University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Carbon neutrality should not be the ultimate goal: finding a 1.5°C aligned target for UBC's fair share

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EXECUTIVE SUMMARY

Strong and urgent action to reduce greenhouse gas (GHG) emissions is needed to avoid the detrimental effects of climate change. To curb climate change and limit global warming to 1.5°C, IPCC (2018) requires an emissions reduction of 45% below 2010 levels by 2030 in global net anthropogenic GHG emissions. The federal government of Canada, the province of British Columbia, the City of Vancouver, and the University of British Columbia (UBC) have set a number of GHG emissions reduction targets. However, since Canada is both historically and currently a high GHG emitter, a 45% reduction may not be considered appropriate when factoring in climate justice and common but differentiated responsibilities (CBDR) frameworks. Within Canada, UBC plays an important role in researching and developing climate initiatives due to its commitment to aligning with the Paris Agreement's goal of limiting global warming to 1.5°C and its global leadership in sustainability. Moreover, with the ability to better leverage bold climate policies quickly, UBC have a climate emergency responsibility to help compensate for Canadian jurisdictions that struggle to reduce emissions. Hence, it is important for UBC to call for a justice-based emissions reduction target that is far more ambitious than both IPCC's 45% global average emissions reduction target and Canadian national targets.

After reviewing literature on CBDR and subnational actions, and acknowledging UBC's commitments to climate justice, I recommend UBC's GHG emissions reduction target to be in the range of 80-100% by 2025, and in excess of 100% by 2030 below 2007 levels, as UBC not only has a relatively high financial and technical capacity but also plays an important role as subnational actor, property owner, employer, education and research hub, as well as the leader of societal transformation. Moreover, it is the best platform to research and promote ambitious and innovative climate actions, as well as to affect broader scale policy decisions in the future if successful. Furthermore, since the purpose of UBC - an academic institution - is not to maximize profits, it can take time and risks to research and implement an aggressive emissions reduction target to build environmental awareness and assess a variety of climate change risks on campus. Apart from that, pressures from other stakeholders and peer universities may also require UBC to implement an aggressive emissions reduction target timely to address the impacts of climate change and stay on track with the goal of limiting global warming to 1.5°C. After all, select an emissions reduction target that exceeds the IPCC's global average targets would not only demonstrate UBC's global leadership in climate awareness and sustainability but also address climate-related risks and opportunities that would help to make campus-wide cohesive financial and operational decisions.

This project underscores why Canada, and therefore UBC, need to set more aggressive emissions reduction targets that exceed the IPCC's global-average targets due to their relatively high financial and technological capacities. In addition, this project seeks to identify deontology, solidarity, and consequentialism in CBDR and climate justice as principles that could serve as a basis for the argument and rationale to test if Canada and UBC's commitments align with the international agreement, and to provide a clear vision and direction for UBC to move on the future climate action pathway. Synthesized results of legal frameworks (CBDR and climate justice) and numerical assessment (emissions data and carbon price) from other literature will be discussed to further give specific recommendations at the university level.

This project also acknowledges that internal carbon pricing provides a unique opportunity for UBC to demonstrate climate leadership and drive energy innovations. While implementing and selecting a carbon price can be complicated and time-consuming, it is important for UBC to seriously address and respond to the challenge of climate change and engage all members of the university in these issues. Moving forward, in order to achieve the target of CAP2030 and contribute to limit global warming to 1.5°C, UBC needs to adopt tools that account for the full scope of direct and indirect emissions, select and implement the a right carbon price on campus that exceeds the most recent federal carbon tax of $170/ tCO^2e by 2030, and take more efforts to get students and the university staff to be environmentally conscious and shift towards more sustainable behaviours.

Moving forward, it is critical for UBC's future climate actions to include effective campus planning and integrated university policies that direct regulations and investment to enable innovations for deep decarbonization or even net-negative emissions pathways. Furthermore, future UBC's projects will require more ambitious policies targeting the decarbonization of both supply and demand side of energy-economy systems to switch energy use and improve energy efficiency, as well as recognize the significant role CO^2 removal played in reaching the net negative emissions in the next half-century.

MAIN TAKE AWAY:

RECOMMENDED EMISSIONS REDUCTION TARGET BEING PUT FORTH HERE FOR UBC:

After reviewing literature on CBDR and subnational actions, and acknowledging UBC's commitments to climate justice, I recommend UBC's GHG emissions reduction target to be in the range of 80-100% by 2025, and in excess of 100% by 2030 below 2007 levels.

WHY IS THE TARGET NECESSARY:

- UBC not only has a relatively high financial and technical capacity but also plays an important role as subnational actor, property owner, employer, education and research hub, as well as the leader of societal transformation
- UBC is the best platform to research and promote ambitious and innovative climate actions, as well as to affect broader scale policy decisions in the future if successful
- Since the purpose of UBC is not to maximize profits, it can take time and risks to research and implement an aggressive emissions reduction target to build environmental awareness and assess a variety of climate change risks on campus
- Pressures from stakeholders and peer universities may also require UBC to implement an aggressive emissions reduction target timely to address the impacts of climate change and stay on track with the goal of limiting global warming to 1.5°C
- Select an emissions reduction target that exceeds the IPCC's global average targets would not only demonstrate UBC's global leadership in climate awareness and sustainability but also address climate-related risks and

opportunities that would help to make campus-wide cohesive financial and operational decisions

RECOMMENDATIONS:

- Select a carbon price based on UBC's values and priorities
- Select an escalating carbon price system to allow a lower and less disruptive starting price as well as to adjust the inflation problem
- Facilitate knowledge-sharing among peers, stakeholders, and government officials
- Emphasize the risks of climate change to university operation
- Advance carbon price discussion and engage in developing climate policy
- Support student activism and endorse public campaigns
- Reduce meat consumption on campus through transitions towards plant-based catering menus
- Replace greenhouse produce with field-grown produce (university food procurement)
- Collaborate with food vendors on campus to work towards minimize waste to demonstrate leadership in the area
- Conduct qualitative research on GHG emissions from different stages of food system cycle such as food processing, food packaging, and food waste

CONTENTS

Executive Summary....1
Main take away:....2
Recommended emissions reduction target being put forth here for UBC:....2
Why is the target necessary:....2
Recommendations:....3
List of Figures....5
1. Introduction....0
2. literature review....1
2.1 What is common but differentiated responsibilities (CBDR)?....1
2.2 what is the importance of polycentric governance and subnational actors?....2
2.3 what is climate justice?....3
2.4 Why does canada need to achieve a more aggressive ghg emission reduction?....4
3. Finding a 1.5°C target for ubc's fair share....5
3.1 National context: canada's fair share....5
3.2 provincial context: bc's fair share....7
3.3 Municipal context: vancouver's fair share....8
3.4 Local context: ubc's fair share....9
4. UBC's responsibility and future target....10
5. Recommendations....11
5.1 Supply side mitigation (scope 2 regulation and energy transition)....11
5.1.1 Establish a more credible and robust transparency system....11
5.1.2 Foster a strong horizontal and vertical alignment for subnational climate actions....12
5.1.3 IMPLEMENT INTERNAL CARBON PRICING AND DEVELOP A RIGHT CARBON PRICE....12
5.14 Why should UBC set a right carbon price to achieve CAP 2030 goal?....15
5.2 DEMAND SIDE MITIGATION (SCOPE 3 BEHAVIORAL CHANGES)....19
5.21 Implement effective food polices and develop strong partnerships with food vendors....19
5.3 Moving forward to net negative emissions: the role of CO^2 removal (CDR)....19
6. Conclusion and future implication for ubc....20
References....21

LIST OF FIGURES

Figure 1 Canada's summary data of historical GHG emissions and current pathways from year 1990 to year (climate action tracker.org. 2020).....5

Figure 2 Canadian emission pathways and projections of emissions reductions needed for limiting global warming to 1.5°C, 2°C, 3°C, and 4°C (Donner, 2019). 6

Figure 3 Total GHG emissions of BC since 1990 to 2018 (Environmental Reporting BC, 2021).....7

Figure 4 GHG emissions per person in BC since 1990 to 2018 (Environmental Reporting BC, 2021). 8

Figure 5 Carbon price levels needed to achieve major GHG emissions reductions (CDP and the We Mean Business Coalition, 2016, p.5).....16

Figure 6 Different countries' price in existing carbon pricing initiatives (World Bank Group and ECOFYS, 2016, p.6).....17

LIST OF ABBREVIATIONS

CBDR	Common but Differentiated Responsibilities
CAP	Climate Action Plan
CAS	Climate Action Secretariat
CDP	Carbon Disclosure Project
CDR	Carbon Dioxide Removal
CO^2e	Carbon dioxide equivalent (a metric ton of CO^2 emitted)
GHG	Greenhouse gases
HEIs	Higher Education Institutions
ICP	Internal Carbon Pricing
IPCC	Intergovernmental Panel on Climate Change
LNG	Liquified Natural Gas
NDCs	Nationally Determined Contributions
SCCs	Social Carbon Costs
SDG	United Nation's Sustainable Development Goals
UBC	University of British Columbia
UC3	University Climate Change Coalition
UNDP	United Nations Development Programme
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNFCCC	United Nations Framework Convention on Climate Change
WCI	Western Climate Initiative

1. INTRODUCTION

Posing serious threats to the ecosystem and the well-being of society, climate change is one of the greatest challenges faced by all nations on earth (IPCC, 2007). Ranging from shifting weather patterns to rising sea levels, its impacts are happening on an unprecedented global scale (United Nations, 2020). By the end of the century, the world is on track for 3 to 4°C warming (Vince, 2019). To avoid catastrophic impacts of climate change, the Paris Agreement set out a global framework in 2015 to limit "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C" (UNFCCC, 2018). This means a 45% global GHG emissions reduction below 2010 levels by 2030 and carbon neutrality by 2050 (IPCC, 2018). Yet, we are still unable to find solutions to seriously address it nowadays even with science and technology developing more and more each day.

