What is Canada's "Fair Share" of the Global Emissions Burden? An Examination of Fair and Proportional Emissions Reduction Targets

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Glossary of Acronyms

- C — Celsius
- CAT — Climate Action Tracker
- CBDR — Common but differentiated responsibilities
- CERP — Climate Equity Reference Project
- Co2 — Carbon dioxide
- Co2eq — Carbon dioxide equivalent
- COP — Conference of the Parties
- EABSWG — Emissions Allocation Burden Sharing Working Group
- ECEPC — Equal Cumulative Emissions per Capita
- ENGOs — Environmental Non-Governmental Organizations
- ENJEU — ENvironnement JEUnesse
- ETS — Emissions Trading System
- EU — European Union
- GDP — Gross domestic product
- GDR — Greenhouse Development Rights
- GHG — Greenhouse Gases
- GSES — Global sector emissions standard

- HDI Human Development Index
- IBA International Bar Association
- INDC Intended Nationally Determined Contribution
- IPCC Intergovernmental Panel on Climate Change
- JMM Joint Meeting of Ministers of Environment and Energy
- NDCs Nationally Determined Contribution
- OECD Organisation for Economic Co-operation and Development
- OBPS Output-based pricing system
- PPM Parts per million
- RCI Responsibility Capability Index
- RCP Responsibility-capability-potential
- SBTI Science-Based Targets Initiative
- UK United Kingdom
- UN United Nations
- UNEP United Nations Environment Programme
- UNFCCC United Nations Framework Convention on Climate Change
- US United States

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I. Introduction

The world is heating up: the last five years (2013 to 2018) have also been the hottest five years recorded in global history.[1] According to the United Nations ("UN") Intergovernmental Panel on Climate Change ("IPCC"), an international body of leading climate scientists, global temperatures are warming by approximately 0.1-0.3° Celsius ("C") per decade.[2] As an estimated 1.1°C of global temperature warming above pre-industrial levels has already occurred,[3] the IPCC claims that 1.5°C of global warming will likely occur sometime between 2030 and 2052.[4] Climate Action Tracker ("CAT") predicts that a global continuation of current policy will result in 1.5°C of warming by 2035, 2°C by 2053, and a whopping 3.2°C by the end of the century.[5] Two new climate models, released in September 2019, predict that continued use of fossil fuels to propel economic growth could lead to 7°C of warming by 2100.[6]

The *Paris Agreement* calls on all states to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue "efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[7] Neither this Agreement's official or aspirational target will fully prevent devastating climate change[8] impacts, however. According to the IPCC, "[w]arming of 1.5°C is not considered 'safe' for most nations, communities, ecosystems and sectors and poses significant risks to natural and human systems as compared to the current warming of 1°C."[9] Allowing global warming to surpass 2°C above pre-industrial

[1] "The 10 Hottest Global Years on Record" (6 Feb 2019), online: *Climate Central* <www.climatecentral.org/gallery/graphics/the-10-hottest-global-years-on-record>.
[2] IPCC, "Summary for Policymakers 2018", *supra* note 1 at 6.
[3] "2019 concludes a decade of exceptional global heat and high-impact weather" (3 December 2019), online: *World Meteorological Organization* <public.wmo.int/en/media/press-release/2019-concludes-decade-of-exceptional-global-heat-and-high-impact-weather>.
[4] *Ibid.*
[5] "Pledged action leads to 2.9°C – time to boost national climate action" (19 Sept 2019), online: *Climate Action Tracker* <climateactiontracker.org/publications/time-to-boost-national-climate-action/>.
[6] Marlowe Hood, "Earth warming more quickly than thought, new climate models show" (17 September 2019), online: *Phys.org* <phys.org/news/2019-09-earth-quickly-climate.html>.
[7] UNFCCC, "Adoption of Paris", *supra* note 3, art 2.1(a).
[8] Throughout this paper, the term "climate change" is used to mean "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". See UNFCCC, *supra* note 5, art 1.
[9] IPCC, "Sustainable Development, Poverty Eradication", *supra* note 6 at 447.

levels will expose hundreds of millions of additional people to water scarcity and heat waves, exacerbating these and other impacts of climate change.[10]

Limiting warming to 1.5°C, however, will require "rapid and far-reaching [system] transitions" to lower greenhouse gas ("GHG") emissions.[11] Revising national emissions reduction targets to accurately reflect the urgency and scale of efforts required could help compel such transitions. If countries were to simply fulfill their existing climate commitments, 70 to 100 percent of the remaining carbon budget under a pathway that provides a 67 percent chance of limiting warming to 1.5°C would be exhausted by 2030.[12] The IPCC warns that, under this 'policy pathway', increasing the scale and ambition of emissions reduction efforts after 2030 would not limit warming to 1.5°C,[13] and Keywan Riahi et al caution that this policy pathway could jeopardize the possibility of limiting warming to 2°C.[14]

Whether 1.5°C or 2°C (or more), the impacts of global warming are subject to several unique risks, including an unprecedented scale and an unpredictable nature, as well as a locking-in of future impacts and positive feedback loops that accelerate further global warming.[15]

Urgent action is needed to align global efforts with limiting warming to 1.5°C. The International Energy Agency and the International Renewable Energy Agency state that to simply have a 66 percent change of limiting warming to 2°C would require energy emissions to peak *before* 2020.[16] The United Nations Environment Programme ("UNEP") advises that

[10] *Ibid at 453.*
[11] IPCC, "Summary for Policymakers 2018", *supra* note 1 at 17.
[12] IPCC, "Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development" in V Masson-Delmotte et al, eds, *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-industrial Levels & Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, & Efforts to Eradicate Poverty* (Geneva, Switzerland: World Meteorological Organization, 2018) 93 at 113.
[13] IPCC, "Summary for Policymakers 2018", *supra* note 1 at 20.
[14] Keywan Riahi et al, "Locked into Copenhagen pledges — Implications of short-term emission targets for the cost and feasibility of long-term climate goals" (2015) 90 Techno Forecasting & Soc Change 8 at 19-20.
[15] "Zero Carbon Zero Poverty The Climate Justice Way: Achieving an Equitable phase-out of carbon emissions by 2050 while protecting human rights" (2015) at 15, online (pdf): *The Mary Robinson Foundation for Climate Justice* <www.mrfcj.org/media/pdf/2014/ZeroCarbontheClimateJusticeWay.pdf>.
[16] "Executive Summary: Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System" (2017) at 5, online (pdf): International Energy Agency & International Renewable Energy Agency <www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Mar/Perspectives_for_the_Energy_Transition_2017_Executive_Summary.pdf?la=en&hash=7FCE69C6C62EA63EBC400A85F1E0BEEBBC7A63E7>.

aligning with a cost-effective 1.5°C pathway would require global emissions to decrease by 7.6 percent each year between 2020 and 2030.[17]

Instead of peaking or decreasing, however, global emissions have increased by an average of 1.5 percent per year over the last decade.[18] International coordination is critically needed to determine how to allocate emissions amongst states to right this trajectory and ensure that a global carbon budget under 1.5°C pathways are not quickly exhausted. Such a suggestion, however, raises the contentious question of *how* to distribute emissions amongst states. The IPCC states that "an equitable [international] regime with fair burden sharing is likely to be a key condition for an effective global response".[19]

In recent years, Canada's total national emissions have also increased on a net basis, despite federal commitments to decrease emissions. Since setting its first emissions reduction target 28 years ago, Canada's national emissions have, in fact, increased by 116 million tonnes of Co2eq.[20] From 2010 to 2017, Canada's total emissions grew by 23 million tonnes of Co2eq.[21] As Canada is the tenth highest-emitting state today,[22] its failure to reduce emissions impedes global mitigation efforts.

