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CLIMATE CHANGE
IMPACTS & STRATEGIES

Plans & Scenarios for a Sustainable Future

August 2022

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The Threat of Climate Change

What Climate Change is and what it means for the 21st century

The Problem

The problem of climate change is actually quite simple. **The human race is currently highly dependent on fossil fuels, such as coal, oil, and natural gas, to heat our buildings, transport people and goods, manufacture things, and generate electricity** [1]. Burning fossil fuels releases greenhouse gasses into the atmosphere. Greenhouse gasses, such as carbon dioxide, methane, and carbon monoxide, trap additional radiation from the sun on Earth, warming the planet [2].

The greenhouse effect is not inherently bad. We need some greenhouse gasses in the atmosphere for Earth to be habitable. However, the more we burn fossil fuels, the more hazardous the greenhouse effect becomes, irreversibly changing Earth's climate.

To prevent a dangerously warm planet, **we need to stop burning fossil fuels**.

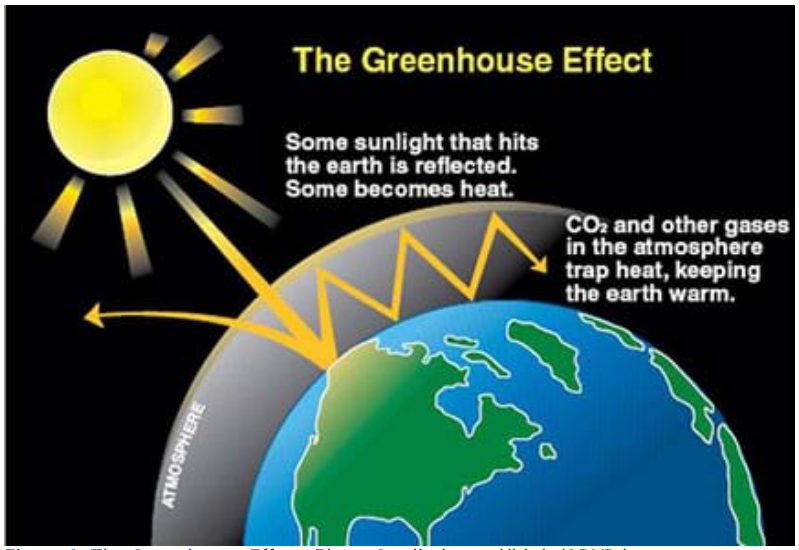


Figure 1: The Greenhouse Effect. Photo Credit: https://bit.ly/3DYIzby

The Threats

Global Rise in Temperature

Global temperatures are currently expected to rise between 1.8 and 3.5 degrees Celsius by 2100 compared to pre-industrial levels [3][4]. That may not sound like much, but even a small amount of warming can effect the Earth's climate.

Global Changes in Precipitation

Rising temperatures will effect rainfall and snowfall around the world [5]. Dry regions will experience harsher droughts, and wet regions will experience more rainfall and flooding.

Increasingly Damaging Storms

Rising temperatures will cause stronger hurricanes, more widespread wildfires, and more severe storms in general.

Rising Sea Levels

Sea levels are expected to rise between 0.2 and 2 meters by 2100 [6]. The amount of sea level rise will vary along Canada's coasts and could continue until 2500, depending on how quickly emissions are reduced [7].

Harms to People, Businesses, and Institutions

Rising temperatures, changing rainfall, severe storms, and rising sea levels will affect us. Climate change will affect our coastal cities, global food production, and global freshwater availability. Climate change will impact global trade, and pose serious risk for governments and institutions due to potential instability.

The Threat of Climate Change

What Climate Change is and means for the world

Is Climate Change Unstoppable? Is it hopeless? Is humanity doomed?

No.*

* While climate change is best understood as an urgent crisis, it is not certain doom or a lost cause [8]. There are multiple scenarios about how climate change could play out this century, ranging from a best-case scenario where we aggressively limit climate change and its effects, to scenarios of flat or increasing greenhouse emissions this century with increasingly hazardous climate change [9].

The most critical thing to discuss now is what actions businesses, governments, and individuals can take to get to the best possible scenario, a future that is prepared for and responds quickly to climate change.

There are two key elements to solving the problem of climate change. First, there is mitigation of climate change; second, there is adaptation to climate change.

Mitigating and Adapting to Climate Change

Adapting to and Mitigating Climate Change

So how do we prevent climate change from getting worse? Adaptation and Mitigation.

What is Mitigation?

