

Green Economy North

INTRODUCTION TO CLIMATE SCIENCE



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Federal Economic Development
Agency for Northern Ontario

Agence fédérale de développement
économique pour le Nord de l'Ontario



Climate Science: Summary Note

1.0 Introduction

- 1.1 In this time of rapid change, reThink Green has compiled a summary note to guide you through the climate science you need to know to start your low-carbon journey!
- 1.2 This summary note will outline the meaning and importance of climate science, some legislation around climate change, the climate goals of our region, and some ways for you to get involved!

2.0 Climate Science: Background

- 2.1 To understand climate science, we need to start with the basics:
- 2.2 Climate is the usual weather patterns that a geographical area experiences.
- 2.3 Climate and weather are different, as climate is mostly seasonal and weather changes day by day. The weather changes quickly, usually within the outline of the climate.
- 2.4 Earth also has a climate, which is a combination of all the climates around the world.

What is Climate Change?

- 2.5 Climate change is the long-term shift of the expected climate in an area. The regular weather that an area's climate dictates will change and be increasingly unusual.
- 2.6 This change could look very different depending on the degree of temperature change, resulting in more or less rainfall, snow, and other extreme weather events. These changes are likely to have a significant impact on our world in the years to come.
- 2.7 The National Center for Environmental Information dives more into climate science [here](#).

What is Global Warming?

- 2.8 The Earth's temperature has now increased by approximately 1.1 to 1.2 Degrees Celsius, based upon pre-industrial temperature levels.
- 2.9 The increase began in the 1800s with the start of the Industrial Revolution; when humans began burning fossil fuels such as Coal, Oil and Gas. These are known to emit harmful Green House Gases (GHGs) into the atmosphere.
- 2.10 These GHGs, including Carbon Dioxide (CO₂), Methane and Nitrogen, add to the Earth's ozone layer. The thicker the ozone layer becomes; the more heat is trapped - thereby heating the Earth's climate.
- 2.11 The heating also has adverse effects on our human population and the natural world, including famine, floods, droughts, and wildfires, etc.

How do we determine our Carbon Footprint?

- 2.12 Carbon Dioxide is the most prevalent GHG. Recognizing this, Scientists have sought to standardize the way in which we measure all GHGs - to create a standard universal measurement. This is known as the Carbon Dioxide Equivalent (CO₂e) measurement.
- 2.13 Converting GHGs to a common unit allows scientists to bundle GHGs for data collection and climate modelling purposes. In this regard, those looking to calculate their Carbon Footprint should not only be familiar with their emission sources and scopes; but understand how potent each gas is, and its ability to trap heat. This is known as the Global Warming Potential (GWP) of a GHG.
- 2.14 In effect, the GWP provides a measurement of just how much warming a GHG is likely to cause during a period of time (i.e., over 100 years) in comparison to CO₂.
- 2.15 When calculating the CO₂e, quantities of GHGs are converted to the equivalent amount of CO₂ referencing their GWP and other important characteristics. The table below compares different GHGs and their Global Warming Potential (GWP).

	Greenhouse Gas	Global Warming Potential (GWP)
1.	Carbon dioxide (CO ₂)	1
2.	Methane (CH ₄)	25
3.	Nitrous oxide(N ₂ O)	298
4.	Hydrofluorocarbons (HFCs)	124 – 14,800
5.	Perfluorocarbons (PFCs)	7,390 – 12,200
6.	Sulfur hexafluoride (SF ₆)	22,800
7.	Nitrogen trifluoride (NF ₃) ³	17,200

Figure One: Retrieved from [ecometrica](#)

- 2.16 A unit of CO₂e can be calculated by multiplying the amount of the GHG in question and its GWP.
- 2.17 For example, if 1kg of Nitrous Oxide is emitted, it will be expressed as 298kg of CO₂ in terms of CO₂e. 1kg Nitrous Oxide X 298 (GWP) = 298kg CO₂e.
- 2.18 View this [document](#) for more definitions of common climate terms.

What is the Science telling us?

- 2.19 The United Nations (UN) reports annually on the global increase in temperature and its effects. You can view the link [here](#) for more information.
- 2.20 Scientists working as part of the International Panel on Climate Change (IPCC) have stated the need to limit the increase in our global annual average temperature to 1.5-Degrees Celsius, based upon pre-industrial levels, to avoid the worse effects of climate change.