Canada's present emissions reductions target is to reduce emissions by 30 percent below 2005 levels by 2030.[23] When this target was set by the federal government in May 2015, it was already considered "less than what is deemed necessary by the Intergovernmental Panel on Climate Change (IPCC) to avoid the catastrophic consequences of global warming."[24] Today,

17 UNEP, "Emissions Gap Report 2019", *supra* note 9 at xiii.
18 *Ibid at xiv.*
19 IPCC, "Sustainable Development and Equity", *supra* note 17 at 291.
20 Government of Canada, "GHG Emissions", *supra* note 11.
21 *Ibid.*
22 Statista, *supra* note 13.
23 Environment and Climate Change Canada, *Canadian Environmental Sustainability Indicators: Progress towards Canada's greenhouse gas emissions reduction target* (Gatineau: Environment and Climate Change Canada, 2020) at 5, online: *Government of Canada* <www.canada.ca/content/dam/eccc/documents/pdf/cesindicators/progress-towards-canada-greenhouse-gas-reduction-target/2020/progress-ghg-emissions-reduction-target.pdf> [Environment and Climate Change Canada, "Canadian Environmental Sustainability"].
24 Davidson & Shah, *supra* note 15.

such a target is utterly inconsistent with the "rapid and far-reaching transitions" called for by the IPCC to attempt to limit global warming to 1.5°C.[25]

This paper uses several equity approaches to consider what might comprise Canada's "fair" emissions reduction target. It should be noted that the "fair" targets proposed in this paper do not consider emissions for which Canada is responsible for, but for the fact that they occur outside of Canada's borders (neither does Canada's present emissions reduction target). For instance, the full life-cycle emissions of products that are produced in Canada but are then used outside of Canada, such as exported oil and gas, are excluded, as are the overseas operating emissions of Canadian companies. The inclusion of these emissions would render Canada responsible for a much larger portion of the global mitigation burden, creating even more ambitious targets than those proposed in this paper.

Section II of this paper discusses several qualities of climate change that render it an extraordinarily difficult problem and emphasizes both the importance of a climate justice lens in considering climate solutions and the pivotal need for fair mitigation responses to climate change. It then examines the extent to which climate justice, equity and effort-sharing approaches have been considered in the international climate change regime as well as in states' domestic commitments to detail the current level of incorporation of these principles.

After providing scoping and methodology considerations in Section III, this paper details Canada's present and projected emissions, as well as its emissions reduction target, in Section IV. This information is useful to compare against "fair share" considerations. Section V summarizes the equity approaches that will be used in Section VI to consider Canada's fair emissions reduction target.

Section VI presents the findings of a literature review on Canada's fair emissions reduction target, which includes two dated studies which allow for higher atmospheric concentrations that would not limit warming to 1.5°C as well as three studies which comply with

[25] IPCC, "Summary for Policymakers 2018", *supra* note 1 at 17.

1.5°C pathways. Every "fair" target suggested by these five studies is significantly more ambitious than Canada's present emissions reduction target. At minimum, these proposed targets call for Canada to nearly double its emissions reduction target, however, multiple suggested targets call for Canada to reach net-zero emissions by 2030 *and* undertake mitigation efforts to further reduce emissions beyond its own borders. The level of ambition required by Canada to meet any of these proposed "fair" targets is incompatible with Canada's projected continuation and expansion of fossil fuel production (as discussed in Section IV of this paper).

Section VII highlights several strategies to work towards setting and meeting fair emissions reduction targets in Canada, Section VIII concludes this paper, and Section IX contains an Appendix.

II. Climate Justice: Why Fairness Matters

A pivotal injustice of climate change is the way in which it disproportionately impacts those who have least contributed to the problem and are often "least well placed to respond", while those largely responsible for the problem are "by virtue of their wealth and/or access to resources, most insulated from it."[26] Climate change also differs from other instances of historical injustice due to the multi-generational lag between its cause and effects, the fact that the "wrongdoing" committed is "only wrongful when done excessively", and that this "wrong" was not committed by a specific generation or community.[27]

Using a climate justice lens to inform climate policies can help remedy these imbalances.[28] There are three major tenets of climate justice: distributive justice, procedural justice, and compensatory justice. This paper focuses on the first aspect, which may examine "equal rights to protection from climate impacts, equal entitlements to property rights over atmosphere space, and equal division of climate policy costs."[29] While largely outside the scope

[26] "Achieving Justice and Human Rights in an Era of Climate Disruption: International Bar Association Climate Change Justice and Human Rights Task Force Report" (July 2014) at 2, online (pdf): *International Bar Association* <www.ibanet.org/PresidentialTaskForceClimateChangeJustice2014Report.aspx>.
[27] Lukas H Meyer & Dominic Roser, "Climate justice and historical emissions" (2010) 13:1 Crit Rev Intl Soc & Pol Phil 229 at 230.
[28] International Bar Association, *supra* note 43 at 3.
[29] Sonja Klinsky & Hadi Dowlatabadi, "Conceptualizations of justice in climate policy" (2009) 9:1 Clim Pol'y 88 at 92.

of this paper, procedural and compensatory justice are equally important components of climate justice. Procedural justice focuses on the representation of stakeholders in decision-making processes,[30] while compensatory justice promotes the use of reparations for those whose interests have been impaired by others.[31]

The following section details why a climate justice lens is aptly-suited for considering actions and responses to climate change. After outlining how climate justice and equity have been incorporated in international climate negotiations, this paper will stress the inadequacy of current domestic commitments to illustrate the rationale for invoking climate justice arguments to compel more ambitious domestic emissions reduction targets.

A. The Nature of the Problem

1. The externality of GHG emissions

Climate change is the epitome of a "wicked problem", defined by Knutti and Rogelj as "a tangle of causes and effects, all interconnected, loaded with uncertainties, involving stakeholders with different views".[32] One particularly challenging aspect of climate change is the borderless nature of its impacts. While each unit of a specific emission equally contributes to global average temperature warming regardless of where it was emitted, the impacts of that emission are not conveniently limited to the emitter. These impacts target human and social systems, which, in turn, infringe several fundamental human rights including the right to life, food and to be free from hunger, water, culture, property, adequate and safe housing, education, work and self-determination, as well as women, children, and Indigenous people's rights. [33]

A small number of countries were responsible for the vast majority of cumulative emissions in our atmosphere: the United States ("US") alone has produced one-quarter of

[30] Harriet Bulkeley et al, "Climate justice and global cities: Mapping the emerging discourses" (2013) 23 Glob Envtl Change 914 at 917.
[31] Klinsky & Dowlatabadi, *supra* note 46 at 90.
[32] Reto Knutti & Joeri Rogelj, "The legacy of our Co2 emissions: a clash of scientific facts, politics and ethics" (2015) 133: Climatic Change 361 at 362.
[33] The Mary Robinson Foundation, *supra* note 32 at 14.

cumulative global emissions since 1750.[34] Three-quarters of global annual emissions today are produced by a mere twenty nations, including Canada.[35] The brunt of impacts from the global warming caused by those emissions, however, are felt predominantly by the world's poorer half of the population, who produce only one-tenth of global annual emissions.[36]