Mitigation is the umbrella term for anything that prevents further climate change by reducing our greenhouse gas emissions. It means anything that prevents or replaces the burning of fossil fuels, makes our society more energy efficient, or generally prevents worsening climate change.

Examples include renewable energy, electrifying manufacturing, enhanced public transport, and zoning for mixed-used, higher density cities. Mitigation strategies and efforts can be anything from international to local.

What is Adaptation?

Adaptation is the umbrella term for anything that helps people adapt to ongoing changes in climate, as well as expected changes. It means anything that helps people withstand a changing climate, resource scarcity, or climate hazards/storm events.

Examples include urban planning, irrigation and water conservation, shoreline maintenance, and nature-based solutions. Adaptation is highly localized to the community undertaking it, although funding adaptation is an international responsibility.

Adapting to and Mitigating Climate Change

Is it possible to Adapt to and Mitigate climate change at the same time?

Yes! I like the way you think!

It is a common mistake to view adaptation and mitigation as entirely separate. There are solutions to climate change that can mitigate our greenhouse gas emissions while helping us adapt to a changing climate, while creating opportunities and improving the quality of life around the world.

Adaptive measures like reforestation, forest protection, and wetland preservation can both mitigate (capture and store greenhouse gasses) and adapt (shade and local cooling effect) to climate change. Meanwhile, efforts like improved public transit can reduce emissions and offer safe and temperature controlled transportation for commuters. So yes, it is possible to implement measures that do both.

For decades, it was assumed that mitigating and adapting to climate change would cause economic harm. This has been proven to be a false dichotomy, as it is possible to decarbonize, adapt to climate change, and have a growing economy.

It makes the most sense now to grow the economy by decarbonizing to improve industries and prevent worstening climate change.

Industry Impacts

How businesses are responding to climate change

How Businesses are Mitigating Climate Change

- Electrification of vehicles
- Improving energy efficiency
- Increasing renewable energy capacity
- Net-zero housing and building retrofits
- Sourcing minerals for green technology
- Investment in green technology
- Carbon offsets
- Carbon capture and storage
- Divesting from fossil fuels

How Businesses are Adapting to Climate Change

- Reinforcing and improving existing infrastructure to withstand climate change hazards
- Making buildings more efficient in power and water usage
- Studying and sharing climate data and trends
- Collaboration with communities and governments on local, national, and international levels.
- Investment in adaptive technology
- Educating the public about climate change and adaptation strategies

Industry Impacts

Considerations for Canadian Industries

How will climate change affect Canadian industries?

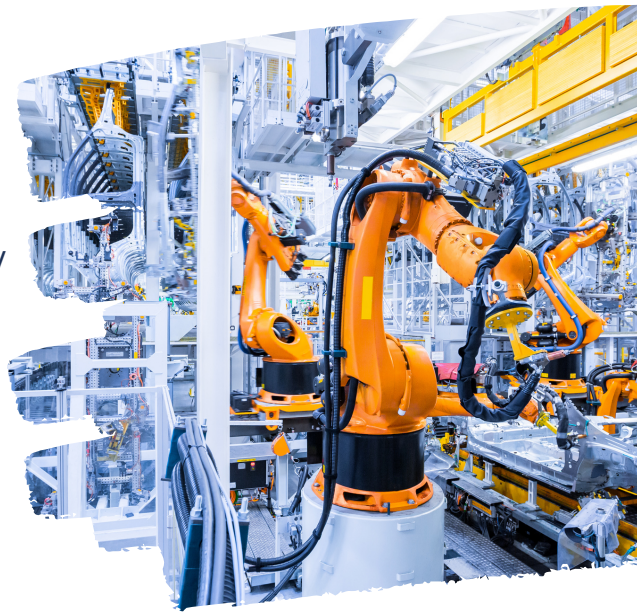
Effects on the Insurance Industry

Climate change creates new risks for insurers. Increasing number of hot days per year, increasing and stronger storm events, and changing rainfall affects the security and longevity of homes, infrastructure, and communities. Assessing climate change as part of the risk assessment process will be critical to the insurance industry [10]. Climate risk management will become critical throughout the 21st century.

Effects on Investment Management

Some investors are being pressured to divest from fossil fuel intensive industries and to invest in renewable or non-emitting new technological developments. As of 2022, Approximately 10% of all investment companies are shifting their focus to climate-sensitive investments [11].

Much like the insurance industry, standards of climate change risk management should become common practice for assessing if investments in fossil fuel-dependent or climate-sensitive industries are viable long-term. For example, if fossil fuels are irrelevant by 2050, the value of contemporary energy companies is based on stranded assets [12].