- 2.21 They identify some key differences between keeping the world's temperature increase under 1.5 Degrees Celsius, and under 2 Degrees Celsius respectively.
- 2.22 According to the IPCC, the global rise in sea levels would be 10cm less with a warming of 1.5°C. They also predict Coral Reefs would decline by 70-90 percent with a 1.5°C increase, whereas almost all the Reefs (>99 percent) would be destroyed with a 2°C increase.
- 2.23 Remaining under a 1.5°C increase in the global annual average temperature will require persistent effort on behalf of all. As Debra Roberts, Co-Chair of the IPCC Working Group II said: *"The decisions we make today are critical in ensuring a safe and sustainable world for everyone, both now and in the future,"*
- 2.24 For more information on the IPCC Global Warming of 1.5°C Report, view the link [here](#).
- 2.25 Some predicted climate change impacts for Ontario, if current trends continue, include extreme weather events, health risks, increased energy demands, heat-related illnesses, and more frequent cardiovascular disorders due to reduced air quality.
- 2.26 The **Manitoulin Island Regional Energy and Emissions Plan**, published by reThink Green in January 2021 also outlines various scenarios, and predicts some of the impacts of our Changing Climate in a Northern Ontario Context. The plan can be viewed [here](#).

What can be done about it?

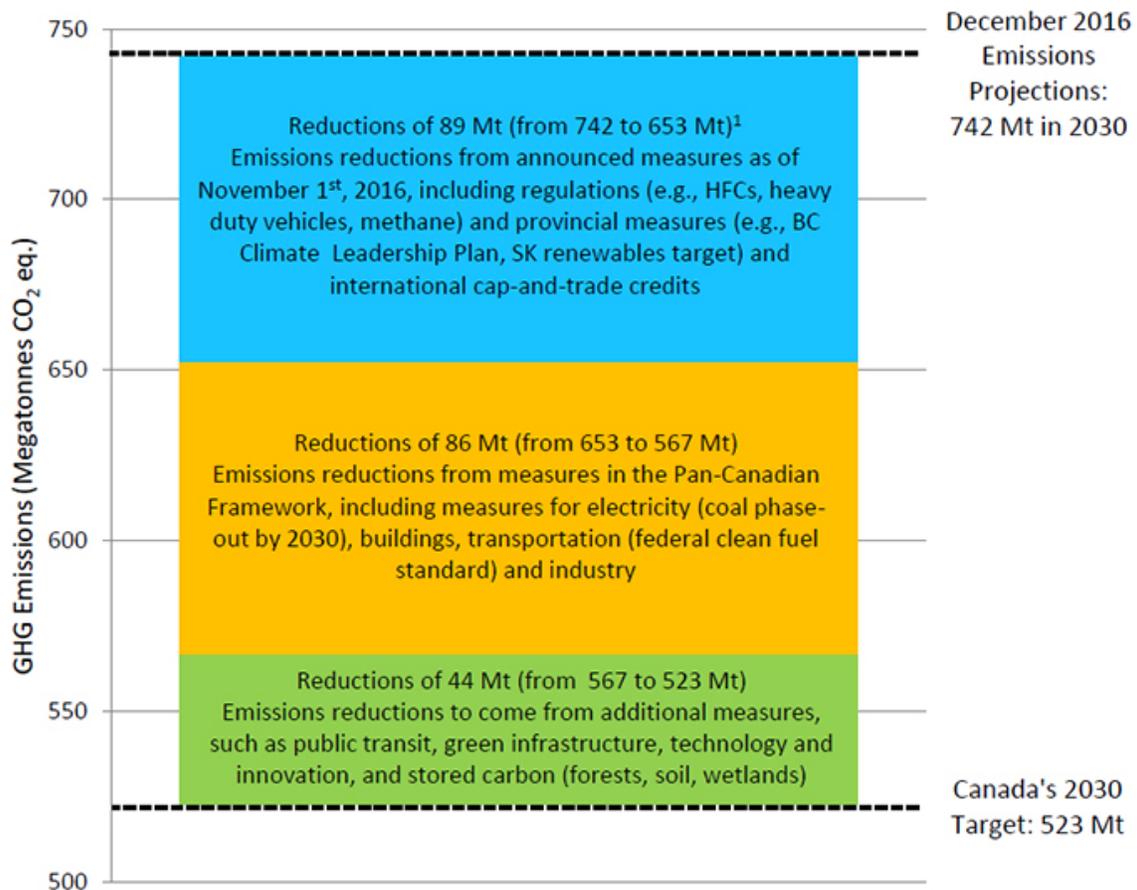
- 2.27 The good news is: many of the solutions we need already exist; however, various changes will be necessary including new legislation and policies that place greater emphasis on the need for Climate Action.
- 2.28 The response required will involve both mitigation and adaptation-led approaches to reduce our total emissions, and will involve a combination of technological, behavioural, and / or nature-based solutions.
- 2.29 The adoption of new low carbon development products, materials, and technologies will require sustained investment. There is not one set path to achieving net-zero emissions, but a combined and sustained effort can result in the changes needed.