Enshrined in the legal framework of the United Nations Framework Convention on Climate Change (UNFCCC), the principle of Common but Differentiated Responsibilities (CBDR) is generally recognized as one of the guiding principles in regulating issues related to climate change (Chen, 2021). The convention requested the developed parties to take the lead in climate change mitigation, which was further enhanced in the Kyoto Protocol with the establishment of a quantified emissions limitation or reduction commitments for developed parties only (Wang and Gao, 2018). Despite global efforts have been already taken to reduce greenhouse gas (GHG) emissions, the long-term effects of climate change are inevitable due to the insufficient actions of major GHG emitters in the world at current levels. Thus, a comprehensive international response with meaningful participation by all the major GHG emitters is urgently needed (Deleuil, 2012). Climate change is a global challenge faced by all nations, however, developed countries should bear primary responsibilities, as they are historically and currently the largest proportion of greenhouse gas (GHG) contributors.

Although UNFCCC does not clearly refer to the historical contributions of developed countries to environmental degradation as it is difficult to reference, it does emphasize the CBDR. According to Article 3.1 of the Convention (UNFCCC, 1992), "the Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities" and "the developed country Parties should take the lead in combating climate change and the adverse effects thereof". The "lead in combating climate change" in the last sentence of Article 3.1 focused more on developed countries' greater technological and financial capacities than their historical contribution to environmental degradation. However, the complexity within the developing countries category and the rise of emerging economies, such as China and India, two of today's major greenhouse gas emitters, have called this international compromise into question (Bortscheller, 2010).

The federal government of Canada is on track to deliver the greatest emissions reduction in the country's history (Environment and Climate Change Canada, 2021). However, even with an extensive deployment of renewable resources such as hydroelectric dams that provide the majority of its power in the country, Canada still shows slow adaptation and transition to the sustainable low-carbon path. Meanwhile, thousands of Canadians have become the victims of severe flooding and wildfires caused by climate change. In addition, successive governments on both sides of the political divide have also consistently failed to meet the nation's pledged climate targets (Gabbatiss, 2019). Government's approval on the pipeline projects to transport their products across the nation and the exploitation of Alberta's oil sands fields also further exacerbates the problem of climate change (Gabbatiss, 2019). Look closer to home, BC's ambitions to develop liquefied natural gas (LNG) projects are estimated to increase

an appreciable amount of emissions in the future (Simmons, 2020). With that, other sectors of the economy in BC, including UBC, will have to overcompensate to enable BC to meet its provincial emissions targets (Simmons, 2020).

The University of British Columbia (UBC) is one of the most prestigious Higher Education Institutions (HEIs) in the world and the first Canadian university to set a carbon-neutral target by 2050. With relatively high technological and financial resources, it is also one of the global leaders in researching climate actions and developing sustainability initiatives. According to reporting on CAP 2020, the UBC Vancouver campus now produces 38% fewer GHG emissions compared to the 2007 level, despite a 21% growth in building floor space and a 30% increase in student population. Future actions will continue on the path for even more aggressive reductions in GHG emissions by 2030 and net-zero carbon emissions by 2050. To further accelerate GHG emissions reductions and align with the Paris Agreement goal of limiting global warming to 1.5°C, UBC has planned to develop and implement more energy and policy innovations. For instance, more research has been focused on implementing and selecting a proper internal carbon pricing on campus, as well as commitments have been made to widen the scope of UBC's climate action planning to include areas that extend beyond UBC's operations such as commuting, air travel, and food.

This project aims to prove that Canada, and therefore UBC, need to set more aggressive emissions reduction targets that exceed the IPCC's global-average targets due to their relatively high financial and technological capacities. In addition, this project seeks to identify deontology, solidarity, and consequentialism in CBDR and climate justice as principles that could serve as a basis for the argument and rationale to test if UBC's commitment aligns with the international commitment to limit warming to 1.5°C, and to provide a clear vision and direction for UBC to move on the future climate action pathway. The fact and value basis and conceptual framework of climate equity, divergence debate and evaluation elements, and innovative approaches for emissions reductions will also be explored in this project. Moreover, synthesized results of legal frameworks (CBDR and climate justice) and numerical assessment (emissions data and carbon price) from other literature will be discussed to further give specific recommendations at the university level.

2. LITERATURE REVIEW

2.1 WHAT IS COMMON BUT DIFFERENTIATED RESPONSIBILITIES (CBDR)?

Created by the UNFCCC in 1992 and improved by the Paris Agreement 23 years later, Common but Differentiated Responsibilities (CBDR) is a key equity principle that calls for developed (wealthier) parties to shoulder more of the burden of climate change mitigation, and it has now become one of the most significant guiding principles in the international climate change regime (Kline et al., 2018). The 2015 Paris Agreement sets a long-term goal for all contracting parties to limit global warming to "well below 2°C above pre-industrial levels" with efforts to limit to 1.5°C. The improvement of CBDR in the Paris Agreement emphasized more about nations' capabilities than responsibilities for emissions, with the statement "in the light of different national circumstances" (Pauw et al., 2019). The CBDR makes developed countries as the first actors due to their economic and technological capacities to reduce GHG emissions, allowing developing countries to follow over time (Bortscheller, 2010). CBDR is also widely accepted in the international community and it plays a crucial role in the international environmental law and climate negotiations.

In addition, the Paris Agreement also requires all parties to submit nationally determined contributions (NDCs), reports that outlined their self-determined emissions reduction targets and "best efforts" actions to limit their GHG emissions and to adapt to the impacts of climate change (Beauregard et al., 2021). Instead of setting emissions reduction targets for developed parties, the Paris Agreement asked all parties to determine their own targets based on their own interests, conditions, and assessment of national capabilities (Čučković, 2019). This replacement of strictly determined quantified GHG emissions reduction targets with NDCs is a major novelty and the heart of the 2015 Paris Agreement on climate change. Due to this novel solution, the relationship between the principles of equality, equity, and differentiated responsibilities in contemporary environmental law has been changed, as differentiation has slowly detached from equality and started to fulfill objectives more than fairness (Beauregard et al., 2021).

However, Deleuil et al. (2012) argued that CBDR is politically and practically flawed because it still has huge vagueness and uncertainties within its practice and parties tend to use their own definitions and interpretations of CBDR to support their interests. Thus, it is in pressing need of a more certain definition and clarification in the future agreement. As the clearer the principle is, the clearer State categories and obligations they are subjected to will be, and the easier compliance will be for parties (Deleuil et al., 2012).

2.2 WHAT IS THE IMPORTANCE OF POLYCENTRIC GOVERNANCE AND SUBNATIONAL ACTORS?

A report of UNFCCC (2015) indicated that even if national governments fulfil all of their climate pledges, emissions will still rise to 19% (8.7 Gt CO^2e) above the 2◦C pathway by 2025 and 35% (15.1 Gt CO^2e) above the emissions limit by 2030. Thus, scientists and regulators have been actively seeking new opportunities such as polycentric governance, as the important role of subnational governments in addressing climate change has been increasingly acknowledged in the global climate governance literature recently. (Anderton and Setzer, 2018).

National governments are no longer the sole actors in global climate governance (Hsu et al., 2017). Being smaller than the nation-state, subnational governments have the advantage of taking more risky, innovative, and reformative climate actions; while being larger than the cities or municipalities, they can have more policy levers, resources, and capacities to affect a larger population (Dale et al., 2020). For instance, Hsu et al. (2017) found that iinfluential provinces can not only facilitate GHG emissions reductions through implementing policies in where national governments falter but also in areas where local governments lack the resources or capacities to act. The study of Dale et al. (2020) also suggested that subnational governments can serve as living laboratories to be tested with experimental and ground-breaking policies, on a scale that prevents potential risks at the national level and could be replicated on a larger scale if successful.

Furthermore, despite the accumulation of human-induced GHG emissions occurs on a global scale, emissions stem from local contexts. Having jurisdiction over some critical sources of GHG emissions, local governments and subnational actors played a key role in implementing climate innovations (Araos et al., 2016). As noted by Anderton and Setzer (2017), due to their unique positions on the frontline of identifying indicators of change in current development paths, subnational actors are more responsive and accessible to citizens through public participation and policy innovation to ensure the necessary changes for transformation to carbon-neutral economies.

Apart from that, Gajevic Sayegh (2020) maintained that the synergy and the coordination of subnational efforts with national and international initiatives can increase the density and centrality of actors working in the climate actions. As an increasing number of actors in a position to reduce GHG emissions, the distribution of duties by polycentric governance will not only improve the conditions for national governments to meet their targets but also enhance opportunities for communication and coordination between agents at different levels of government (Gajevic Sayegh, 2020). Such coordination with the national government, other subnational governments, and the local actors offers an opportunity for policy diffusion and even inter-state collaboration (Setzer and Nachmany 2018). For instance, California's cap and trade program linked with partners allied with Western Climate Initiative (WCI) which including Quebec, Nova Scotia, and British Columbia (although B.C. currently does not participate in emissions trading). This collaboration under the establishment of the WCI not only becomes an innovative pilot test of how subnational government can work collaboratively to tackle climate change but also shows a significant subnational response to the federal inaction in both Canada and the USA (Gajevic Sayegh, 2020).

Nonetheless, Van den Brande et al. (2012) emphasized the enormous role national governments played in addressing climate change since most multi-actor interactions still relied heavily on the national government to initiate actions, formulate priorities, coordinate efforts, fund innovative projects, and legitimate final decisions. In addition, it should be noted that national governments are important to promote societal changes for sustainable development, since they are the only actors that have a legitimate democratic mandate to represent collective interests and be held accountable for it (Van den Brande et al., 2012).

