JANUARY 31, 2025

Energy management and efficient electrification series for Ontario municipalities

Net zero planning and low carbon initiatives

Presented by Christian Tham

Overview

1. Introduction
2. Definitions and background – net zero emissions, net zero energy, carbon neutrality, etc.
3. Seven steps to net zero
4. Some municipal examples of net zero emissions
5. Middlesex Centre, Ajax and Caledon
6. Questions and answers – general discussion

Speaker biography

Christian Tham

Program Specialist

LAS

Christian has over two decades of municipal **experience in environmental sustainability and energy management**. His experience includes the planning and construction of Canada's first net zero Fire Hall in Coldstream Ontario. In his role, Christian **helps municipalities implement energy efficiency measures and develop a culture of conservation** through custom workshops and energy treasure hunts.

On the global stage, Christian has participated in the United Nations (Department of Economic and Social Affairs) Expert Group Meeting on Climate Change where he presented a paper on Climate Change – The Role of Sustainability Indicators. He holds a Master's in Environment and Sustainability from Western University in London, and a Master's in Environment and Development from the University of Natal in South Africa.

Let’s kick things off!

Where are you currently in your net zero or low carbon planning?

On your phone or computer, go to **menti.com** and enter the code:

2152 8131

Or use the QR code:

Introduction and background

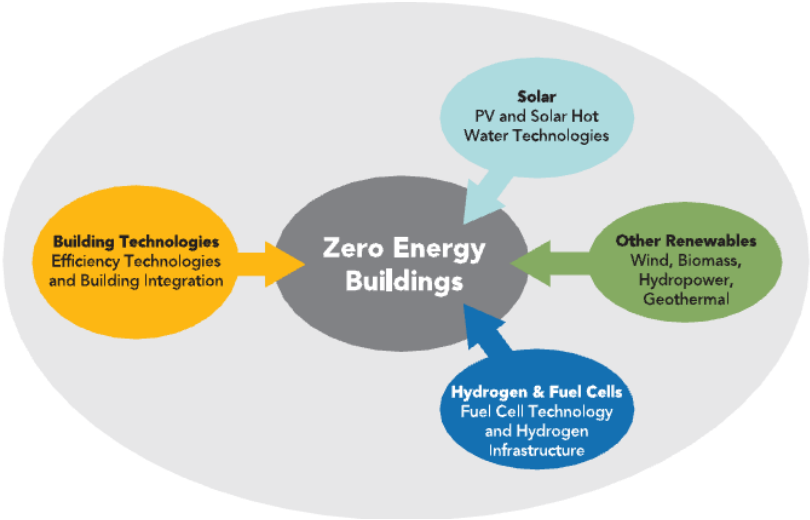
Definitions: net zero emissions

- The goal of removing carbon emissions to a level that can be absorbed by nature
- **Amount of emissions = to amount of absorption**
- Emissions from buildings, transportation, industry, etc.
- Excessive amount of carbon and other greenhouse gases (GHG) has a detrimental effect on the planet

Source: Global News 2018: https://globalnews.ca/news/4715549/zero-carbon-emissions/

Net zero energy in buildings

- A building that produces as much energy on-site as it consumes on an annual basis
- Buildings that balance their energy needs with energy produced from renewable zero emission sources
- Building efficiency and renewable energy (e.g. solar photovoltaic [PV], wind, geothermal) are crucial to obtain net zero energy



[Source: Hui, S. 2010. Zero energy and zero carbon buildings: myths & facts. In Proceedings of the International Conference on Intelligent Systems, Structures and Facilities (ISSF2010)]

Carbon neutrality

- Often this term is used interchangeably with net zero
- Introduced in 2005 and made popular by the United Nations Environment Programme - (UNEP)
- "A company's emissions are **offset** at an equivalent volume of certified carbon credits" – Science Based Targets initiative (SBTi)
- Carbon offsetting: sequestration – plant more trees, invest in projects that support carbon sink capture