2. The distribution of climate impacts

A multitude of factors render many developing countries distinctly vulnerable to climate change's impacts. For instance, altered weather patterns can create droughts and flooding, compromising the sustainability of agricultural crops and forestry—resources which "1.2 billion people who live in extreme poverty heavily rely on."[37] Changing environmental conditions may displace populations, reduce access to resources, damage or destroy wildlife and human habitats and communities, erode shorelines, and impact subsistence activities.[38] The International Bar Association's ("IBA") comprehensive report on "Achieving Justice and Human Rights in an Era of Climate Disruption" detailed that "it is the developing nations and their peoples who stand to suffer the most extreme consequences of rising sea levels, rising temperatures, and other human-induced environmental shifts."[39]

A global index ranking countries' vulnerability to climate change confirms that developing countries are the most vulnerable, ranking the following countries as the most vulnerable in the year 2017: Somalia, Niger, Solomon Islands, Chad, Micronesia, Guinea-Bissau, Sudan, Liberia, Mali, and Eritrea.[40] The IPCC states that the most severe impacts of

[34] David R Boyd, *Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment*, UNGA 74th Sess UN Doc A/74/161 (2019) at para 14.

[35] These nations are (in diminishing order) China, the United States, India, Indonesia, the Russian Federation, Brazil, Japan, Canada, Germany, the Islamic Republic of Iran, Mexico, the Republic of Korea, Saudi Arabia, South Africa, Australia, the United Kingdom, Nigeria, Argentina, Zambia and Thailand. See *Ibid* at para 14.

[36] *Ibid* at para 13.

[37] International Bar Association, *supra* note 43 at 41.

[38] *Ibid* at 41.

[39] *Ibid* at 45.

[40] The Notre Dame Global Adaptation Initiative's Vulnerability Ranking assesses exposure to hazards, sensitivity to impacts of hazards, and adaptive capacity across six life-supporting sectors (health, food, ecosystems, human habitat, water, and infrastructure) to determine the "[p]ropensity or predisposition of human societies to be negatively impacted by climate hazards." See C Chen et al, "University of Notre Dame Global Adaptation Index Country Index Technical Report" (November 2015) at 3, online (pdf): *ND-GAIN* <gain.nd.edu/assets/254377/nd_gain_technical_document_2015.pdf>; "Rankings" (last visited 3 November 2019), online: *Notre Dame Global Adaptation Initiative* <gain.nd.edu/our-work/country-index/rankings/>.

approximately 1.5°C of global warming "are projected for urban areas and some rural regions in sub-Saharan Africa and Southeast Asia."[41]

In addition to inter-country inequalities, the distribution of climate impacts within a country—whether developed or developing—is also skewed. As Islam and Winkel note in their 2017 paper on "Climate Change and Social Inequality", a "vicious cycle" exists, "whereby *initial* inequality makes disadvantaged groups suffer *disproportionately* from the adverse effects of climate change, resulting in greater *subsequent* inequality."[42] In countries that span a large area or encompass several geographic regions, the distribution of impacts may also vary. For instance, Northern Canada is warming at a quicker rate than the rest of Canada: from 1948 to 2016, it is estimated that mean annual temperatures increased 2.3°C in northern Canada, as opposed to 1.7°C in Canada as a whole.[43]

The distribution of impacts is not simply skewed within or between geographic states, however. In a 2019 report to the UN General Assembly, UN Special Rapporteur on Human Rights and the Environment David Boyd detailed how "[c]limate change interacts with poverty, conflict, resource depletion and other factors to cause or exacerbate food insecurity, loss of livelihoods, infrastructure breakdown and loss of access to essential services including electricity, water, sanitation and health care."[44]

As Boyd notes, climate change disproportionately affects poor populations. Researcher Sam Barrett explains: "[e]xposure and sensitivity to physical events is driven by manifestations of poverty and underdevelopment... whereby poor education, health infrastructure and

[41] IPCC, "Impacts of 1.5°C global warming on natural and human systems" in V Masson-Delmotte et al, eds, *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-industrial Levels & Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, & Efforts to Eradicate Poverty* (Geneva, Switzerland: World Meteorological Organization, 2018) 177 at 244.
[42] S Nazrul Islam & John Winkel, *Climate Change and Social Inequality*, UNDESA Working Paper ST/ESA/DWP/152 (2017) 1 at 2 (emphasis in original).
[43] Xuebin Zhang et al, "Temperature and Precipitation Across Canada" in E Bush & D S Lemmen, eds, *Canada's Changing Climate Report* (Ottawa: Government of Canada, 2019) 112 at 116, online (pdf): *Government of Canada* <changingclimate.ca/site/assets/uploads/sites/2/2018/12/CCCR-Chapter4-TemperatureAndPrecipitationAcross Canada.pdf>.
[44] Boyd, *supra* note 51 at para 7.

governance structures magnify adverse consequences".[45] Academics Anna Kaijser & Annica Kronsell agree that "those most exposed and vulnerable to the adverse impacts of climate change are poor and marginalised people living particularly in low-income areas."[46] Boyd warns that climate impacts could drive an additional 100 million people into extreme poverty by 2030.[47]

Climate change also disproportionately impacts women and girls around the world. In 2018, the Committee on the Elimination of Discrimination against Women released a General Recommendation to address "Gender-related dimensions of disaster risk reduction in the context of climate change",[48] in which they noted that many women and girls experience greater climate change and disaster-related risks, burdens and impacts.[49] For instance, McLeod, Rall and Barr detail how climate change may exacerbate the rate of child marriage in countries where child marriage already takes place.[50] Other examples of climate change's disproportionate impact on women and girls were noted by Human Rights Watch in a submission to the Committee on the Elimination of Discrimination against Women, and include:

- Gender discrimination creating disadvantages in obtaining humanitarian assistance and climate adaptation funding or claiming reparations for harms resulting from climate change;
- Women and girls, who are often responsible for securing water, fuel and food for their families, experiencing new obstacles due to climate change; and
- The spreading of diseases that disproportionately impact women.[51]

[45] Sam Barrett, "Local level climate justice? Adaptation finance and vulnerability reduction" (2013) 23 Global Envtl Change 1819 at 1819. Barrett is a researcher with the International Institute for Environment and Development.
[46] Anna Kaijser & Annica Kronsell, "Climate change through the lens of intersectionality" (2014) 23:3 Envtl Pol 417 at 418.
[47] Boyd, *supra* note 51 at para 7.
[48] Committee on the Elimination of Discrimination against Women, *General Recommendation No. 37 on Gender-related dimensions of disaster risk reduction in the context of climate change*, CEDAW/C/GC/37 (2018).
[49] *Ibid* at para 2. For further information about gendered impacts of climate change, see: Fatma Denton, "Climate change vulnerability, impacts, and adaptation: Why does gender matter?" (2002) 10:2 Gender & Dev 10.
[50] Christie McLeod, Heather Barr & Katharina Rall, "Does Climate Change Increase the Risk of Child Marriage: A Look at What We Know - And What We Don't - With Lessons from Bangladesh and Mozambique" (2019) 38:1 Colum J Gender & L 96.
[51] Human Rights Watch, "Submission to the Committee on the Elimination of Discrimination against Women on "Gender-Related Dimensions of Disaster Risk Reduction and Climate Change"" (2016) at 3-9, online (available for download): *United Nations Human Rights Office of the High Commissioner* <www.ohchr.org/EN/HRBodies/CEDAW/Pages/ContributionsClimageChange.aspx>.