2.3 WHAT IS CLIMATE JUSTICE?

Address complex ethical and moral issues related to climate change mitigation and adaptation actions, climate justice has gained ground in the growing scientific advance (Alves and Mariano, 2018). Instead of only being recognized as a global environmental issue, the concepts of climate change has expanded in recent years to be framed as an issue of justice (disparities in vulnerability to climate change) and human rights (social inequalities), which can be increasingly observed in the discourses of nations, civil society organizations, and the Paris Agreement (Alves and Mariano, 2018). As explained by Mary Robinson Foundation – Climate Justice (MRF, 2018), "Climate justice links human rights and development to achieve a human-centred approach, safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and its impacts equitably and fairly".

As a country, Canada is known for its abundant and diverse natural resources, which mainly include energy (natural gas, crude oil, and coal), minerals, and timber resources. Natural resources extractions also contribute significantly to Canada's total wealth. Since indigenous lives, cultures, and traditions are closely tied to the land, they are more disproportionately impacted by the ongoing effects of this global crisis (Evangeliou, 2020). From indigenous perspectives, socio-environmental and climate justice are pre-conditions of an equitable socio-political system for fair participation and democratic decisions (Perkins, 2019). According to Perkins (2019), their praxis of climate justice is grounded in activists' leadership for communing and environmental resistance to natural resource extraction on their lands, the fossil fuel economy, and commodified property rights. These movements are also building a politics of decolonization, respect, equity, and solidarity (Perkins, 2019).

Generally, climate justice not only focused on the rights of individuals, communities, and nations to access a safe, clean, healthy, and sustainable environment but also took measures within the legislative systems at various levels (from regional to international) to mitigate and adapt climate change in a way that respects human rights (Beauregard et al., 2021). There are also various types of climate justice. For instance, **distributive justice** - the allocation of costs and benefits; **procedural justice** - the inclusion of all stakeholders in the decision-making processes that impact them; **compensatory, restitutive, and corrective justice** - the rights that all people should be respected and the compensation will be provided if a violation of rights occurs; and **intergenerational justice** - the recognition of that current climate actions will strongly affect future generations' wellbeing and the rights for future generations to enjoy a clean and safe environment (Gach, 2019; Khan et al., 2020).

2.4 WHY DOES CANADA NEED TO ACHIEVE A MORE AGGRESSIVE GHG EMISSION REDUCTION?

Industrialization and fast development of parts of the world were accomplished through exploitation in others and the relationships between industrialization, colonialism, slavery, and global capital accumulations are deeply intertwined (Malm, 2013). For instance, the urban and energy development achieved across Canada would not be possible without the expropriation of indigenous territories through settler colonialism and energy extraction (Bliss and Temper, 2018). In addition, many of those who have contributed least to climate change are most vulnerable, and many of the systemic inequalities are fuelled by the accumulation of wealth and privileges that resulted in climate change (Čučković, 2019). According to Alves and Mariano (2018), low income, socially and economically marginalized communities, individuals suffering from physical and mental diseases, older and young people, and vulnerable populations will also be disproportionately affected by climate change due to their limited ability to adapt.

As well as that, insufficient climate actions will negatively affect the achievements of the United Nations' Sustainable Development Goals (UNDP) that promoting the well-being of people in developing countries and marginalized communities within developed countries (United Nations, 2019). For instance, Canada may fail in its commitment made in United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) to fully recognize, respect, protect, and fulfill the rights of indigenous peoples, as the impacts of climate change on indigenous peoples are wide and immediate. Hence, adopting a more aggressive target and guaranteeing climate justice guarantees the human development of the individual as the definition of human development in UNDP (2016) clearly stated that the two fundamental aspects of human development is the freedom of well-being and the freedom of agency.

Emerging economies, small-island developing states and other developing countries such as Brazil and Bolivia have also called on developed countries like Canada to "promote, facilitate, and finance the transfer of, access to, and development of environmentally sound technologies and know-how, for both climate mitigation and adaptation", and "commit to deep emissions reductions in order to advance the objective of avoiding dangerous anthropogenic interference with the climate system and its consequences, to reflect their historical responsibility for the causes of climate change, to respect the principles of equity and common but differentiated responsibilities in accordance with the UNFCCC." (Deleuil, 2012). As noted by Broome (2008), "If the world is to do something about climate change, some people-chiefly the better-off among the current generation-will have to reduce their greenhouse gases".

3. FINDING A 1.5°C TARGET FOR UBC'S FAIR SHARE

3.1 NATIONAL CONTEXT: CANADA'S FAIR SHARE

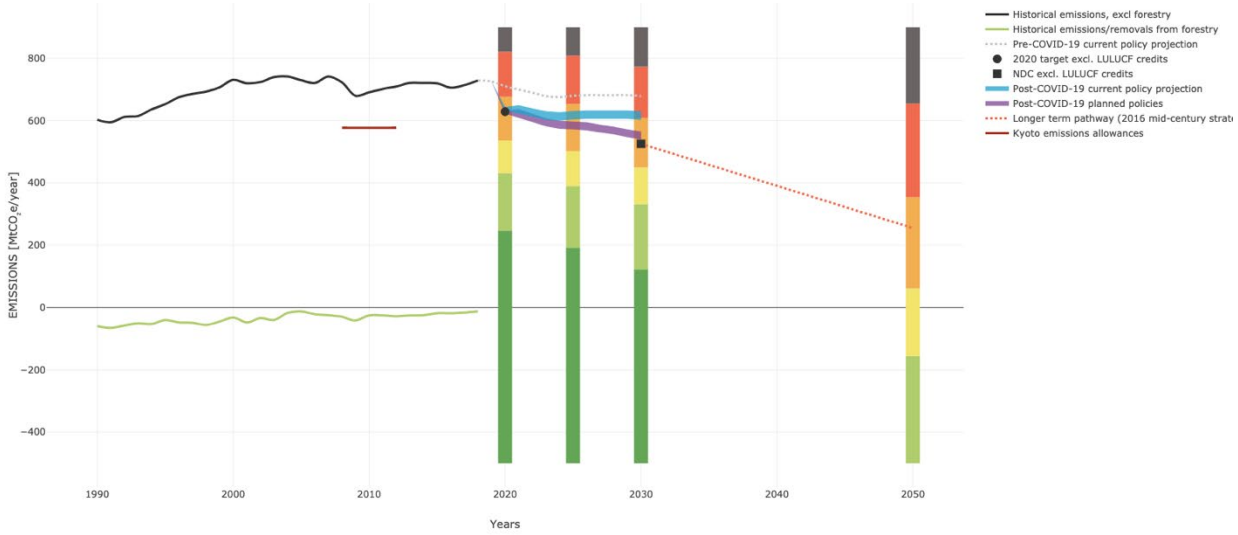
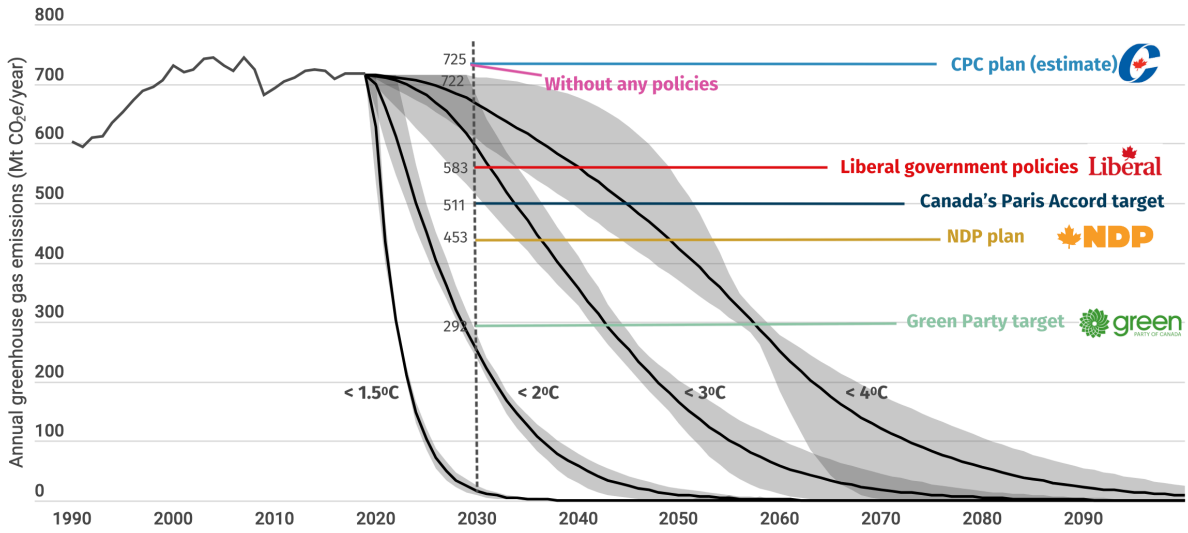


Figure 1 Canada's summary data of historical GHG emissions and current pathways from year 1990 to year (climate action tracker.org. 2020).

As one of the world's top 10 largest GHG emitters and a top 10 emitter for over a century, Canada is a substantial historical and current GHG emissions contributor that not only reaping enormous economic benefits but also accumulating a substantial carbon debt (Gabbatiss, 2019). This means that Canada has a large responsibility and moral obligation to cut its domestic GHG emissions, support emissions reductions in developing nations, as well as protect human rights that are threatened by climate change. Moreover, Canada is also one of the top 10 wealthiest and most economically productive countries in the world (Silver, 2020). With sufficient financial and technological resources, Canada must do a fair share towards a global effort to limit global warming to no more than 1.5°C. According to Climate Action Network Canada (2019), Canada's fair share target is to reduce GHG emissions by a total of 140% below 2005 levels by 2030. That is a total emissions reduction in 2030 of 1,039 Mt CO2e below 2005 GHG emissions levels, with 445 Mt domestic reductions (60%) and 594 Mt (80%) in developing countries through financial and technological support (Climate Action Network Canada 2019). By applying an equitable distribution of the carbon budget and not considering negative emissions, Donner (2019) also suggested that it has been already too late for Canada to do its fair share to avoid 1.5°C of global warming unless Canada takes a drastic emissions reduction which is a 96-99% drop below 2019 levels by 2030 (Figure 2).