Effects on Manufacturing

The transition to net-zero emissions will affect what energy sources and materials are available in the manufacturing process. Fossil-fuel intensive products like steel and concrete will have to be re-engineered or replaced.

Electrification of personal vehicles, construction equipment, and transport equipment will reduce the number of components used, reduce the labour requirements to build, and will increase costs in the short-term until widespread adoption.

Industry Impacts

Considerations for Canadian Industries

How will climate change effect Canadian industries?

Effects on Supply Chains

The 2020s have thus far been a period of crisis for supply chains as the COVID-19 pandemic, unprecedented demand for goods, and rising costs have caused global disruption. Climate change is set to create further disruption, with a rise in extreme climate events and storms expected to be a further destabilizing force that will cause shipping delays and seasonal variability to the dependability of international shipping [13].

Effects on Agriculture

Effects of climate change on the agricultural sector will vary wildly across Canada. Northern regions, which currently have an unfavorable growing season, could become more hospitable for agriculture overall, although soil quality in the Northern regions is a potential concern. Meanwhile, the prairies could face debilitating droughts later this century, requiring adaptation measures or shifts to warm weather crops [14].

Effects on Oil & Gas Production

The long-term prognosis for Canada's oil and gas sector is grim. For while oil is immensely profitable in 2022 amidst sanctions on Russia and increasing demand rebounding from the worst of the COVID-19 pandemic, long-term demand is expected to gradually decrease with the electrification of transportation and the decline of the internal combustion engine [15]. While the current surges in oil and energy prices can be seen as a temporary boost, this volatility is likely to have long-term negative consequences.

Policymakers' Responses

How are elected leaders responding to climate change?

International

The Paris Agreement and COP26

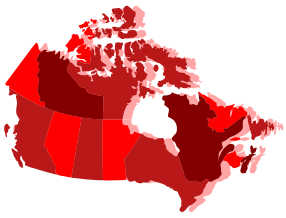
The 2015 Paris Agreement is an international treaty that asks participating countries to reach net-zero emissions by 2050, reduce emissions by half by 2030, and help fund emissions reduction and adaptation for developing countries [16].
The 26th Conference of the Parties (COP26), an international conference on climate change, noted current pledges are not in line with limiting warming to 1.5 degrees Celsius. However, new efforts and pledges are constantly being created, including a pledge on ending deforestation, phasing down coal, and cutting methane emissions [17].

Federal

The 2030 Emission Reduction Plan and *Net-Zero 2050*

Canada's federal government has a legally-binding commitment to reduce Canada's emissions to net-zero by 2050 [18]. Reaching net-zero will mean eliminating 90% of Canada's emissions with some means of carbon storage [19].
Meanwhile, an interim goal of reducing emissions by 40-45% by 2030 was recently announced by the federal government [20], that promotes zero-emissions vehicles, renewable energy, carbon capture and storage, and home retrofit programs [21].

Provincial



A Range of Responses on Climate Change

Canada's provinces vary wildly in their approaches to climate change. Ontario currently has very limited and vague climate goals that will have minimal impact on emissions. Ontario does not have concrete plans for emissions reductions or roadmaps for achieving net-zero or a substantial reduction by 2030 [22].
Other provinces, such as Nova Scotia and British Columbia, have more ambitious and concrete goals for net-zero by 2050, with higher standards for emissions reporting [23].

Local

Municipal Net-Zero Plans & Pledges

Municipalities of all sizes across Canada have made plans and pledges to reach net-zero emissions by 2050, with interim goals in the 2030s and 2040s [24][25][26].

Criteria for a Net-Zero Future

What Canada and the world will need for a prosperous future

Increased Electricity Production:

- The electrification of fossil fuel dependent industries and transportation will coincide with an enormous increase in overall energy consumption this century.
- Canada will need to double or perhaps even triple its supply of renewable energy to have enough energy for electric vehicles, heating, and manufacturing by 2050 [27].

Batteries and Smart Grids:

- While renewable energy has the power to be transformative, a shift to renewables is going to require battery storage and smart grids to distribute energy when the sun and wind aren't generating enough power to meet demand. Improving battery technology and incorporating smart technology to monitor grids will be essential to an emissions free future.

Rare Earth Metals:

- Lithium and nickel are expected to be increasingly valuable from the 2020s to the 2040s, with demand to increase exponentially over the next decade [28]. Cobalt will be increasingly in demand this decade, although it is expected to taper off in the 2030s [29].