In Canada, many Indigenous peoples' dependency on the land for food and practicing cultural traditions and activities also renders them disproportionately vulnerable to the impacts of climate change. These impacts may include altered migratory patterns of wildlife, new pests, thinning sea ice, and increasingly unpredictable weather patterns.[52]

3. The need for common but differentiated responsibilities

The international climate change regime has a longstanding commitment to the principle of common but differentiated responsibilities ("CBDR"), which sets forth varying commitments for states based upon "specific national and regional development priorities, objectives and circumstances."[53] Principle Seven of the 1992 Rio Declaration states that

> [i]n view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit to sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.[54]

This language was modelled in the UN Framework Convention on Climate Change ("UNFCCC").[55] The Paris Agreement also echoes this language.[56]

While developing countries have not historically been held to the same mitigation standard as developed countries, developing countries will not be able to stimulate economic development through unencumbered emitting in the same way developed countries have historically acted. Instead, their emissions will need to peak while most of their citizens strive to sustain or improve their means of support and increase their standard of living.[57] As ActionAid et al note, "[p]oorer countries are now given no choice but to shift to alternative development

[52] Robert B Gibson et al, "From Paris to Projects: Clarifying the implications of Canada's climate change mitigation commitments for the planning and assessment of projects and strategic undertakings" (January 2019) at 16, online (pdf): *Metcalf Foundation* <uwaterloo.ca/paris-to-projects/sites/ca.paris-to-projects/files/uploads/files/p2p_full_report_23jan19.pdf>.
[53] UNFCCC, *supra* note 5**,** art 4(1).
[54] *Rio Declaration on Environment and Development*, 13 June 1992, A/CONF 151/26 (vol 1), Principle Seven.
[55] UNFCCC, *supra* note 5**,** art 3(2).
[56] UNFCCC, "Adoption of Paris", *supra* note 3**,** art 2(2).
[57] The Mary Robinson Foundation, *supra* note 32 at 20.

trajectories at an incredibly rapid pace if the world is to avoid catastrophic climate change."[58]

Although the finite global carbon budget forces developing countries to quickly transition to a low-carbon economy, technological advances may permit these countries to reach similar levels of development with lower emissions than countries who undertook such development earlier.[59]

4. The multi-generational dilemma

About half of the carbon dioxide ("Co2") emissions emitted each year are absorbed by the Earth's forests, oceans, and other ecosystems,[60] while the remaining emissions accumulate in the atmosphere. According to Knutti & Rogeli, approximately 15 to 40 percent of this carbon remains in the atmosphere for more than 1000 years.[61] This means that "[m]ost aspects of climate change will persist for many centuries, even if emissions are stopped".[62]

Past generations reaped the benefits of partaking in emission-generating activities which have already induced an estimated 1.1°C of global temperature warming above pre-industrial levels.[63] The world now faces the consequences of their actions, just as future generations will similarly bear the brunt of the impacts caused by the emissions of those who came before them. This concept violates the principle of intergenerational equity, which advocates "that all generations have an equal place in relation to the natural system, and that there is no basis for preferring past, present or future generations in relation to the system."[64] Intergenerational equity calls on each generation to ensure that future generations enjoy equal access to the planet's

[58] ActionAid et al, "Fair Shares- A Civil Society Equity Review of INDCs" at 7, online (pdf): *Civil Society Review* <civilsocietyreview.org/wp-content/uploads/2015/11/CSO_FullReport.pdf>.
[59] Niklas Höhne et al, "Assessing the ambition of post-2020 climate targets: a comprehensive framework" (2018) 18:4 Climate Pol'y 425 at 432 [Höhne et al, 2018].
[60] NOAA Headquarters, "Earth still absorbing about half carbon dioxide emissions produced by people: study" (1 August 2012), online: *Phys.org* <phys.org/news/2012-08-earth-absorbing-carbon-dioxide-emissions.html>.
[61] Knutti & Rogelj, *supra* note 49 at 362.
[62] "Climate Change" (last visited November 3 2019), online: *United Nations* <www.un.org/en/sections/issues-depth/climate-change/>.
[63] World Meteorological Organization, *supra* note 20.
[64] Edith Brown Weiss, "In Fairness to Future Generations and Sustainable Development" (1992) 8:1 Am U Intl L Rev 19 at 20.

resources,[65] while intragenerational equity calls for equitable access to resources between members of the same generation.[66]

Intergenerational and intragenerational equity are pivotal components of climate justice, given that future generations typically lack a political voice in decision-making processes. The former UN Secretary-General Ban Ki-moon noted that the representation of future generations' interests is "limited to the vicarious concern of present generations".[67] The Intergenerational Climate Coalition's factum in the recent Ontario Court of Appeal case regarding the constitutionality of the *Greenhouse Gas Pollution Pricing Act* stated that "[d]ue to decisions made before they were born or able to vote, they [Canadian children] will live their entire lives under the mounting environmental, economic, and health stresses caused by GHG emissions."[68]

Recognizing the inadequacy of present government climate action, youth around the world have raised their voices to seek government accountability. A class action lawsuit was recently brought against the Canadian government to address their failure in adopting adequate emissions targets and measures to limit global warming to 1.5°C.[69] While the Quebec Superior Court dismissed the class action certification (disagreeing with the age limits of the proposed class), the Judge importantly noted that the issues raised were justiciable.[70]

In October 2019, fifteen youth from across Canada also filed a lawsuit at the Federal Court alleging that the Federal government's conduct regarding climate change violates their

[65] *Ibid* at 21.
[66] "Intragenerational equity" (last visited 14 October 2019), online: *InforMEA* <www.informea.org/en/terms/intragenerational-equity>.
[67] UN Secretary-General, *Report on Intergenerational Solidarity and the Needs of Future Generations*, UNGA 68th Sess, UN Doc A/68/x (2013) at para 5.
[68] *Reference re Greenhouse Gas Pollution Pricing Act*, 2019 ONCA 544 (Factum of the Intergenerational Climate Coalition at para 7) [Pollution Pricing Reference, ICC Factum].
[69] Environnement Jeunesse c Procureur Général du Canada (2019), 2019 QCCS 2885 (Canlii) (Motion for Authorization to Institute a Class Action and Obtain the Statut of Representative: Unofficial Translation at 2.80) [EnJeu, "Motion for Authorization"]. For further discussion of this lawsuit and other youth-led climate suits, see Section VII of paper.
[70] Michael P Theroux, Laura M Gill & Stephanie Gagne, "Quebec's Superior Court Leaves the Door Open to Canadian Climate Change Litigation" (1 August 2019), online: *Bennett Jones* <www.bennettjones.com/Blogs-Section/Quebecs-Superior-Court-Leaves-the-Door-Open-to-Canadian-Climate-Change-Litigation?utm_source=Mondaq&utm_medium=syndication&utm_campaign=View-Original>.

Charter-protected rights to life, liberty and security of the person, and equality.[71] These cases are discussed further in Section VII of this paper.

B. Climate Justice, Equity & a Fair Share Approach

1. Equity & Fair Shares

The IPCC's fifth assessment report notes that while "climate change is a classic commons problem", the 'commoners' are far from equal in terms of "contribution to climate change (past and present), in vulnerability to the impacts of climate change, in capacity to mitigate the problem, and in power to decide on solutions".[72]

Limiting warming to 1.5°C results in a finite limit to the level of permissible global emissions. With such a limit, every tonne of gas emitted in one country is one less tonne that can be emitted in other countries.[73] An equitable system of emissions allocation is thus needed to fairly distribute this carbon budget.