3.0 Legislative Approach to Climate Change

What is being done to fight Climate Change?

- 3.1 Several important international agreements, and other national legislation, have been put into effect in recent times.
- 3.2 Arguably one of the most important agreements to be signed was the "Paris Agreement", forming part of the United Nations (UN) Climate Change Conference ([COP 21](#)).
- 3.3 The Paris Agreement is a legally binding international agreement, which brought together the vast majority of global nations in a common effort to combat climate change. It was signed by 196 parties (Countries) at COP21, on December 12, 2015.
- 3.4 The overarching goal of the Paris Agreement is to *"limit global warming to well below 2, and preferably to 1.5 degrees Celsius, compared to pre-industrial levels"*.

- 3.5 The Paris Agreement introduced a 5-year review cycle, which required signature countries to prepare and submit their first plan for climate action in 2020. Those plans are referred to as Nationally Determined Contributions (NDCs).
- 3.6 As a general rule, NDCs must include a detailed summary of the activities that Countries plan on pursuing to reduce their Total GHGs (across different sectors). They should also identify the actions Countries will take to ensure increased resilience - as we adapt to our changing climate.
- 3.7 One of Canada's goals includes the phasing out of coal by the end of 2030. If you want to learn more about Canada's NDCs please refer to the web page [here](#).
- 3.8 Canada has also stated its intention to achieve an annual emissions target of 523 Megatonnes (Mt) in 2030, compared to the 731 Megatonnes recorded in 2020. The following figure summarizes Canada's plan to reach its 2030 goal. For more information refer to the link [here](#).



Note: Reductions from carbon pricing are built into the different elements depending on whether they are implemented, announced, or included in the Pan-Canadian Framework. The path forward on pricing will be determined by the review to be completed by early 2022.

¹ Estimates assume purchase of carbon allowances (credits) from California by regulated entities under Quebec and Ontario's cap-and-trade system that are or will be linked through the Western Climate Initiative.

Figure Two: Retrieved from the [Government of Canada](#)

- 3.9 The Paris Agreement also encouraged countries to determine Long-Term Low Emission Development Strategies (LT-LEDS). These are the longer-term version of NDCs. Refer to the link [here](#), if you'd like more information on Canada's LT-LEDS.
- 3.10 Under the Pan-Canadian Framework on Clean Growth and Climate Change; Canada also committed to reducing its Total GHG emissions by 30% below 2005 levels by 2030 and beginning work so Canada can achieve net-zero emissions by 2050.
- 3.11 These targets were further strengthened ahead of the Glasgow Summit (COP26) held in 2021; when Canada made a revised pledge to **'cut emissions by at least 40-45% below 2005 levels by 2030'**.
- 3.12 The 'Climate Action Tracker' is a tool which has been developed to monitor the progress being made by various Governments and Countries around the world. The following link provides a snapshot of how Canada is performing:
<https://climateactiontracker.org/countries/canada>
- 3.13 Recognizing that climate finance is essential for the mitigation and adaptation of climate risks, the Paris Agreement also encouraged developed countries to provide financial assistance to more vulnerable Countries.
- 3.14 This ambition was finally realized at the most recent COP27 held In Sharm El Sheikh, Egypt (in December 2022), when developed Countries agreed to develop a mechanism through which lower income / developing Countries will be able to access funding to support their transition and adaptation to the predicted effects of climate change.
- 3.15 The Paris Agreement also stated a vision of realizing a technology development and transfer mechanism; to ensure the widespread use of climate-resilient technology between nations.
- 3.16 The Agreement also stated that developing and developed countries should seek to enhance their climate-related capacity-building; to ensure appropriate training, skills, and resources as Countries set about making this transition.
- 3.17 Finally, the Paris Agreement established the Enhanced Transparency Framework (ETF), which, starting in 2024, will require countries to demonstrate greater transparency through reporting on progress made on a more frequent basis.
- 3.16 The Paris Agreement has already had some successes, spearheading the creation and expansion of various low-carbon solutions and markets.
- 3.17 More and more, countries, regions, and cities have been declaring carbon neutrality targets, and zero-carbon solutions such as renewable technologies are now becoming increasingly competitive with Fossil Fuel.
- 3.18 For further information on the Paris Agreement visit this link [here](#).
- 3.19 Given this urgent need for change, the United Nations has declared the 2020s the "Decade of Action". You can view more information on the UN's Decade of Action [here](#).