Non-Emitting Transportation:

- Net-zero transportation goes far beyond electric personal vehicles. While that is an excellent start, a net-zero transportation sector also means electric public transport, hydrogen heavy-duty vehicles, nuclear-powered industrial shipping, and the decarbonization of all air travel.

Net-zero Buildings

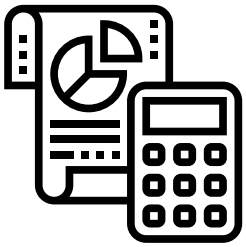
- New construction in Canada will be required to meet new standards where heating and powering homes is entirely electric, with airtight building envelopes to improve energy efficiency.
- Fossil-fuel intensive materials, such as concrete and steel, will have to be reengineered, minimized, or created with carbon capture as part of the industrial process.

Climate Strategies and Innovations

The threat of climate change is inspiring a global wave of new thinking and innovation to prevent dangerous climate change. Some of the most exciting innovations include:

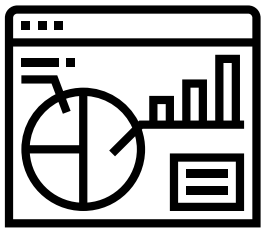
Carbon Accounting

Keeping track of, monitoring, and reducing greenhouse gasses is essential to reaching net-zero. Businesses can easily find and use the tools to calculate and monitor their scope 1, 2, and 3 emissions to gradually reach net-zero.



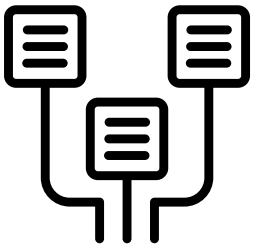
Climate Data Analysis

Enormous quantities of climate data can be found in academic, government, and citizen collections. This data can reveal climate trends, recent disruptions, and changes on a global, regional, or local level. Analyzing climate data can help organizations prepare for a new climate.



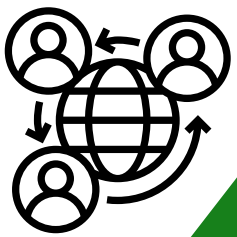
Climate Scenario Planning

Developing long-term scenarios for the global climate, and creating pathways to each scenario can plan for a variety of climate outcomes to ensure the stability and success of businesses and organizations facing an uncertain future.



Climate Mainstreaming

Rather than considering climate change as a standalone issue, incorporating it into business, development, and governance strategies can strengthen mitigation and adaptation efforts while accomplishing other long-term goals.



Additional Information

What isn't talked about when we talk about climate change

While people are talking about climate change more than ever, there are still difficult questions for us to collectively work through:

Q. People talk about 2050 a lot when talking about climate change impacts. Does that mean by 2050, climate change will be over?

No, climate change will continue to be a concern for hundreds of years, perhaps into the 2300s or 2500s, especially concerning sea-level rise [30]. However, long-term severe climate damage can be limited if greenhouse gas emissions are reduced to net-zero by 2050 with interim 2030 and 2040 targets.

Q. Are some parts of the world immune to climate change?

No, climate change is a global phenomenon. The impacts and effects of climate change will not be evenly distributed around the world, with some locations seeing mild temperature increases or changes in rainfall, while others will experience extreme rises in temperature and changes in storm strength, and precipitation [31], even in low-emissions scenarios.

Q. What will climate change mean for poor and developing countries?

Climate change will disproportionally harm people in developing countries [31a]. Impoverished and developing countries are not as well equipped to handle the damage and impact of increasingly powerful storms, find alternative food sources during drought, or fund adaptation measures to improve their capacity to manage climate change. *The Paris Agreement* calls for assistance to developing countries, which developed countries must provide [32].

Q. Is climate change affecting people's mental health and wellbeing?

Yes, climate change is a mental-health problem as well. Anxiety, grief, and guilt about climate change are common, especially in younger people [33].

Q. Will anyone benefit from climate change?

While the vast majority of climate change effects will be negative, there will be some minor benefits in some parts of the world. Some regions with limited growing seasons will see greater opportunities for agriculture, for example. But this is the exception rather than the rule.

Questions?

If you have questions about anything in this report, please contact me.

Whether you are a concerned citizen, an activist, a business leader, a member of a non-profit climate organization, or are just generally interested in talking about or learning more about climate change, feel free to reach out to me! I'd be delighted to hear from you and to hear more about your perspective on our changing climate, the challenges we're facing, and potential solutions.

Contact Info:

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