Knutti & Rogelj liken this question of distribution to the allocation of a pie to a group of children:

> How would we distribute a pie between ten kids in a fair way? One would probably give a tenth to each. However, imagine two kids have eaten two thirds of the pie, and we can only distribute the rest. The two who already ate much want more, because they are addicted. The others want the rest because they are hungry. Some argue they should get compensation in the form of other sweets because there is not much left. What would now be a fair distribution? Already in this simple example, different interpretations of fairness can be defended... The problem we are facing is similar... Much of the CO_2 budget... has already been emitted in the past, and how the remainder should be distributed is debated. The challenge is to find a 'fair' allocation of the remaining carbon budget, between countries, between people within a country, and over time.[74]

[71] "15 Canadian youth launch Canada's first federal youth climate lawsuit to protect their charter and public trust rights" (25 October 2019), online: *David Suzuki Foundation* <davidsuzuki.org/press/15-canadian-youth-launch-canadas-first-federal-youth-climate-lawsuit-to-protect-their-charter-and-public-trust-rights/>; *La Rose et al v Canada (Attorney General)* (Statement of Claim to the Defendants), online: <davidsuzuki.org/wp-content/uploads/2019/10/Statement-of-Claim-2019-10-25-FILED.pdf> [La Rose et al, "Statement of Claim"].
[72] IPCC, "Sustainable Development and Equity", *supra* note 17 at 295.
[73] *Reference re Greenhouse Gas Pollution Pricing Act*, 2019 ONCA 544 (Factum of the Intervenor, the Attorney General of British Columbia, at para 11).
[74] Knutti & Rogelj, *supra* note 49 at 367.

2. Climate justice, Equity & Fair Shares in the International Climate Change Regime

Considerations of equity and climate justice have permeated climate change discussions since its emergence on the international agenda. For instance, the IPCC's first assessment report, released in 1990, noted that key issues of climate change included "how to address equitably the consequences for all" and "whether obligations should be equitably differentiated according to countries' respective responsibilities for causing and combating climate change and their level of development".[75]

The UNFCCC, created during the 1992 Earth Summit in Rio de Janeiro, acknowledged that parties should take climate action "on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities".[76] Calling on developed countries to "take the lead in combating climate change and the adverse effects thereof",[77] the Convention mandated that policies and measures "take into account different socio-economic contexts"[78] and fully consider the "specific needs and special circumstances of developing country Parties".[79] While developed countries committed to limiting emissions,[80] the emissions of developing countries would be permitted to "grow to meet their social and development needs".[81]

Although this Convention shifted the mitigation burden to developed countries, it was still unclear as to how this burden should be equitably shared amongst these nations. Lasse Ringius, Asbjørn Torvanger & Bjart Holtsmark state that equitable burden sharing amongst the Organisation for Economic Co-operation and Development ("OECD") countries was a key issue in the climate negotiations that occurred from 1995 to 1997.[82] While some developed countries called for equal emissions reductions—either through an equal percentage of reductions or in

[75] As stated in IPCC, "Sustainable Development and Equity", *supra* note 17 at 289.
[76] UNFCCC, *supra* note 5, art 3.1.
[77] *Ibid*, art 3.1.
[78] *Ibid*, art 3.3.
[79] *Ibid*, art 3.2.
[80] *Ibid*, art 4.2(a).
[81] *Ibid*, Preamble.
[82] Lasse Ringius, Asbjørn Torvanger & Bjart Holtsmark, "Can multi-criteria rules fairly distribute climate burdens?" (1998) 26:10 En Pol'y 777 at 777.

alignment with a country's level of emissions in a certain base year—other countries focused on an equitable distribution of abatement costs.[83]

Adopted in 1997, the Kyoto Protocol assigned emission allowances for developed countries, calling on them to reduce their emissions of certain gases by a minimum of 5 percent below 1990 levels by 2008 to 2012.[84] These states were also called to implement measures "in such a way as to minimize adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties".[85]

The fourth IPCC assessment report, released in 2007, sought to advance the deliberation of equitable national climate responses. The third volume in this report included a now-infamous "Box 13.7" (reproduced below) which used a 2°C pathway to create emissions reduction targets for Annex I and Non-Annex I countries.

Figure One: Reproduction of Box 13.7[86]

Box 13.7 The range of the difference between emissions in 1990 and emission allowances in 2020/2050 for various GHG concentration levels for Annex I and non-Annex I countries as a group[a]

Scenario category	Region	2020	2050
A-450 ppm CO_2-eq[b]	Annex I	–25% to –40%	–80% to –95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Centrally-Planned Asia	Substantial deviation from baseline in all regions
B-550 ppm CO_2-eq	Annex I	-10% to -30%	-40% to -90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
C-650 ppm CO_2-eq	Annex I	0% to -25%	-30% to -80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and MIddle East, East Asia

[83] *Ibid* at 777.
[84] *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, 11 December 1997, UN Doc FCCC/CP/1997/7/Add.1 (entered into force 16 February 2005), art 3.1.
[85] *Ibid*, art 2.3.
[86] S Gupta et al, "Policies, Instruments and Co-operative Arrangements" in Bert Metz et al, eds, *Climate Change 2007 Mitigation: Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom: Cambridge University Press, 2007) 745 at 776.

At the UNFCCC Conference of the Parties ("COP") in 2007, the European Union ("EU"), G77[87] and several environmental non-governmental organizations ("ENGOs") advocated that this Box's key conclusion—that Annex I countries must reduce their emissions by 25 to 40 percent below 1990 levels by 2020—should ground negotiations leading up to the 2009 COP meeting. As Bård Lahn states, "drawing on the scientific credibility of the IPCC, the numbers came to represent 'what science says' that countries should do."[88]

Soon after the 2007 COP, however, the authors of this box, Michel den Elzen and Niklas Höhne, published a paper expanding on their methodology,[89] which revealed that these figures had been informed by "a wide range of different burden-sharing proposals in the existing literature—some of which were mutually excluding, and some of which were strongly opposed by countries in the UNFCCC negotiations."[90] Den Elzen and Höhne's paper also quantified the "substantial deviation from baseline" as requiring non-Annex I countries to reduce their emissions by 15 to 30 percent below their baseline levels by 2020.[91] As den Elzen and Höhne presented this information as simply "quantifying what has already been implicitly assumed", some scholars have questioned why these figures were not included in the original box.[92]

With these additional targets for Non-Annex I countries, the Box's acceptance vastly diminished. While many expected the IPCC's fifth assessment report (published in 2014) to update or expand on this box, it instead steered clear of quantifying reduction targets altogether. Lahn & Sundqvist note that "[t]he IPCC seems to have abandoned attempts to establish a scientifically based "fixed point" for equitable sharing of emission reductions between the North and the South, transferring this discussion from the realm of science to the realm of politics."[93] Indeed, the fourth chapter of the fifth assessment report stated that "scientific assessments cannot

