive_link

What are Carbon Emissions?

As a Building Operations professional, it is also important for you to understand Carbon emissions. Carbon emissions are classified as either:

- Direct: From combustion of fossil fuels.
 - or
- Indirect: Examples include the purchase and use of electricity, steam, and chilled water, produced in part or in whole by the combustion of fossil fuels.

Carbon emissions are a result of the release of carbon dioxide (CO₂) into the atmosphere which contributes to the greenhouse effect. CO₂ is the most abundant greenhouse gas emitted by human activities and is primarily generated through the combustion of fossil fuels like coal, oil, and natural gas for energy production, transportation, industrial processes, and residential use.

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Sustainable eco-friendly office building with glass in modern city

Image Suggestion: Adobe Stock 695027029- [https://drive.google.com/file/d/105INljnIAS3-](https://drive.google.com/file/d/105INljnIAS3-6zTZ9xAgFho9JK_Ub1/view?usp=drive_link)

[6zTZ9xAgFho9JK_Ub1 /view?usp=drive_link](https://drive.google.com/file/d/105INljnIAS3-6zTZ9xAgFho9JK_Ub1/view?usp=drive_link)

Measurement Units for Carbon Emissions and Examples

Carbon emissions are typically measured in equivalent tonnes of carbon dioxide. To better grasp the scale of emission quantities, it is useful to compare them to common activities. For example, 10 tonnes of CO_{2e} (carbon dioxide equivalent) is about what three passenger cars emit per year or about what six homes emit per year from their electricity use. These figures are from NRCAN's Greenhouse Gas Equivalencies Calculator. In comparison, a typical commercial building's greenhouse gas emissions may fall inside a range of 0.00086 to 0.018 tCO_{2e}/ft² but they could be lower or higher based on these factors:

- The size and purpose or use of the building.

- Type of equipment, its operations and maintenance, and its efficiency.
- The building's climate zone or location.
- The generation mix of the power grid in its region.

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Knowledge Check 1 (Multiple Choice Question)

Which of the below impact a building's carbon emissions? (Check all that apply)

- A) Size and purpose or use of the building.**
- B) The average age of the tenants.
- C) Type of equipment, its operations and maintenance, and its efficiency.**
- D) The building's climate zone or location.**
- E) The generation mix of the power grid in its region.**

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Operational Carbon: Adobe Stock 544204182 -

https://drive.google.com/file/d/1BtN3u_QvNwZYWxyYN8PA_so_Mrx12zZQ/view?usp=drive_link

Embodied Carbon: Adobe Stock 554522551 -

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Operational vs Embodied Carbon

Operational emissions from the building sector accounts for 28% of global emissions, while embodied emissions account for another 11% (EC). According to CAGBC, embodied carbon can represent over 90% of a new building's emissions.

Operational Carbon:

- Operational carbon – whether on-site or off-site – encompasses emissions arising from energy and water consumption and a life cycle assessment is needed to inventory these emissions.

Embodied Carbon:

- Embodied carbon covers emissions in the different stages of building materials: extraction, production, transportation, construction, replacement cycles, refrigerant leakage and end of life, with optional reporting of reuse and recycle content

Your understanding of both operational and embodied carbon as it relates to a decarbonization strategy and the operation of your building is very important. We will continue to explore these two elements as this certificate progresses.

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Source Types of Carbon Emissions

Now that you understand both Operational and Embodied Carbon, let's look at the three Scopes of Carbon....

Scope 1 Carbon (Operational Direct Emissions)

Image suggestion: Adobe Stock 717449738 - https://drive.google.com/file/d/1Xrtv-uVww_3onj0b0hKgyhmaKj0NfcjL/view?usp=drive_link

These are greenhouse gas (GHG) emissions that a company or building makes directly. For example, operating gas-fired heating equipment, diesel (or gas-fired generators) and vehicles powered by ICE (internal combustion engines).

Scope 2 Carbon (Operational Indirect Emissions)

Image suggestion: Adobe Stock 372527563 - https://drive.google.com/file/d/1xUk3bkj3o8Ahk828JwV1kqKDd9CipmX9/view?usp=drive_link

These are the emissions a building owner is indirectly responsible for along with the provider, such as a local utility. An example is when energy is purchased to heat and cool buildings. Some pertinent examples include: Municipal water, electricity, natural gas, and district steam, chilled water, and hot water.

Scope 3 Carbon (Embodied Indirect or Supply Chain Emissions)

Image suggestion: Adobe Stock 511194305 - https://drive.google.com/file/d/189gErnqC5udd-8qr5Fe0IE1WAJY4dtOX/view?usp=drive_link

These are emissions associated, not with the company who made a purchase itself, but with the organization(s) that are responsible for the activities up and down its supply chain. For example, when buying a new piece of equipment from a manufacturer for your building, carbon was used in the manufacturing process, and transportation of the equipment. When installed in the building, these components have embodied carbon.

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Decarbonization and Net Zero

Dev note: this image is for the “What is decarbonization?” text below.

Image suggestion: Adobe Stock 247377770 - https://drive.google.com/file/d/1jjoL2Ca4naX_N1-kE4RvUytOoLnHrOkW/view?usp=drive_link

What is Decarbonization?

Decarbonization refers to the goal of minimizing or eliminating carbon dioxide emissions; the production of these emissions are primarily caused by human activity. These emissions trap heat in the atmosphere leading to a warming of the earth’s surface. Some sectors where these emissions are produced are: oil and gas production, transportation and power generation for buildings.

Dev note: this image is for the “What is Net Zero?” text below.

Image suggestion: Shutterstock 2108230025 - https://drive.google.com/file/d/1io7htOxnW_fGYLpsa3s9n684iznAO5CB/view?usp=drive_link

What is Net Zero?

While the definition of net zero has a number of common concepts, there are varying definitions provided by organizations that participate in the buildings sector. A common thread that ties these definitions together is the need to eliminate greenhouse emissions which includes carbon at different stages in a buildings life cycle: construction, operation, decommissioning and demolition.

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Dev note: please have the three Scopes (1, 2, and 3) listed separate from the definitions so the learner can drag and drop them where required. The 3 Scopes are listed below with their correct definition.