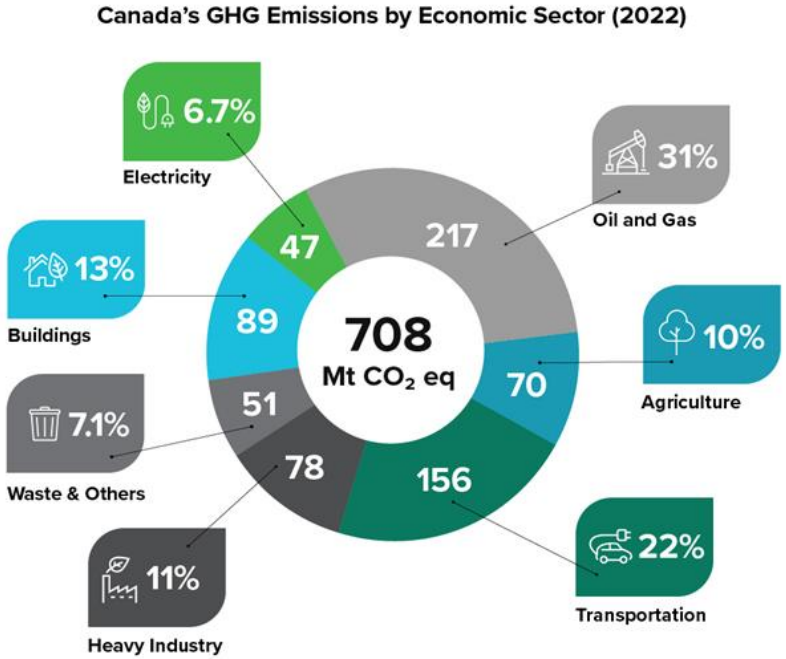
[Source: https://medium.com/carbonclick/carbon-neutrality-what-it-means-and-how-your-business-can-get-there-4e34ddd2cd53]

Legislative mandate – Net Zero Emission Accountability Act 2021

- Establishes accountability, transparency and framework for national efforts to achieve net zero
- Legislation supports the development of renewable energy technologies
- Invest in emerging technologies (e.g. geothermal, carbon capture technologies, etc.)
- Establish net zero advisory body to provide expert advice and support

[Source: https://laws-lois.justice.gc.ca/eng/acts/c-19.3/fulltext.html]

GHG emissions by sector



* National Inventory Report 1990-2022: Greenhouse Gas Sources and Sinks in Canada

Emissions type – Scope 1

Direct emissions from:

- Fuel burnt while running your boilers, gas/diesel in municipal vehicles, etc.
- Process emissions from wastewater treatment plants (WWTPs) (e.g. flaring of methane)
- Fugitive – unintentional release of gases/vapours (e.g. refrigerant leaks at arenas)
- Agriculture emissions from livestock and landfills

[Source: https://www.carpro.com/blog/aaa-traffic-deaths-increased-dramatically-during-pandemic]

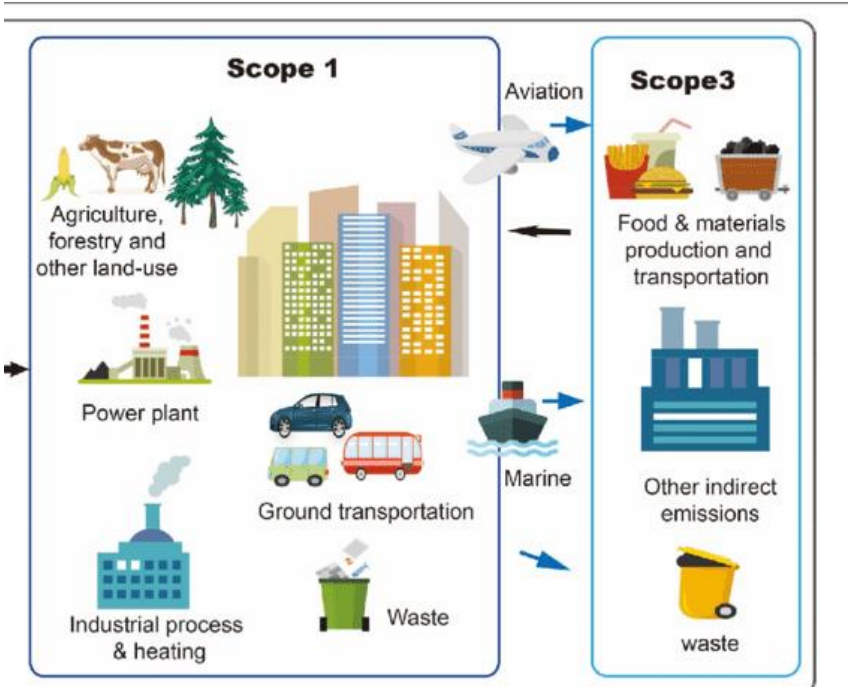
Emissions type – Scope 2

- Lighting, cooling and heating require electricity
- Emissions that are produced by burning fuels at a power station to provide electricity
- Coal, natural gas, etc.
- Categorized under the Greenhouse Gas Protocol
- Framework widely used for carbon accounting