[87] The G77 is the "developing countries' negotiating bloc". See Bård Lahn, "In the light of equity and science: scientific expertise and climate justice after Paris" (2018) 18: Intl Envtl Agreements 29 at 34.
[88] *Ibid* at 35. At the time of publication, Lahn was affiliated with the Center for International Climate Research in Oslo, Norway.
[89] Michel den Elzen & Niklas Höhne, "Reductions of greenhouse gas emissions in Annex I and non-Annex I countries for meeting concentration stabilisation targets" (2008) 91: Climatic Change 249.
[90] Lahn, *supra* note 104 at 35.
[91] Den Elzen & Höhne, *supra* note 106 at 260.
[92] Bård Lahn & Göran Sundqvist, "Science as a "fixed point"? Quantification and boundary objects in international climate politics" (2017) 67 Envtl Sci & Pol'y 8 at 12.
[93] *Ibid* at 13.

define what equity is and how equitable burden sharing should be implementing the Convention and climate policies in general".[94]

The *Paris Agreement* was adopted in 2015 and signaled a radical shift from previous climate agreements in its global obligation for states to partake in mitigation efforts. The Agreement calls on all states to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue "efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[95] The Agreement is to "be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances."[96]

While calling for equitable implementation, however, the *Paris Agreement* does not answer the longstanding question of how such implementation is to occur. Peculiarly, the Agreement's preamble notes "the importance for some of the concept of "climate justice", when taking action to address climate change".[97] As Lahn states, "This, of course, begs the question: For whom does justice matter in the global response to climate change? And, perhaps even more intriguing... For whom is justice apparently of no concern at all?"[98]

After the signing of the *Paris Agreement*, many climate activists were hopeful that the Paris Rulebook would provide further insight on how equitable national targets could be established. While the recently-published rulebook affirms that the global stocktake—"the Agreement's main mechanism for assessing countries' differentiated contributions to the common temperature goals"[99]— will assess collective progress "in the light of equity",[100] it does not detail how this assessment will occur.

As such, there is currently no international consensus on how to define, measure or

[94] IPCC, "Sustainable Development and Equity", *supra* note 17 at 291.
[95] UNFCCC, "Adoption of Paris", *supra* note 3, art 2.1(a).
[96] *Ibid,* art 2.2.
[97] *Ibid,* Preamble.
[98] Lahn, *supra* note 104 at 30.
[99] *Ibid* at 31.
[100] *Preparations for the implementation of the Paris Agreement and the first session of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement*, UNFCCC 24th Sess UN Doc FCCC/CP/2018/L.16 (2018) at paras 1-2.

consider equity for national emissions reductions targets, and fair share deliberations have effectively been "relocated from the UNFCCC to national political processes."[101]

3. The Inadequacy of Nationally Determined Contributions

Prior to the 2015 COP meeting in Paris, nearly every state submitted an intended nationally determined contribution ("INDC") proposing national climate action pledges for post-2020. Upon ratification of the *Paris Agreement*, these pledges were converted into nationally determined contributions ("NDCs"), and are to be regularly strengthened in response to the progress made under the Paris Agreement.[102] States are presently being invited to update their NDCs prior to the end of 2020.[103] The global stocktake will commence in 2023 and be held every five years thereafter.

The bottom-up approach in which states set these targets, however, coupled with the lack of guidelines from the UNFCCC regarding indicators or metrics to compose the target, has led to a murky array of commitments. Some NDCs detail a specific amount of emissions reduction, while others provide a reduction range. Many of the commitments are unclear on the sectors covered, the impacts of certain mitigation activities, the base year to measure reductions from, or the accounting practices regarding land use and market instruments.[104] Further, many of the proposed activities in developing countries are conditional upon receiving financial or technological support. This imprecision allows for a variety of possible outcomes, making it difficult to assess and compare commitments.

It is clear, however, that many G20 countries are not on track to meet their 2030 targets.[105] A 2019 study by Michel den Elzen et al examining the G20 members' climate policies against their emissions found that, collectively, the G20 members need to enact additional policies to reduce 2030 GHG emissions by 2.5 billion tonnes and 3.5 billion tonnes of carbon dioxide equivalent ("Co2eq") to meet the targets contained within their unconditional and

[101] Lahn, *supra* note 104 at 36.
[102] UNFCCC, "Adoption of Paris", *supra* note 3, art 14(1).
[103] UNEP, "Emissions Gap Report 2019", *supra* note 9 at xx.
[104] Joeri Rogelj et al, "Paris Agreement climate proposals need a boost to keep warming well below 2 °C" (2016) 534 Nature 631 at 632.
[105] UNEP, "Emissions Gap Report 2019", *supra* note 9 at xvi.

conditional NDCs, respectively.[106] The UN Emissions Gap Report notes that, globally, 4 and 6 billion tonnes of Co2eq are needed to meet unconditional and conditional NDCs, respectively.[107]

Given that the G20 members are together responsible for 78 percent of global annual GHG emissions,[108] their actions are critical in affecting the success of the *Paris Agreement*. It is difficult to assess a country's climate action simply by whether it is meeting its NDC, however, as there was no consensus on equity or mitigation pathways to inform these commitments. As such, a country that is not presently on track to meet its NDC could have a more ambitious target than a state that is on track to meet its commitments.

This bottom-up target-setting approach also failed to ensure that the totality of pledges would be sufficient to limit warming to 1.5°C. The figure below, taken from the UNEP's 2019 Emissions Gap report, illustrates the gaps between global commitments contained in the NDCs and limiting warming to 2°C or 1.5°C. As illustrated, the NDCs would need to commit to 12 to 15 billion tonnes of Co2eq of additional reductions to limit warming to 2°C or 29 to 32 billion tonnes of Co2eq of additional reductions to limit warming to 1.5°C.

Figure Two: Global GHG emissions under different scenarios and the emissions gap in 2030[109]