Source: https://simondonner.com/2019/09/27/canadas-climate-plans/

Figure 2 Canadian emission pathways and projections of emissions reductions needed for limiting global warming to 1.5°C, 2°C, 3°C, and 4°C (Donner, 2019).

In addition, the Canadian Federal Government has committed to implementing strong climate plans that not only meet but also exceed its 2030 GHG emissions reduction target (Government of Canada, 2021). Jointly developed by the federal, provincial, and territorial governments, the Pan-Canadian Framework on Clean Growth and Climate Change has been released as Canada's first national climate plan (Government of Canada, 2021). Although it is projected to reach Canada's 2030 goal of reducing 30% of GHG emissions based on the 2005 level, it still remains far from meeting Canada's commitment to limit global warming to 1.5°c (Government of Canada, 2016). As a result, the national government released its strengthened federal climate plan in December 2020, A Healthy Environment and a Healthy Economy, which contains 64 new federal climate policies, programs, and investments to reduce pollution and build a more resilient and inclusive economy (Government of Canada, 2020). Apart from that, Canada has also committed to achieving a net-zero mission economy by 2050 (Government of Canada, 2020). In order to reach this goal, the national government introduced the Canadian Net-Zero Emissions Accountability Act in November 2020, which aims to establish a series of interim emissions reduction targets at 5-years milestones towards the goal (Environment and Climate Change, 2020). Moreover, just several days ago, Prime Minister Justin Trudeau announced new targets (a 40 to 45 % emissions reduction) to fight against climate change, which are 4-9% higher than the most recent new plan of emissions reduction by 36% below 2005 levels by 2030 (Scherer, 2021; Taylor, 2021).

As has been noted, Canada is working hard on delivering the largest emissions reduction in its history. However, Guyadeen et al. (2019) pointed out that (i) the implementation, monitoring, and evaluation processes in Canada's municipal climate change plans are relatively weak, and (ii) the stakeholder engagement in the climate change plan-making process of Canadian municipalities is insufficient. In addition, research has been suggested that the NDCs of Canada is less ambitious than their CBDR even under the least ambitious global emissions scenario available (Maclean et al., 2019). Climate Action Tracker (2020) also determined Canada's NDC as "insufficient", indicating that Canada's climate commitment in 2030 is inconsistent with holding global warming to below 1.5°C as required under the Paris Agreement, but instead is consistent with global warming between 2°C and 3°C. This means that Canada's current climate commitment and actions are not what would be a fair share of global effort

and not consistent with the 1.5◦C limit target of the Paris Agreement unless other countries contribute greater efforts to make deeper GHG emissions reductions (Climate Action Tracker, 2020). If all countries were to follow Canada's climate approach, global warming could easily and inevitably reach 2◦C and go up to 3◦C (Climate Action Tracker, 2020). It is clear that every actor in Canada must come together to fight against climate change if we are to effectively address today's climate emergency.

3.2 PROVINCIAL CONTEXT: BC'S FAIR SHARE

As one of Canada's provincial government leaders in climate action, B.C. has not only recognized the urgency but also been working hard to establish timely actions to protect local communities, health, and environment and to build a more sustainable future. The province of British Columbia (B.C.) emits 9% of Canada's total GHG emissions, with emissions sources mainly coming from the building, transportation, and industrial sectors (Auditor General of B.C., 2018). The Ministry of Environment and Climate Change Strategy's Climate Action Secretariat (CAS) is responsible for the climate mitigation and adaptation approach in the province. In 2018, gross GHG emissions in B.C. were 7.1% higher than the 2007 base year (Figure 3). Although the GHG emissions per person in B.C. were less in 2018 than the 2007 base year per capita emissions have been increasing since 2015 (Figure 4). In addition, according to the Environmental Reporting BC. (2019), B.C.'s per capita emissions levels (13.1t CO^2e/person) are almost three times higher than the world average (4.55t CO^2e/person).

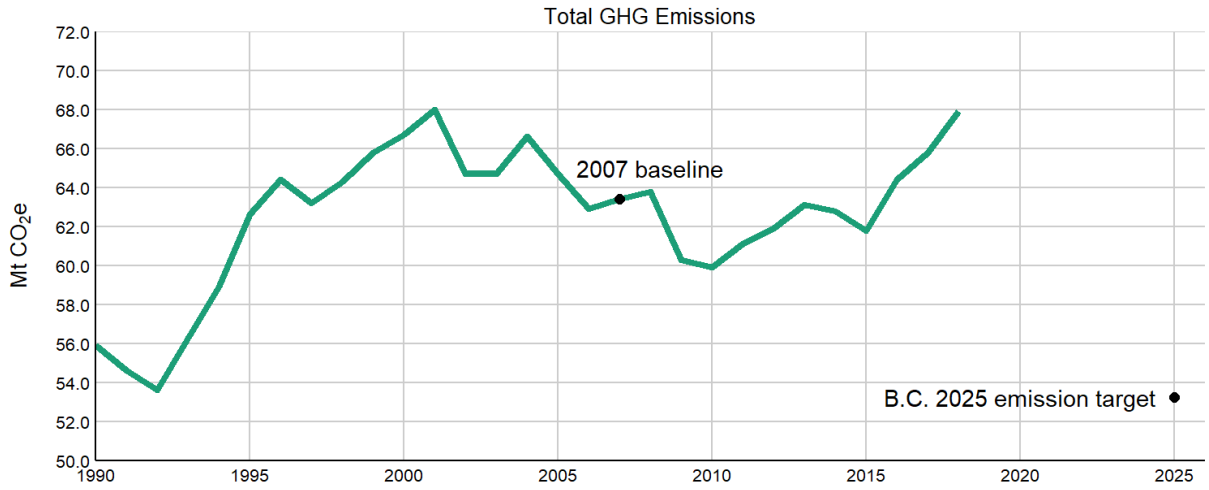


Figure 3 Total GHG emissions of BC since 1990 to 2018 (Environmental Reporting BC, 2021).

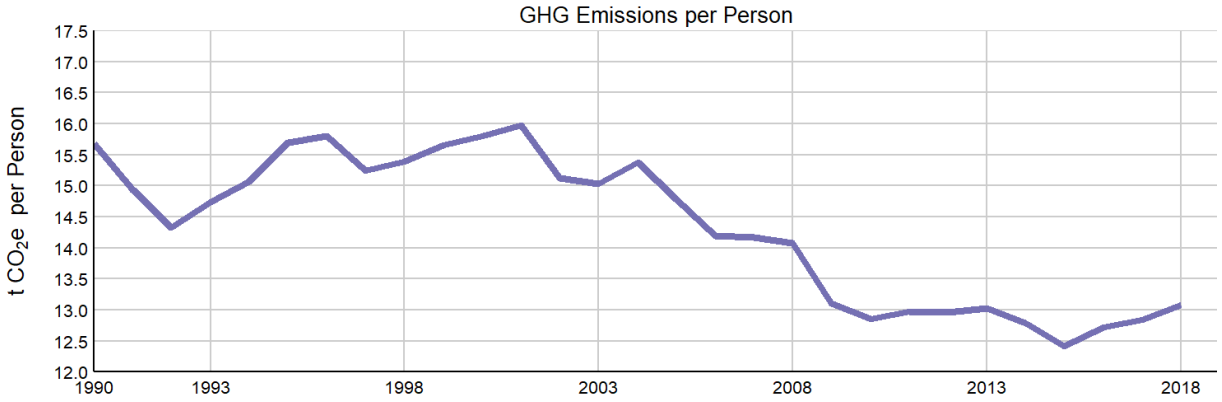


Figure 4 GHG emissions per person in BC since 1990 to 2018 (Environmental Reporting BC, 2021).

B.C. has taken the opportunity to demonstrate the provincial leadership and to explore the implementation of climate innovations. For instance, energy innovators across B.C. are leading the way of clean economic growth in Canada, as B.C. has 7 out of the 10 innovative Canadian firms on the Global Cleantech 100 list for 2018 (Wu, 2018). The province also mandated carbon neutrality and GHG emissions reporting across all public sectors such as government offices, post-secondary institutions, and hospitals through the Climate Change Accountability Act to measure, reduce, and offset possible operational GHG emissions (Government of British Columbia, 2010). Moreover, B.C. has started strong voluntary efforts, which included the introduction of Canada's first broad-based revenue-neutral carbon tax on fossil fuels and the B.C. Climate Action Charter voluntary agreement in 2007, to set and meet climate goals that are far more ambitious than those mandated by the federal government (Dale et al., 2020).

Nonetheless, although the Carbon Tax Act has started to phase in an escalating revenue-neutral carbon tax, with all revenue generated from the tax returning to taxpayers through reductions in other provincial taxes to provide protection for lower-income British Columbians, the province has not increased the carbon tax as originally planned (Dale et al., 2020). Schatz (2021) also suggested that BC's carbon tax is not bad but not sufficient, as it needs supplemental policy to bring the province's emissions down enough to meet its emission targets. In addition, according to the Pacific Climate Impacts Consortium (2016), there has been a 1.4◦C increase in B.C.'s average temperature from 1900 to 2013 and the average annual temperature is projected to increase 2.5◦C by 2050, which is far from the crucial tipping point of 1.5◦C warming set by the Paris Agreement. Moreover, Lee (2018) has clearly stated that the Clean BC plan does not have enough measures to meet BC's legislated 2030 target, along with its ongoing LNG development. Almost certainly, the 2030 GHG emissions reduction target will likely not be met as the climate actions of the provincial government are insufficient.