[Source: https://ejfoundation.org/news-media/ejf-outlines-path-from-conflict-driving-fossil-fuels-to-a-sustainable-future-2]

Emissions type – Scope 3

- Indirect emissions from a company's value chain but are not produced by the company itself
  - Purchased goods and services: - emissions from buying and using products from suppliers
  - Transportation and distribution: emissions from transporting goods and services
  - Emissions from employee commuting
- Often represent an organization's total GHG emissions
- Leased assets ……. emissions from leased assets
- Difficult to track ……. very broad and vague



Source: J. Chen, 2020. Carbon Balance and Management 15 (1).

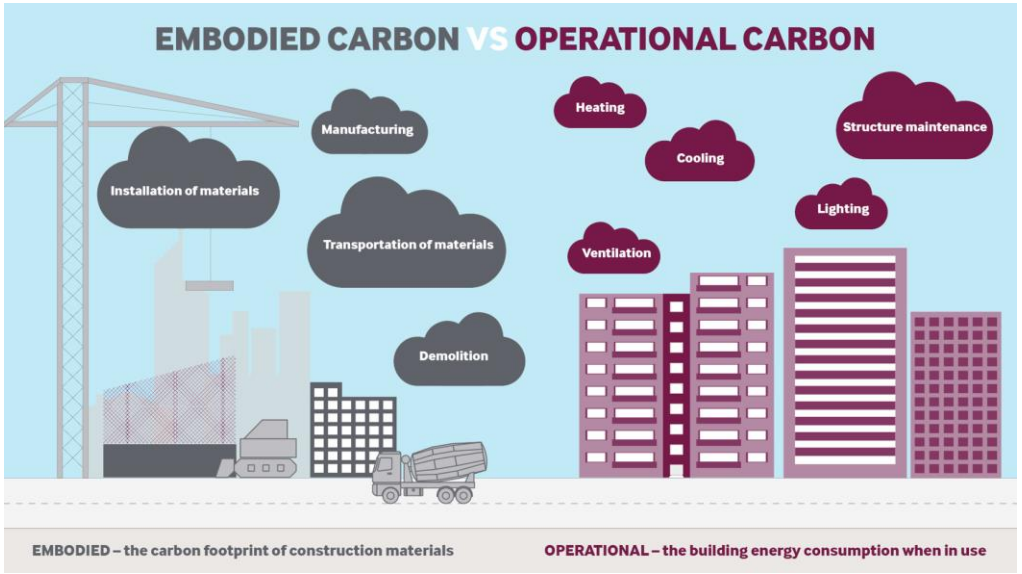
Embodied carbon – basic ideas

What is embodied carbon?

- The amount of carbon emissions during the construction of a building

- How do we account for it?

- https://www.caretool.org/



https://www.rpsgroup.com/services/environment/sustainability-and-climate-resilience/what-is-embodied-carbon/

Seven steps to net zero planning

Step 1: Dedicated staff

- Identify dedicated staff to champion courses on low carbon initiatives/net zero planning
- Undivided attention and focus
- Energy manager, environmental planner, sustainability manager, etc.
- IESO Energy Manager program

(Source: https://saveonenergy.ca/en/For-Business-and-Industry/Programs-and-incentives/Energy-Manager-Program)

Step 2: Team work and senior staff buy-in

Use an existing team or create a new team

Examples:

- Corporate energy management team
- Green team
- Net zero planning committee
- Involve senior staff and elected officials

"Coming together is beginning, staying together is progress, working together is success," – Henry Ford

Step 3: Plot your path to low carbon – the plan

- Asset management and renewal
  - New build or renovate
- Building condition assessment (BCA)
- Net zero planning studies
- Climate action plan
- Feasibility and specialist studies

"If you can measure it, you can improve it." – Lord Kelvin

Source: Christianse, K 2023: https://maintenanceworld.com/2023/05/09/how-to-navigate-the-facility-condition-assessment-industry/