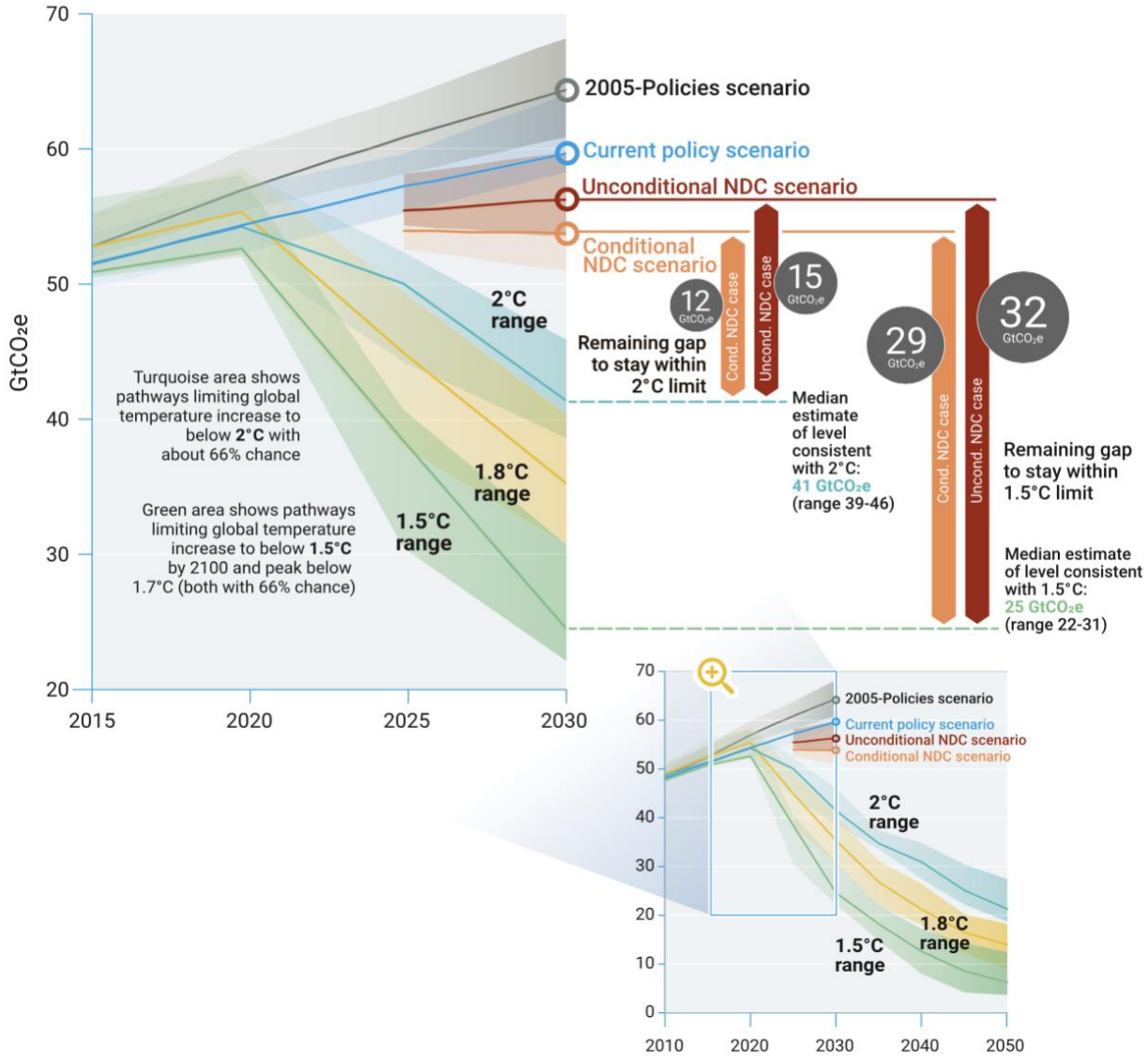
[106] This study examined the non-EU members of the G20 as well as the European Union as a whole. See Michel den Elzen et al, "Are the G20 economies making enough progress to meet their NDC targets?" (2019) 126 Energy Policy 238 at 244.

[107] These are the median figures considered by the UNEP under different scenarios. See UNEP, "Emissions Gap Report 2019", *supra* note 9 at xviii.

[108] *Ibid* at 5.

[109] *Ibid* at 26.

Figure 3.1. Global greenhouse gas emissions under different scenarios and the emissions gap in 2030 (median estimate and 10th to 90th percentile range).



This illustration makes clear the inadequacy of domestic targets to collectively limit warming to 1.5 or 2°C. The Emissions Gap Report warns that implementing the unconditional NDCs (coupled with consistent climate action) would have a 66 percent chance of limiting global average temperature warming to 3.2°C above pre-industrial levels by 2100, and implementing the conditional NDCs would only lower the total warming by 0.2 °C.[110] As these

[110] *Ibid* at xix.

targets were made within the last few years, however, the gap between policies and targets may continue to shrink as additional policies are adopted.[111]

While the global ambition level of states thus needs to drastically increase, neither the *Paris Agreement*, the Paris Rulebook, nor the UNFCCC have determined how to assess national targets in relation to 1.5°C compliant pathways. Is there a fair way to allocate a global carbon budget amongst states?

When submitting NDCs, countries were assigned to explain how their pledge was "fair and ambitious, in light of its national circumstances"[112]—without receiving information on how these terms were defined.[113] Harald Winkler et al studied 163 INDCs to assess how countries considered their contributions to be fair, noting that three levels of substantiation were provided to broadly justify the fairness of a state's commitments.[114] Nearly half the states (75 out of 163) gave no explanation to support their fairness claim, while the other half of states (86 out of 163) supported their claim with work from experts in their own country. Only two states (Nigeria and South Africa) cited the work of experts from other countries in substantiating their fairness claim.[115]

Some states also used specific indicators to support their fairness claims. For example, Winkler et al found that 29 countries quantified an indicator of fairness, such as how their country's emissions contributed to global cumulative or annual emissions.[116] While 96 of the 101 countries that cited having a "small share" of emissions in their NDC each comprise less than 1 percent of annual global emissions, together these 'small-emitting states' contribute 18.2 percent of annual global emissions.[117]

111 Den Elzen et al, *supra* note 123 at 246.
112 *Lima Call for Climate Action*, UNFCCC 1/CP.20 at para 14.
113 UNFCCC, "Adoption of Paris", *supra* note 3, para 27.
114 At the time of publication, Winkler was affiliated with the Energy Research Centre at the University of Cape Town. Harald Winkler et al, "Countries start to explain how their climate contributions are fair: more rigour needed" (2018) 18 Intl Envtl Agreements 99 at 102-3.
115 *Ibid at* 102-3.
116 *Ibid at* 103.
117 *Ibid at* 105.

Surprisingly, the large majority of NDCs analyzed (122 out of 163) did not ground their fairness claim in science. Of the 41 states who did, only 20 states referenced compliance with a 1.5°C or 2°C global target, and only three of these 20 states referred to the global carbon budget put forward in the IPCC's fifth assessment report. Bolivia was the only country to indicate its compliance with an IPCC 1.5°C carbon budget.[118] As Winkler et al concluded, it is particularly concerning that "[n]o OECD countries refer to 1.5 °C as an equity argument."[119]

Without consensus on how to measure equity, a coalition of scientific experts and international civil society organizations considered NDCs in relation to a fair share range to limit temperature warming to 1.5°C.[120] Separating states into "wealthier" and "poorer" countries,[121] they found that "poorer countries' NDCs exceed their fair shares of the needed global mitigation, by a substantial margin and even if only the unconditional components of their NDCs are considered," while "wealthier countries' NDCs fall collectively far short of their fair share of mitigation".[122] This echoes Yann Robiou du Pont et al's findings, who found that the conditional INDCs of most developing countries were more ambitious than the average emissions reduction required under five equity approaches to limit global warming to 2°C.[123]

Wealthier countries' fair share of mitigation often exceeds a plausible level of domestic emissions reduction. To meet their fair share of mitigation, wealthier countries can incorporate financial and technological support for developing countries' mitigation efforts into their commitments. This also helps developing countries, who may lack sufficient means to undertake either their fair share of mitigation or accomplish their full mitigation potential. Holz, Kartha & Athanasiou note, however, that the support from wealthier countries creates a two-pronged

[118] *Ibid at* 103.
[119] *Ibid at* 110.
[120] ActionAid et al, *supra* note 75.
[121] The authors defined "wealthier" countries as those whose fair shares of global mitigation in 2030 were larger than their estimated domestic mitigation potential, while countries deemed "poorer" were those for whom the opposite was true. The authors note that this dichotomy does not match the UNFCCC's division of states into Annex 1 and non-Annex 1 countries. See Christian Holz, Sivan Kartha & Tom Athanasiou, "Fairly sharing 1.5: national fair shares of a 1.5 °C-compliant global mitigation effort" (2018) 18: Intl Envtl Agreements 117 at 129.
[122] *Ibid at* 129.
[123] Yann Robiou du Pont et al, "Equitable Mitigation to achieve the Paris Agreement Goals" (2016) 7 Nature Climate Change 38 at 38 [du Pont et al, 2016]. See Section VI of this paper for more information.

obligation for poorer countries, who are to achieve their fair share of mitigation efforts as well as arrange and accommodate mitigation activities beyond their fair share within their jurisdiction.[124]

These studies illustrate the need for rapid action on two fronts: countries need to act to meet their current targets as well as set more ambitious targets.[125] Xunzhang Pan et al agree, noting that for most countries, "emissions before 2030 exhaust the available [fair share] emissions allowances under the Paris Agreement goals throughout the whole century."[126]

III. Approach & Scope

While equity is fundamentally enshrined in both international and domestic climate commitments, this value has not been meaningfully applied to inform climate policy. Instead of considering how a state can play an equitable role in reducing global emissions, countries' domestic climate commitments are often based on a modest reduction of their national "business-as-usual" emissions.