3.3 MUNICIPAL CONTEXT: VANCOUVER'S FAIR SHARE

There is a growing number of municipalities in Canada have raised their voices and taking actions to declare climate emergencies and acknowledge the emergency of climate crisis (Cornish, 2019). Listed on the CDP Cities A List, the City of Vancouver is leading the transition to a climate-safe future through having a city-wide emission inventory, setting an emissions-reduction target, publishing a climate action plan, and completing a climate adaptation plan (Plana, 2020). The Vancouver City Council declared a

climate emergency in 2019 to recognize the serious threats posed by climate change and call to scale up Vancouver's efforts to cut GHG emissions (City of Vancouver, 2020). The Vancouver City Council also approved the Climate Emergency Response, which establishes bold municipal targets to reduce 50% of its emissions by 2030 from 2007 levels and aims to achieve carbon neutrality by 2050 (City of Vancouver, 2020). According to an IPCC report summarized from Bazaz et al. (2018), Vancouver's targets are largely consistent with the 1.5°C until mid-century and roughly falling in the middle range of the IPCC global emissions pathway. However, although Vancouver has lowered its emissions by 9% below 2007 levels (City of Vancouver, 2021), it is far from reaching the IPCC 1.5°C target, let alone achieve the municipal target of reducing 50% by 2030 which will require a five-fold increase in emissions reduction Cornish (2019). The report summarized from Bazaz, et al. (2018) also emphasized that even though their modelling indicates those targets are achievable, Vancouver is in need of a significantly accelerated emissions reduction and the establishment of negative emissions targets after mid-century to remain consistent with 1.5°C.

3.4 LOCAL CONTEXT: UBC'S FAIR SHARE

The University of British Columbia (UBC) was the first Canadian university to have the University Sustainability Initiative (USI). As an institution of higher education, it not only conducts faculty research on climate science and solutions actively but also commits to ensuring its climate actions and targets in compliance with provincial climate legislation to achieve carbon neutrality on both campuses (Teslenko, 2019). In 2010, UBC's Board of Governors adopted the Climate Action Plan (CAP) and announced its bold GHG emissions reduction targets, which are 33% by 2015, 67% by 2020, and 100 % by 2050 GHG emissions reduction below 2007 levels (UBC CAP, 2020). Moreover, UBC purchases carbon offsets annually for the remaining GHG emissions after the reduction efforts to achieve carbon neutrality on campus (UBC, 2020). There are also five main on-campus and off-campus engagement programs that contribute to UBC's sustainability goals: the SEEDS program, Sustainability Ambassadors, UBC Reads Sustainability, Student Sustainability Council, and Sustainability in Residence, and the Greenest City Scholars at the Vancouver campus (Teslenko, 2019).

Apart from specific commitments and programs, the provincial carbon tax also has implications on UBC's financial feasibility to take climate actions. In addition to the energy costs, UBC is required to pay \$55/t CO^2e, which is the combination of a carbon tax of \$30/t CO^2e plus the legislated carbon offsets of \$25/t CO^2e (UBC CAP, 2020). Moreover, the federal government recently decided to increase the carbon tax to \$170/tCO^2e by 2030 (CBC News, 2020). This tightened government policy will increase UBC's carbon liability materially in the future, let alone UBC currently pays around \$3 million per year for its carbon liabilities already (UBC CAP 2030). According to UBC CAP 2030, if UBC takes no new climate action, the expected future carbon liability would accumulate to \$100 million over the next 25 years. Thus, reducing GHG emissions strategically now would make UBC considerably better off with lower risks of potentially high external carbon costs in the future.

Furthermore, UBC also pledged to align with the global target of 1.5°C in its Climate Emergency Declaration in 2019, which aims to reduce GHG emissions at a scale equal to "the science of the IPCC, the UN Production Gap Report, and the Paris Agreement" (UBC CAP, 2020). With national and provincial emissions reductions likely to be unable and insufficient to reach the 1.5°C target, academic institutions like UBC that are committed to climate justice and have the financial and technological resources to pursue systemic change will need to make huge differences and cut their emissions far beyond the targets set by the national and provincial governments (Lee and Lee, 2021). From the global perspective,

it could be argued that UBC has a disproportionately important role to play in sustainability and accelerated decarbonization due to its relatively high technological and financial resources to achieve a low-carbon and net-zero path, comparing to other sub-national communities worldwide. Thus, it has yet to be determined whether adhering to a global average target by 2030 accurately represents UBC's commitments and obligations to reduce emissions at a 1.5°C pace. The CAP 2030 also provides opportunities for UBC to save on the carbon-related costs and continue its international leader in climate action through energy innovation and behaviour change (Scope 3) research. Lastly, in the order to meet UBC's ambitious targets for 2030 and 2050, more departments and sectors will need to act strategically and work collaboratively.

4. UBC'S RESPONSIBILITY AND FUTURE TARGET

To curb climate change and limit global warming to 1.5°C, IPCC (2018) requires an emissions reduction of 45% below 2010 levels by 2030 in global net anthropogenic GHG emissions. While all nations are both emissions contributors and victims of climate change, the contributions and consequences vary greatly across countries, regions, and communities (Klinsky et al., 2017). Given that adequate climate action requires deeper mitigation efforts and collaborations from more actors than ever before and that the impacts of climate change are increasingly threatening those who have contributed little emissions and who lacked the resources to adapt, it is clear that CBDR and climate justice remain as fundamental to address climate change.

Both CBDR and climate justice indicate that Canada bears a large responsibility to address the climate crisis and has a moral obligation to cut its GHG emissions as fast as financially and technologically feasible (Climate Action Network Canada, 2019). Currently, according to the Environment and Climate Change Canada (2021), the national target to limit the increase to 1.5°C is 30% reduction below 2005 levels by 2030, and 80% by 2050. Consider that Canada is both a rich and capable country and a major GHG emitter, it is necessary for Canada to become a climate leader and pursue emissions reduction targets that are bolder than 45% by 2030 and net-zero by 2050 to pay its fair share towards a global effort that ensures global warming is limited to no more than 1.5°C without overshoot. Within Canada, B.C. released the Climate Leadership Plan to fight climate change, which highlights the provincial target of 40% emissions reduction by 2030, 60 % by 2040, and 80% by 2050 below 2007 levels, respectively (Clean BC, 2020). Look a little closer to home, Vancouver has been named global leader for climate change by the CDP, a non-profit organization which aims to study the impacts of climate change (Plana, 2020). It has set bold municipal targets to cut 50% of its emissions by 2030 from 2007 levels and shift to carbon neutral by 2050 (City of Vancouver, 2020). In addition, the City of Vancouver (2020) approved its Climate Emergency Action Plan in 2020, which mandates embodied emissions from new buildings to be reduced 40% compared to 2018 baseline.

As we can see, from national to provincial to municipal scale, the climate actions and emissions reduction targets are getting more ambitious. This is because subnational governments have the advantage of taking more risky, innovative, and reformative climate actions and have more policy levers, resources, and capacities to affect a larger population. In addition, they can serve as living laboratories to be tested with experimental and ground-breaking policies, on a scale that prevents potential risks at the national level and could be replicated on a larger scale if successful. As a result, UBC, as one of the most important subnational actors in the position to reduce GHG emissions within BC and City of Vancouver, needs to set an ambitious emissions reduction target beyond both the provincial

and municipal targets to improve the conditions for federal government to meet their targets and enhance opportunities for communication and coordination between different levels of government.

Nonetheless, Bushnell et al. (2015) indicated that there is a substantial and still-growing action gap between what climate scientists tell governments and the public that is necessary to prevent detrimental impacts of climate change both in Canada and the world. According to the CBC News (2020), Prime Minister of Canada Justin Trudeau also encouraged the government to rely more on scientists to help out the country and heed their advice on the threat of climate change. At the moment of need for a rapid action on the climate change issues, the role of HEIs such as UBC in actively researching and teaching sustainability, informing effective climate policy, and leading the policy implementation is more important than ever. UBC's global leadership in sustainability and institutional alignment with cultures of sustainability and social justice efforts require UBC to set a justice-based emissions reduction target that is far more ambitious than both IPCC's 45% global average emissions reduction target and municipal target.

Although it is difficult to obtain a specific target due to the limited scope of this project, I recommend UBC's GHG emissions reduction target to be in the range of 80-100% by 2025, and in excess of 100% by 2030 below 2007 levels, as UBC not only has relatively high financial and technical capacities to research and promote ambitious and innovative climate actions but also plays an important role as subnational actors, property owners, employers, education and research hubs, as well as leaders of societal transformation. In addition, with the infrastructure and services on the same scale of a local community and the ability to make its own decisions on buildings and operations, UBC needs to set a transformational GHG emissions reduction target that exceeds the IPCC's global average target, national targets, provincial targets, and municipal targets, as it is the best platform to research and promote ambitious and innovative climate actions, and to affect policy decisions in the future if successful. Furthermore, as mentioned above, since the purpose of UBC - an academic institution - is not to maximize profits, it can take time and risks to research and implement an aggressive emissions reduction target to build environmental awareness and assess a variety of climate change risks on campus. Apart from that, pressures from other stakeholders and peer universities may also require UBC to implement an aggressive emissions reduction target timely to address the impacts of climate change and stay on track with the goal of limiting the global warming to 1.5^{o}C. After all, select an emissions reduction target that exceeds the IPCC's global average targets would not only demonstrate UBC's global leadership in climate awareness and sustainability but also address climate-related risks and opportunities that would help to make campus-wide cohesive financial and operational decisions.