4.0 Regional Perspective

- 4.1 Most regions and communities across Canada have now, to varying degrees, sought to establish low-carbon goals, emission reduction targets, or other declarations - to demonstrate their commitment to Sustainability.
- 4.2 The City of Greater Sudbury has created a **Community Energy and Emissions Plan (CEEP)**. The CEEP is Sudbury's *"long-term plan to reduce carbon emissions and pollution in Greater Sudbury"*. You can view the CEEP report [here](#).
- 4.3 In producing the CEEP, the City of Greater Sudbury pursued Four Steps, which are summarized as follows:
 1. To understand current and predicted energy emissions.
 2. To list various activities, and the actions currently taking place.
 3. To explore various emission reduction scenarios; and
 4. To produce a framework which supports climate action moving forward.
- 4.4 The CEEP applied a baseline emissions count from 2016. This will be the year that will be used to cross-check emission reports for status updates and improvements moving forward.
- 4.5 The CEEP also looked far into the future, including research on the City's total energy demands, predicted demographic changes, anticipated energy production and use, plus information regarding major sources of emissions.
- 4.6 The CEEP analyzed various steps and goals moving forward, including in the near-term (within 5-years); in the medium-term (within 5 to 10 years); and in the longer-term (within 10 to 15 years and beyond).
- 4.6 The CEEP also outlined *"Strategy Sectors"* which are sectors of the community that have common climate goals, such as Water, Wastewater and Solid Waste, Efficient Buildings, and more. Each of these sectors has specific goals and timelines.
- 4.7 The CEEP mentions that *"approximately 70% of global emissions are under the direct or indirect control or influence of municipal governments"*.
- 4.8 It establishes 18 sustainability goals. Two of which, are summarized as follows:
 1. **Creating compact communities through infill development and decreasing dwelling sizes.**
To go about this Sudbury will coordinate with its Executive Leadership Team, the Growth and Infrastructure Department, and the Transit Services Division.
 2. **Increasing the energy efficiency and performance of new buildings**
All new residential buildings, from 2030 onward, will be expected to be Passive House Energy-compliant. To achieve this goal, Sudbury will create a new *'Greater Sudbury Green Standard'* which enhances its energy efficiency requirements.