Step 4: Consider and integrate all energy sources

- Conservation
- Energy efficiency
- Electrification
  - Geothermal/ground-source heat pump
  - Air-source heat pump
- Renewables
  - Solar PV
  - Biomass
  - Wind turbines

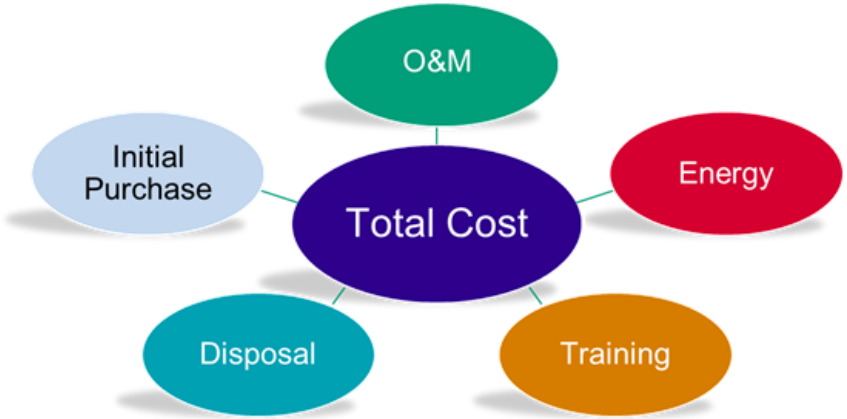
Source: Shukla, S. 2024:https://blog.feniceenergy.com/is-solar-energy-a-renewable-resource-find-out/

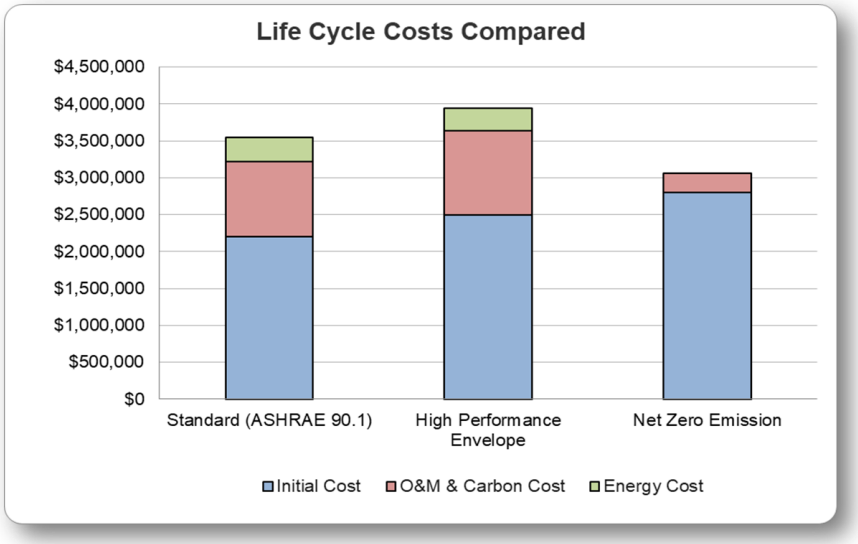
LCC – What does it entail? (Mentimeter)

- Total cost of ownership
- Initial cost is great (reasonable), but what are the other costs associated with ownership?

- What are some of the costs you can foresee with net zero planning?

Step 5: Lifecycle costing for financial justification





Step 6: Secure funding

- **Incremental improvements**
  - **Save on Energy** incentives
  - Enbridge (multi-residential and others)
- **Larger projects**
  - Federal – Net Zero Accelerator Initiative
  - FCM Green Municipal Fund
  - Scotiabank – Net-Zero Research Fund
  - Canadian Community-Build Fund

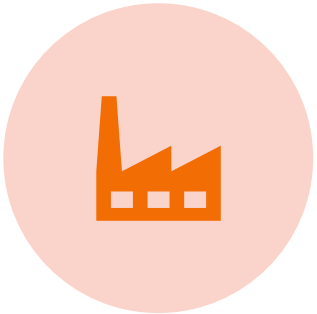
[Source: https://www.hubresearch.ca/10-things-you-need-to-know-about-cihrs-new-funding-schemes/]

Step 7: Plan to monitor and verify

Energy Monitoring and Verification

- GIVES DETAILED INFO ABOUT CONSUMPTION
- ACCURATE SETTING AND TRACKING OF ENERGY USE REDUCTION GOALS
- INFORMS PLANNING BASED ON REAL CONSUMPTION PATTERNS AND TRENDS

Some potential benefits



REDUCTION OF ORGANIZATION'S GHG EMISSIONS

REDUCTION OF COST OVER THE LIFE CYCLE OF THE FACILITY

OCCUPANCY COMFORT OF BUILDINGS

Attendee pain points/challenges (Mentimeter)

Of the seven steps presented, which do you think is the most difficult?