5. RECOMMENDATIONS

5.1 SUPPLY SIDE MITIGATION (SCOPE 2 REGULATION AND ENERGY TRANSITION)

5.1.1 ESTABLISH A MORE CREDIBLE AND ROBUST TRANSPARENCY SYSTEM

Since many domestic climate actions occur at subnational levels, it is important for subnational actors such as UBC to establish a comprehensive and integrated domestic transparency system across multiple levels of "measurable, reportable, verifiable" (MRV) practices to take advantage of existing resources and driving investment from other sectors and to enhance mutual trust (Winkler et al., 2017). An

effective and robust transparency system will boost the confidence of all actors in combating climate change, as it not only shows serious and collective actions taking by a large number of actors but also encourages actors to exchange information and learn from each other (Wang and Xiang, 2018). In addition, Jacoby et al. (2017) found that enhanced domestic transparency systems will fulfill the pledged obligations, as well as better inform the domestic decision-makers at various levels. For instance, the successful implementation of internal carbon pricing in UBC will rely heavily on how energy information is presented, how carbon-pricing revenue is redistributed, and how clearly and transparent information and incentives for carbon pricing to change behaviour are conveyed. Moreover, if these pilot tests in UBC actually prove that systems are more effective when integrated, UBC could advocate for federal and provincial governments to adopt these similar standards and collaborate with different levels of government agencies to replicate them on a larger scale.

5.1.2 FOSTER A STRONG HORIZONTAL AND VERTICAL ALIGNMENT FOR SUBNATIONAL CLIMATE ACTIONS

Hsu et al. (2017) suggested that both vertical alignments, the linking and coordination of policies between different levels of actors, and horizontal alignments, the connection of peer actors through networks of transnational climate governance, can help facilitate needed coherence in a fractured climate governance landscape and coordinate actions to achieve climate mitigation. The linkage between subnational governments and other institutions, networks, and regimes produces interaction effects, which can lead to convergence and coherence of works between different actors to achieve the goal of addressing climate change (Dale et al. 2020). Aligning efforts can also provide various benefits such as efficient resource allocation, information sharing, capacity building, regulative or rule setting, and transmission of best practices. Moreover, the success of many innovative carbon reduction practices needs strong government regulators and climate policy in force, since lax national climate policy will result in slow dissemination of new climate practices. For instance, strong national climate policy can exert pressures on private sectors and stakeholders to refrain from polluting the air and implement an aggressive emissions reduction target timely to and stay on track with the goal of limiting the global warming to 1.5°C.

5.1.3 IMPLEMENT INTERNAL CARBON PRICING AND DEVELOP A RIGHT CARBON PRICE

As one of the top HEIs in the world, UBC is uniquely positioned to implement and promote carbon pricing policy to demonstrate its leadership on the issues of ambitious GHG emissions reduction. Implementing a carbon pricing mechanism on campus to evaluate university expenditures encourages the growth of energy efficiency projects and helps to achieve emissions reduction targets such as carbon neutrality. Internal carbon pricing also provides UBC with an opportunity to demonstrate leadership, integrity, and social responsibility which may further benefit UBC's reputation and credibility.

- Select a carbon price based on UBC's values and priorities
- Select an escalating carbon price system to allow a lower and less disruptive starting price as well as to adjust the inflation problem
- Facilitate knowledge-sharing among peers, stakeholders, and government officials
- Emphasize the risks of climate change to university operation
- Advance carbon price discussion and engage in developing climate policy
- Support student activism and endorse public campaigns

5.131 BACKGROUND ON CARBON PRICING METHODS

Actions against climate change require the active and collective involvement of organizations to adopt new climate practices to assess and mitigate their GHG emissions (IPCC, 2018). Putting a value on emissions has been suggested for many years as a market-based solution to avoid dangerous climate change since it offers a direct incentive to reduce energy consumption and thus mitigate climate change (Gillinghan et al., 2017). According to IPCC (2018), the standard term for setting the price on carbon is called the social costs of carbon (SCC), which sets the cost based on the net present value of aggregate negative externalities from one tonne of CO^2 emitted. Faced with higher costs, organizations will have an incentive to shift to more efficient energy uses that generate fewer emissions (Harpankar, 2019). The World Bank (2018) also reported that the adaptation of carbon pricing as a tool to achieve carbon strategy goals around the world is accelerating, however, almost none of those carbon prices are in the range that needed to reach the target of the Paris Agreement.

5.132 INTRODUCTION OF CARBON PRICING

There are various approaches to implement carbon pricing such as carbon taxes, cap and trade, implicit or explicit carbon pricing, clean energy standards, and emissions reduction subsidy (Chang, 2017). The carbon price under the cap and trade system will function as a demand and supply model of GHG emissions allowances; the carbon price under a carbon tax will require organizations to pay at a fixed price for the carbon they emit per tonne; and the carbon price under a proxy/shadow price will allow private sectors to study how future changes in carbon price can affect investment decisions (Ambasta and Buonocore, 2018; Bento and Gianfrate, 2020; Harpankar, 2019). An internal tax increases the costs of carbon-intensive goods and services within the organization, thus, the organization will have a greater incentive to decarbonize with a higher price (Harpankar, 2019). In addition, the revenue raised from internal charges can be redistributed to different sectors or invested in future emissions abatement plans (Lee and Lee, 2021). Involving no actual financial transactions but are considered when making decisions, proxy/shadow prices are often setting higher (Chang, 2017). They are often used to project the future cost of multi-year infrastructure investment by adding the carbon costs to the calculated cost of each project to simulate a carbon tax imposed by regulators and to quantify the effects of carbon emissions (Barron and Parker, 2018). Although there is no revenue raised from this approach, the carbon price can shape the decisions in long-term investment choices (Grillingham et al., 2017).

5.133 MOTIVATIONS AND LIMITATIONS TO USE CARBON PRICING

Internal carbon pricing can be implemented by organizations for many reasons in various settings. For instance, it can be used for regulatory and financial risk management purposes (Tost et al., 2020). By aligning investment decisions now, organizations can prepare for the environmental upgrade costs and future mandatory carbon tax, meanwhile, assess which activities and sectors are most vulnerable to increasing carbon costs (Harpankar, 2019). Chang (2017) also argued that it is important for government actors to create policy interventions to accelerate the adoption of a right carbon price widely, since those regulations can not only help organizations discover energy inefficiencies in their operations but also trigger innovations that can partially or fully offset the carbon costs.

Along with the risk management, a strong carbon price will provide incentives for decision-makers to cut GHG emissions in a most cost-effective way, to invest in low-carbon or carbon-neutral

technologies, and to lead a long-run transition to a low-carbon future (Boyce, 2018). In addition, rather than only setting targets for internal energy-efficiency standards or renewable energy innovation, organizations will achieve their goals in a more cost-effective and timely way through the application of a carbon price (Boyce, 2018). Bento and Gianfrate (2020) also stated that internal carbon pricing can help organizations to internalize their implicit costs of carbon, either actual or expected, under various climate policies and regulations. For instance, as carbon price is often featured in strategic planning activities and an important input in the definition of the long-term business model, it can be applied to plan future project investments that are related to an increase in GHG emissions (Bento and Gianfrare, 2020).

Although the ultimate goal is to avoid dangerous climate change, carbon pricing policy can have significant public health co-benefits as higher transportation fees from higher fuel costs can encourage people to walk or use public transportation (Ambasta and Buonocore, 2018). Aleksandrowicz et al. (2016) also revealed that carbon prices can increase the cost of foods with high GHG emissions such as animal-based products, and lead consumers to replace them with more vegetarian products which help reduce obesity overall.

While the carbon pricing is central to prompt mitigation pathways compatible with 1.5°C, it needs to be complemented with other stringent policies to drive the require changes. For instance, a carbon tax can be difficult to implement due to the need for a strong central administrative infrastructure for monitoring, reporting, and verification of GHG emissions (Harpankar, 2019). Besides that, places with carbon pricing systems often have complementary strategies, making it difficult to track the actual impact and reduction of GHG emissions from carbon pricing alone (Ambasta and Buonocore, 2018).

5.134 CURRENT CARBON PRICING SYSTEM IN NATIONAL CONTEXT

The pricing of carbon pollution is a central piece of the Pan Canadian Framework on Clean Growth and Climate Change to achieve Canada's emissions target by 2030 (Government of Canada, 2021a). In Canada, mandatory carbon pricing has been in effect across the country since 2019 (Government of Canada, 2018), which requires all Canadian provinces and territories to have a cap and trade system or carbon tax in place. Beginning at $20 per tonne of carbon dioxide equivalent emissions (tCO^2e) in 2019, this coordinated nation-wide carbon price will rise to $50 per tonne in 2022 (Government of British Columbia, 2021). In addition, Ambasta and Buonocore (2018) found that carbon pricing policies, either explicit price-based systems in B.C or the cap-and-trade system in Quebec and Ontario, have covered 80% of the Canadian population. Recently, the federal government also decided to increase the carbon tax to $170/$tCO^2e$ by 2030, which means a $15/$tCO^2e$ increase in the federal carbon tax per year for the next eight years after it hit $50/$tCO^2e$ in 2022 (CBC News, 2020).

5.135 CURRENT CARBON PRICING SYSTEM IN PROVINCIAL CONTEXT

B.C. introduced the first comprehensive and substantial revenue-neutral carbon tax in North America in 2008, covering 70% of its GHG emissions (Murray and Rivers, 2015). Despite an 8.1% increase in population, the province has reported a 5.5% GHG emissions reduction from 2007 to 2014 (Government of British Columbia, 2021). According to the Government of British Columbia (2021), B.C.'s carbon tax has increased to $45 per tonne on April 1, 2021, and plan to increase to $50 per tonne on April 1, 2022.

Revenues generated from increasing the carbon tax will be used to provide carbon tax credit and protect affordability through increasing the Climate Action Tax Credit to $174 per adult and $51 per child as of July 1, 2020, meanwhile, encourage new green initiatives through the CleanBC Program for Industry directs an amount equal to the incremental carbon tax paid by industry above $30/tonne into incentives for cleaner operations. (BC Ministry of Finance, 2020).