4.9 The image below shows the volume of emissions proposed to be reduced by each goal within the CEEP.

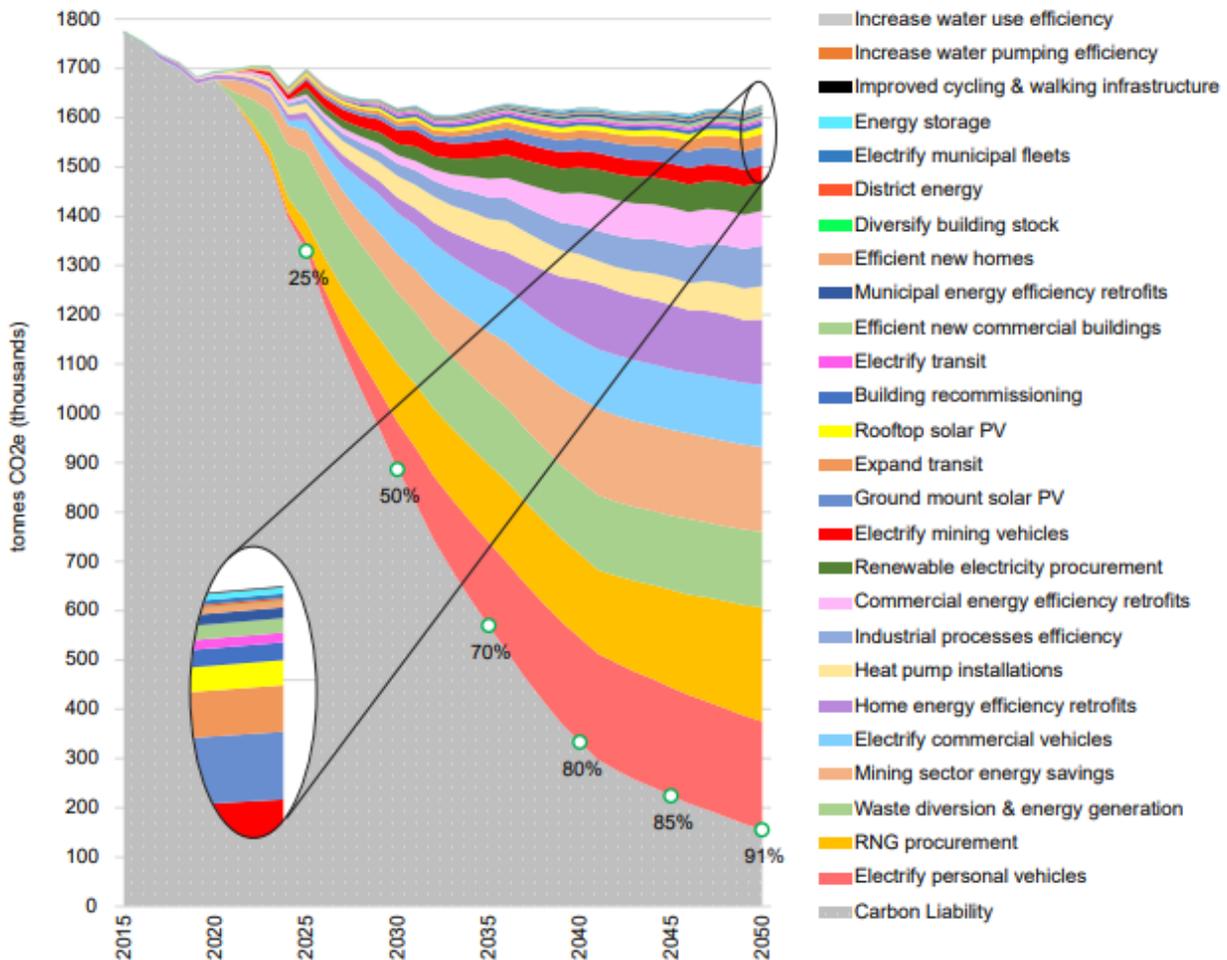


Figure Three: Retrieved from the [Community Energy & Emissions Plan](#)

4.10 As seen above, many of these goals will not reduce emissions right away, but it is important that we start to implement the goals and solutions immediately; so, we can see improvements by 2030, 2040 and 2050 respectively.

5.0 Opportunities to get involved in the Green Economy

5.1 There are many potential opportunities for you to get involved, and support the development of our Green Economy, whether as an individual, household, community, business, or publicly funded organization.

5.2 Businesses and Organizations interested in learning more about their Carbon Footprint, and taking action to reduce your total energy consumption, emissions, and associated costs; are invited to join our growing National Network of [Green Economy Leaders](#) led by Green Economy Canada.

- 5.3 To join our Regional Hub, please visit the [Green Economy North](#) webpage and complete the **Membership Inquiry Form**.
- 5.4 As a member of our Green Economy North program, you'll be guided through our tried-and tested milestone process, bringing you closer to your low-carbon, or sustainability goals.
- 5.5 The milestone process involves 4 Steps, as follows:
- **Milestone 1:** Getting Engaged.
 - **Milestone 2:** Measure your Footprint.
 - **Milestone 3:** Set a Target.
 - **Milestone 4:** Achieve Results.
- 5.6 As a program member you will also be able to access a range of grants and other program incentives to help you start your low-carbon journey. Green Economy North and reThink Green also host many events for networking and education purposes.
- 5.7 Check out our website at www.rethinkgreen.ca for further details.