Municipal examples – low carbon and net zero planning initiatives

Town of Ajax net zero initiatives

https://www.ajax.ca/en/get-involved/environmental-sustainability.aspx

Corporate Net Zero Energy Plan (CNZEP)

The town is currently developing a comprehensive and actionable strategy that defines the pathway to achieve net zero by 2050 with a focus on:

- **Energy and emission reductions** - achieve net zero emissions through deep energy retrofits on existing assets and design and procure new assets that are net zero ready.
- **Cost management** - implement cost-effective solutions to reduce GHG emissions and enhance capital efficiency by ensuring the identified low carbon solutions are aligned with the regular capital renewal schedules
- **Enhance asset quality, comfort, health and resilience** - create an environment that is comfortable, healthy and resilient for all building users
- **Improve staff capacity – i**ncrease internal communication, awareness and staff capacity to allow better monitoring, planning, construction, retrofitting, operations and maintenance of net zero projects

Corporate Net Zero Energy Plan (CNZEP) continued

- To develop the CNZEP, ASHRAE Levels 2 and 3 energy audits have been conducted to identify net zero measures to replace aging high-carbon equipment in the town's top energy consuming buildings with new low-carbon equipment while increasing building resiliency through local energy generation

EnergyCAP CarbonHub – Corporate GHG dashboard

EnergyCAP CarbonHub is an online dashboard (Figure 1) that shows the Scope 1, 2 and 3 GHG emissions based on energy consumption from corporate operations.

Figure 1: An example of the dashboard in CarbonHub.

The implementation of CarbonHub is currently underway and has the **following benefits**:

- Provides a visualization of GHG emission impacts
- Helps in monitoring decarbonization targets
- Facilitates behavioural change among staff to conserve energy

Town of Caledon – low carbon HVAC retrofit

HVAC strategy

Engineering firm evaluated multiple retrofit scenarios, considering the energy, emission and cost impacts

Detailed design

Detailed design for heat pumps with gas auxiliary back-up heat for Rooftop Units (RTUs) 1-4 and all electric heat pumps for remaining units

Funding

Phased approach through capital budget. Applied for federal funding to help offset large electrical capacity upgrade

Measure and monitor

Upgrading building automation systems (BAS) concurrently

RETScreen Expert performance monitoring

Anticipated outcomes:

- Energy avoided: 1,868,046 ekWh
- Emissions: 71% compared to basecase or 357 tonnes of CO2
- Net operating costs: $33,067

Decarbonization pathways for town facilities

- Updating all BCAs and developing decarbonization pathways for all town-owned facilities
- Receiving ~$200,000 from FCM to conduct a net zero emissions assessment on eight priority buildings
- **Outcome:** Understand how our facilities can reach net zero emissions and use that knowledge to inform budget planning

A new build example

Coldstream net-zero energy fire hall

Net zero features

- 60 kW solar PV system
- 52 vertically drilled wells for geothermal heating and cooling
- Triple-pane windows
- Upgraded building envelope

Construction phase

Open discussion
Let's learn from each other

Ideas:

What are the next steps for your organization?

Do you have any recommendations to others regarding the process?

Can you share your experience about planning, senior-staff buy-in, funding, teamwork, etc.?

Multiple resources available

- **Find multiple types of resources on the SaveonEnergy website**: https://saveonenergy.ca/Training-and-Support

Webinars	**Fact sheets**	**Measurement and verification templates**	**Practical guides**

- **Sign up for one-on-one coaching:** Post-webinar support intake form

➢ Coaching sessions conducted virtually by phone, video calls and email

➢ Designed for organizations seeking guidance

Thanks for the opportunity to be of service!

“The help desk is now open!”

Christian Tham

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