5.136 CURRENT CARBON PRICING SYSTEM IN UNIVERSITY CONTEXT

UBC is a member of the University Climate Change Coalition (UC3), a collaborative group of North American research universities that not only pledged to aggressive GHG emissions reductions but also actively worked to create climate guidelines and policies to lead cross-sector collaborations (Lee and Lee, 2021). In the report of the Role of Higher Education in Advancing Carbon Pricing (Carter, 2019), carbon pricing is promoted by UC3 as the most efficient mechanism to decarbonize campus and incentivize campus users to reduce GHG emissions. In addition, UBC is also one of the leading universities in North America that have pledged to various international treaties on climate change and implemented carbon-neutral initiatives on campus (CAP, 2020). It not only adopted green building standards to ensure the sustainable designs of new buildings and identify more low-carbon operations opportunities on campus, but also initiated a carbon neutral action plan which charges $25/t$CO^2$e emitted by all university-related air travels (Carter, 2019). Nonetheless, it is not an easy task for UBC to move to an environmentally sustainable campus without innovative approaches and UBC currently has no internal carbon pricing on campus in action.

5.14 WHY SHOULD UBC SET A RIGHT CARBON PRICE TO ACHIEVE CAP 2030 GOAL?

A sufficiently high carbon price can internalize the global negative externality (Harpankar, 2019). According to Boyce (2018), in order to achieve the goal of the Paris Agreement, the range of carbon price is at least US$40-80/t CO^2e by 2020 and US$50-100/t CO^2e by 2030 which is higher than most carbon prices used in the world at present. According to CDP and We Mean Business Coalition (2016), carbon prices that are above US$80/t are targeted to achieve specific climate policy objectives (Figure 1). Internal carbon prices are significantly higher in countries with more stringent climate policy in force, corresponding with the findings from environmental economics studies about the relationship between organizations and regulation in the adoption of environmental practices (Bento and Gianfrate, 2020).

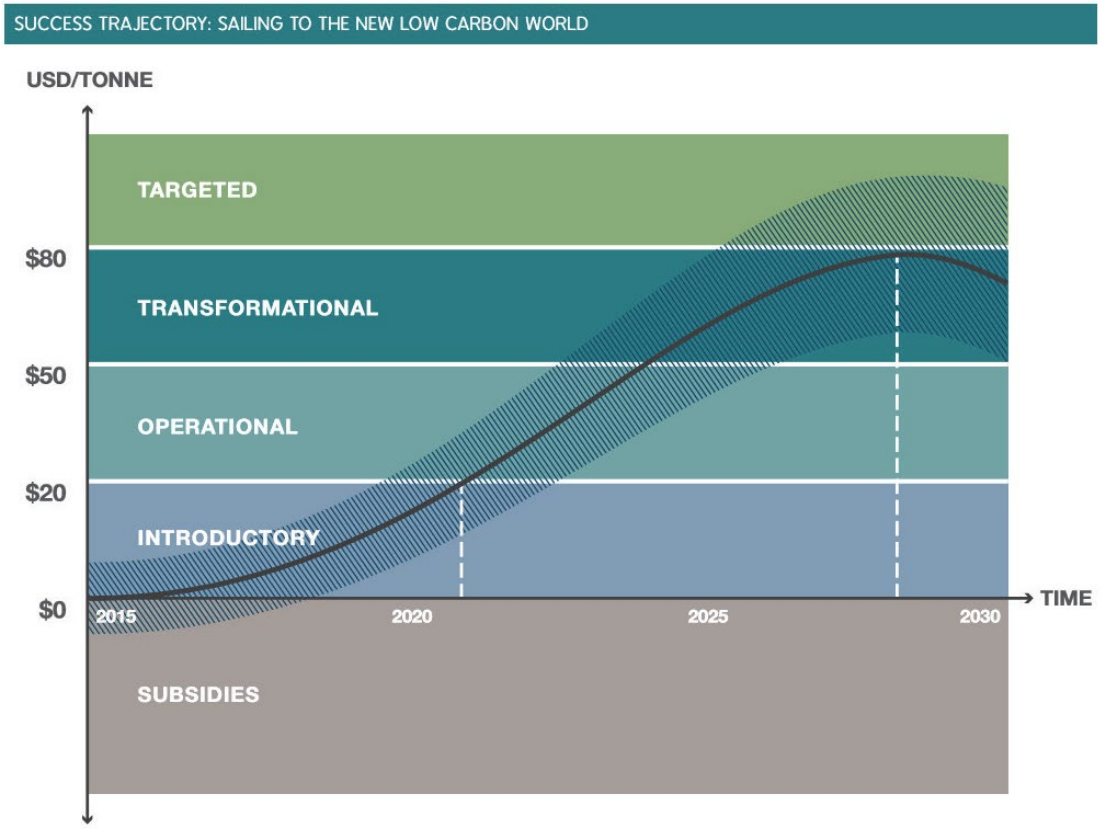


Figure 5 Carbon price levels needed to achieve major GHG emissions reductions (CDP and the We Mean Business Coalition, 2016, p.5).

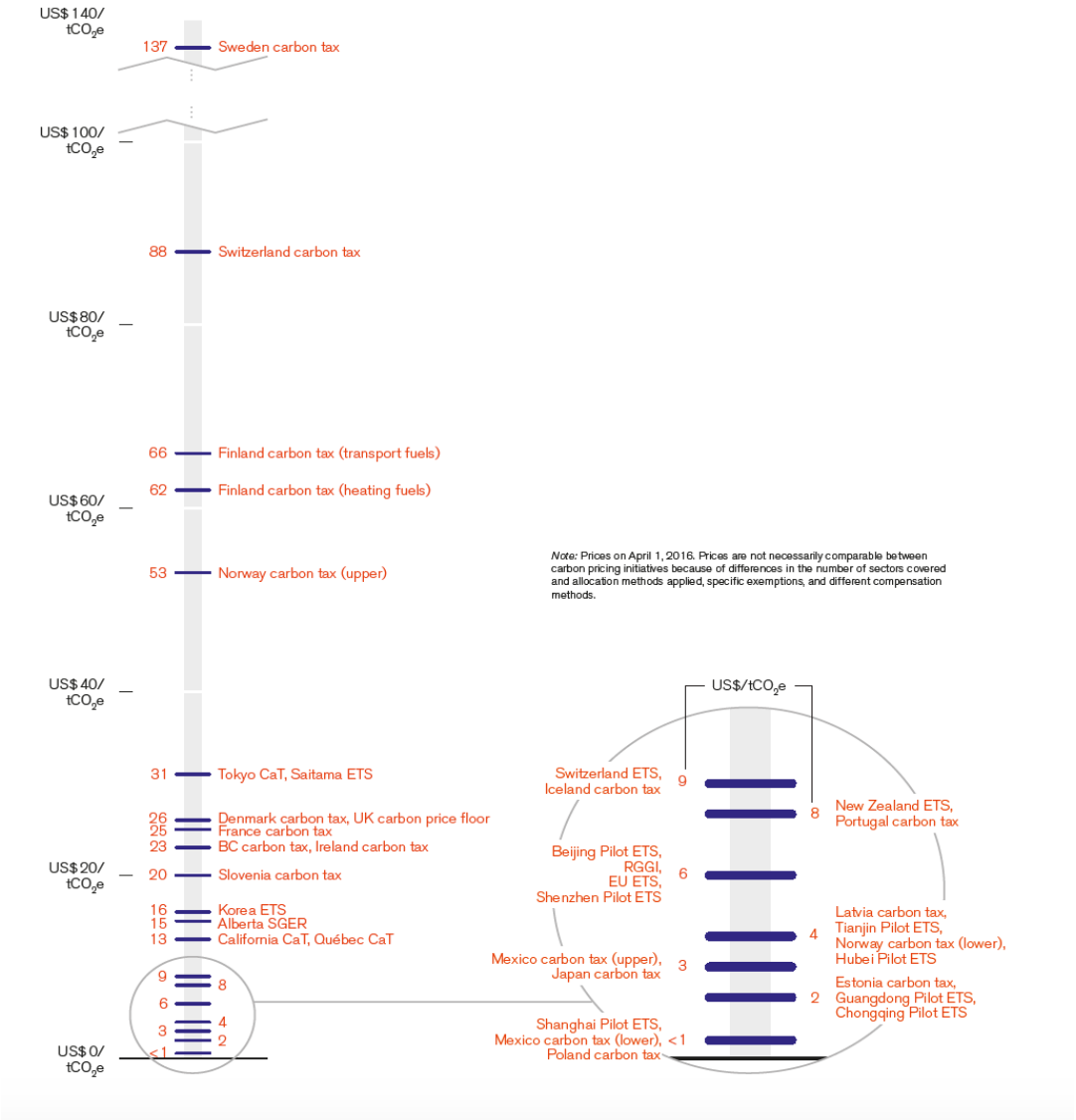


Figure 6 Different countries' price in existing carbon pricing initiatives (World Bank Group and ECOFYS, 2016, p.6).

In order to achieve necessary GHG emissions reductions and avoid irreversible impacts of climate change, the internal carbon price will need to be adopted widely and increased rapidly to or above US$80/t CO^2e before 2030 to achieve transformational results of a low-carbon or carbon-neutral future (CDP and We Mean Business Coalition, 2016). Nonetheless, currently in the world, only Sweden (US$137/t CO^2e) and Switzerland (US$88/t CO^2e) have national carbon taxes at this level, with Finland (US$62-66/t CO^2e) and Norway (US$53/t CO^2e) following in the transformational level (Figure 2). In addition, after reviewing a number of reports from Carbon Disclosure Project (CDP), Chang (2017) found that nearly no organization uses an internal carbon price above the introductory level, but a number of organizations use proxy/shadow prices of US$50-80/t CO^2e or higher to anticipate future climate policies.

HEIs played a pivotal role in promoting technological innovations and driving positive behavioural changes (O' Malley, 2019). With the infrastructure and services on the same scale of a local community and the ability to make their own decisions on buildings and operations, HEIs are the best platform to support carbon pricing policies through estimating campus GHG emissions, setting the right price that

can affect people's decisions, charging emitters for their emissions, and using the revenue they generated from carbon pricing to invest in other climate efforts (Barron et al., 2020). Apart from this, internal carbon pricing enables HEIs to find innovative and low-cost approaches to reduce GHG emissions at university levels without relying on stringent government regulations or specific national policies (Gillingham et al., 2017). In addition, since the purpose of academic institutions is not to maximize profits, HEIs can take time and risks to research and conduct pilot tests on different approaches to find the solutions that are best fit for their contexts (O'Malley, 2019).

Moreover, HEIs can have various reasons for adopting a carbon price such as to meet challenges and adopt innovations, to account for the social cost of carbon, to mitigate regulatory risks, to meet internal emissions targets, to fund climate-related projects, to educate university staffs and students, and to align with government policy or peers (Barron et al., 2020). Setting an effective carbon price for internal emissions will also allow HEIs to achieve their own GHG emissions reduction goals as this will not only create incentives for faculties, staffs, and students to choose cleaner options but also generate revenues that can be further invested in the sustainable projects to reduce and offset GHG emissions (Gillingham et al., 2017). One of the famous examples of carbon pricing initiatives at university level is Yale University's carbon-charge pilot launched in 2015, which observed that buildings that had faced carbon charges used less energy than those are not due to an increased awareness of energy use and the higher cost of energy (Gillingham et al., 2017).

Despite ongoing international policy efforts from Kyoto Protocol to the Paris Agreement, global GHG emissions are still steadily increasing over time (IPCC, 2018). To fight against this backdrop, the federal government of Canada recently decided to increase its carbon tax to CA$170/tCO^{2}e by 2030, which means a CA$15/tCO^{2}e increase in the federal carbon tax per year for the next eight years after it hit CA$50/tCO^{2}e in 2022 (CBC News, 2020). Since these new climate policies from the federal government have already suggested a trend of drastic increase in carbon tax to cut GHG emissions, UBC should implement internal carbon pricing and set a price that is higher enough to reduce future carbon liability, assume a leadership role in climate mitigation, and shape future long-term governmental decisions. It is important for HEIs like UBC to ramp up their efforts to implement sound climate policies and put a brake on activities within university that could facilitate global warming (Lee and Lee, 2021). In addition, as any infrastructure built today on campus could cost more under a future regulatory carbon price given the long lifetime for usage of campus infrastructure, it is logical for HEIs like UBC to adopt a right internal carbon price to assist with resource and capital allocation decisions in the future investment (Barron and Parker, 2018).

Additionally, UBC can use internal carbon pricing to assist with its GHG emissions reduction goals in CAP2030, since monetizing GHG emissions can provide an opportunity to build environmental awareness, as well as assess a variety of climate change risks on campus. For instance, successful implementation of a carbon price initiative on campus may not only create incentives for campus users to reduce emissions but also understand the university's carbon footprint better, which could in turn adjust present climate strategies accordingly (Barron and Parker, 2018). Besides, by applying the internal carbon pricing in advance, UBC can get ahead of the learning curve to ease the transition to future regulation of GHG emissions as internal carbon pricing reveals hidden risks and opportunities (Chang, 2017). Moreover, pressures from other stakeholders and peer universities may also require UBC to implement and set a right carbon price timely to assess and address the climate-related risks. Lastly, adoption of an internal carbon price may not only demonstrate UBC's climate awareness and policy in a

more transparent way but also translate climate risks and opportunities into tangible monetary terms that would help to make campus-wide cohesive financial and operational decisions (Ahluwalia, 2017).

As argued by Harpankar (2019), meeting the objectives of the Paris Agreement will largely depend on the adaptation of effective internal carbon prices globally. The implementation of an internal carbon price on campus will not only represent UBC's firm commitment to address climate change as a local priority but also enable decision-makers to gain a better understanding of community-based vulnerabilities and develop tailored approaches to climate change adaptation and mitigation due to the close proximity of university to stakeholders (Carter, 2019). The goal of internal carbon pricing is to help universities recognize that there are social costs of carbon in each investment, and the successful implementation of internal carbon pricing requires the participation, collaboration, and transparent communication among all campus users to reduce GHG emissions (Lee and Lee, 2021). Given that the global governance of GHG emissions is insufficient, weak, and fragmented, there is a pressing need to adopt an internal carbon pricing system, as well as to consider the important contributions that could be done by subnational actors (Dale et al., 2020). Although it is clear that internal carbon pricing is not a substitute for regulatory action, it may aid global progress on the issues of climate mitigation by forming a stronger collective action (Tost et al., 2020).

5.2 DEMAND SIDE MITIGATION (SCOPE 3 BEHAVIORAL CHANGES)

5.21 IMPLEMENT EFFECTIVE FOOD POLICES AND DEVELOP STRONG PARTNERSHIPS WITH FOOD VENDORS

Currently, UBC's food policies do not include specific targets for reducing food-related GHG emissions and instead focus more on food security and food waste on campus. Given the significant GHG footprint of UBC's food consumption, reducing the GHG impact of campus food procurement can be a promising step for reaching the ambitious GHG emissions reduction targets. According to Maji (2019), dietary choices are more significant in determining GHG emissions impact compared to whether food is imported or locally produced, and policies should focus more on dietary shifts from meat, particularly beef and pork to plant-based foods. Thus, it is important for UBC to implement effective food policies and establish strong partnerships with stakeholders to understand dietary preferences as well as sensitivity towards existing inequalities in terms of exercising dietary choices.

- Reduce meat consumption on campus through transitions towards plant-based catering menus
- Replace greenhouse produce with field-grown produce (university food procurement)
- Collaborate with food vendors on campus to work towards minimize waste to demonstrate leadership in the area
- Conduct qualitative research on GHG emissions from different stages of food system cycle such as food processing, food packaging, and food waste

5.3 MOVING FORWARD TO NET NEGATIVE EMISSIONS: THE ROLE OF CO^2 REMOVAL (CDR)

According to Hausfather (2020), the world is not close to being on track to meet the 1.5°C target and the world will likely exceed 1.5°C between 2026 and 2042. Recently, more research has been focused on generating negative emissions by removing carbon dioxide from the atmosphere as a promising way to achieve the long-term climate goals of the Paris Agreement (Minx et al., 2017).

Nonetheless, CDR still has huge uncertainties on the deployment scale and technological risks such as the reliance on underground carbon storage and competition for lands (Rogelj et al., 2018). Although CDR is not comparable to aggressive emissions reductions, it could still support climate mitigation efforts through counterbalancing difficult-to-control sources such as CO^2 from aircraft, if managed properly and sustainably (Field and Mach, 2017). Thus, as a global leader for taking urgent action to combat climate change, UBC needs to consider neutralizing emissions from sources on campus where no mitigation measures have been identified and seek or research more net-negative emissions opportunities that avoid 1.5°C overshoot in the future as delay longer in emissions reductions will lead to a higher likelihood of 1.5°C overshoot and more reliance on net negative emission technologies (Rogelj et al., 2018).

6. CONCLUSION AND FUTURE IMPLICATION FOR UBC

Climate change has presented unprecedented challenges and posed significant threats to all nations on Earth. However, since there is temporal and spatial distance separates the causes and effects of climate change, those who have benefited from emissions and those who are most harmed are separated by physical distance and time, generating severe problems for decision-making and accountability. In light of current and predicted climate change, it is crucial for current and future decisions and climate actions to protect those most vulnerable within society and those communities that will be negatively impacted. For UBC, a robust transparency system and a deeper understanding of individual needs, behaviour patterns and energy use practices in buildings across campus are required to lessen the adverse impacts of climate change and identify the root causes of inequalities.

As stated by Gajevic Sayegh (2020), in the case of climate change, acting too slow is just another way of losing and winning faster is the only way to win at all. It is important for policymakers to understand the shared benefits and trade-offs of climate actions and act timely to achieve broader sustainability goals and accelerate more innovations on climate change. As argued by Hoffmann (2011), rather than counting on the amount of GHG emissions reduced, the ultimate goal of climate actions is to redirect our economy and society onto a sustainable low-carbon pathway. In shaping the future of the climate or environmental law, every action will depend on the bravery and caution of all actors as well as their faith and compliance in the regime.

Furthermore, it is also crucial to facilitate new networks of collaboration and accelerate the climate innovations and actions between UBC and other actors by identifying the best practices of knowledge transfer, such as peer-to-peer learning exchanges and face-to-face meetings. UBC could also benefit from more partnerships with peer universities, indigenous people, the City of Vancouver, and the B.C. government to promote urgently needed strategic climate action to achieve a significant reduction in emissions.

Lastly, internal carbon pricing has been widely acknowledged as a cost-effective and low-carbon approach to reduce carbon emissions at the university level. It provides a unique opportunity for UBC to demonstrate climate leadership and drive energy innovations. While implementing and selecting a carbon price can be complicated and time-consuming, it is important for UBC to seriously address and respond to the challenge of climate change and engage all members of the university in these issues. Moving forward, in order to achieve the target of CAP2030 and limit global warming to 1.5°C, UBC needs to select and implement the right carbon price and take more efforts to get students and the university staff to be environmentally conscious and shift towards more sustainable behaviours.

To achieve the 1.5°C target would require an aggressive reduction in GHG emissions in all sectors. However, since all sectors are interconnected, changing one sector can have significant implications for another. Although there is no definitive way to limit global temperature rise to 1.5°C, what we do know is that countries' pledges to reduce their emissions are currently insufficient and not in line with limiting global warming to 1.5°C. Effective campus planning and integrated university policies that direct regulations and investment to enable innovations for deep decarbonization or even net-negative emissions pathways are also critical in the future climate actions. Furthermore, future UBC projects will require more ambitious policies targeting the decarbonization of both supply and demand side of energy-economy systems to switch energy use and improve energy efficiency, as well as recognize the significant role CO^2 removal played in reaching the net negative emissions in the next half century.

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