States bear a wide range of responsibilities regarding the global mitigation burden. This paper predominantly uses the term "developed" countries to refer to the countries who bear the overwhelming responsibility for the emissions that have accumulated in our atmosphere. These countries may also be referenced to as the global North, or alternatively, as Annex I countries (as they were distinguished in previous climate agreements). The remaining states, who bear far less responsibility for contributing to global emissions, are referred to as "developing" countries, the global South, or non-Annex I countries. While these binary divisions and the use of these terms simplify the discussion, the author of this paper acknowledges that these terms can be seen as imposing a Western concept of development to analyze a country. The division between states' level of responsibility is also not this clear. A "developing" country may have high historical emissions, perhaps due to reliance on coal or diesel fuel. Countries once considered

[124] Holz, Kartha & Athanasiou, *supra* note 138 at 131.
[125] UNEP, "Emissions Gap Report 2019", *supra* note 9 at xx.
[126] Xunzhang Pan et al, "Exploring fair and ambitious mitigation contributions under the Paris Agreement goals" (2017) 74 Envtl Sci & Pol'y 49 at 52 [Pan et al, 2017].

"developing", such as China, may also emit significant amounts of greenhouse gases today. For instance, while China's per capita emissions remain quite low, its national emissions comprise 26 percent of global emissions,[127] and are more than the combined emissions of the US and the EU.[128]

Equitable mitigation is also only part of a solution to reconcile the historical and present inequities of climate change. While outside the scope of this paper, responsibility and funding for adaptation measures for those who are and will be disproportionately impacted by climate change is another pivotal climate justice concern. As Chukwumerije Okereke & Philip Coventry note, "adaptation is the highest priority" for many low-income countries, and "has been viewed as the key link between climate change, risk, poverty, and development."[129]

This paper's focus is further narrowed to consider fair share approaches for absolute emissions reductions targets. While some states (and corporations) have set emissions targets to reduce the intensity of their emissions, such metrics do not limit the level of absolute emissions and thus allow the continuation of rising emission levels in our atmosphere.

Canada's fair share emissions reduction target is specifically considered in this paper. Rather than duplicating the works of others, this paper compiles the findings of those who have used a variety of equity approaches to consider or derive fair share emissions allocations or targets for Canada. Through presenting and comparing these findings, the author of this paper hopes to spur further dialogue as to the inadequacy of Canada's current emissions reduction target and encourage law reform to strengthen Canada's target.

In deciding which studies to include and assess within this compilation, several scoping decisions were made, which are laid out in Section III of this paper. Due to the rapid pace of

[127] This figure excludes emissions from land use change. UNEP, "Emissions Gap Report 2019", *supra* note 9 at 5.
[128] Robert Rapier, "China Emits More Carbon Dioxide Than the U.S. and EU Combined" (1 July 2018), online: *Forbes* <www.forbes.com/sites/rrapier/2018/07/01/china-emits-more-carbon-dioxide-than-the-u-s-and-eu-combined/#17a994d628c2>; "Co2 Emissions By Country 2019" (2019), online: *World Population Review* <worldpopulationreview.com/countries/co2-emissions-by-country/>.
[129] Chukwumerije Okereke & Philip Coventry, "Climate justice and the international regime: before, during, and after Paris" (2016) 7 WIREs Clim Change 834 at 842.

climate science and the continued accumulation of emissions in our planet's atmosphere, many older pieces—which were likely cutting-edge at the time of publication—are now outdated and were thus excluded from this analysis. Other pieces were excluded due to the nature of their findings, which did not allow for translation into an emissions reduction target. Two of these studies still provided thoughtful consideration and have been briefly summarized in Section VI of this paper.

This paper relies on scientific information to inform equitable distributions or "fair shares" of the global carbon budget. This reliance is not without flaws, as there are sizable uncertainties regarding the precise carrying capacity of the earth's atmosphere for emissions levels, as well as variability regarding the exact severity, location, timing and frequency of impacts.[130] Science also shields some equitable concerns. For instance, while a 1.5°C pathway will mitigate impacts and thus benefit vulnerable populations, this heightened ambition requires rapid transitions which may exacerbate inequalities. Sonja and Harald present a set of six elements to assess the equity implications of policy actions that are consistent with 1.5°C pathways.[131] These elements emphasize the importance of considering the profile of the pathways that are used to inform emissions reduction targets.

The following section will consider Canada's present-day emissions, its projected emissions, and its current 2030 emissions reduction target to contextualize the importance of setting a fair share emissions reduction target in Canada.

[130] Franziskus von Lucke, "O Justice, Where Art Thou? Developing a New Take on Climate Justice" (April 2017) at 4, online (pdf): *GLOBUS Research Papers* <poseidon01.ssrn.com/delivery.php?ID=984094084082031122101006121122084068102080021061010049073012104118078005022117105098016059027059030017044100099115000093119029043027046041038064116105117112090065070075051121115104093065085020020102113024095079064026122124127028074071103125108084120&EXT=pdf>. At the time of publication, von Lucke was a researcher at the University of Tübingen in Germany. This paper was issued by the ARENA Centre for European Studies in Oslo, Norway.

[131] Sonja Klinsky & Harald Winkler, "Building equity in: strategies for integrating equity into modelling for a 1.5°C world" (2018) 376 Phil Trans Royal Soc 1 at 3-5.

IV. Business-as Usual: Canada's Present & Projected Emissions

A. Where We're At: Canada's Present-Day Emissions

Canada is responsible for 1.7 to 1.8 percent of the cumulative emissions in our atmosphere,[132] and is the tenth highest-emitting state today.[133] In 2017, Canada's total GHG emissions totaled 716 million tonnes of Co2eq.[134] This figure, while a net decrease of 2 percent below Canada's 2005 emissions level,[135] is nearly 19 percent larger than its 1990 emission levels.[136]

Since 2005, Canada's emissions per capita decreased from 22.7 to 19.5 tonnes of Co2eq per capita in 2017.[137] Despite these improvements, Climate Transparency notes that Canada has the highest level of energy-related emissions per capita among G20 members—the G20 average is eight tonnes per person.[138] Canada's federal government states that Canada's high per capita emissions are due to its "size, its climatic conditions, and its energy intensive, resource based economy."[139]

B. Where We Want to Go: Canada's Emissions Reduction Target

Canada has been setting—and failing to meet—emissions reductions targets for nearly 30 years. Consider the following figures:

132 Eric Kemp-Benedict et al, "The Climate Equity Reference Calculator" (2019), online: *Climate Equity Reference Project* <calculator.climateequityreference.org> [Climate Equity Reference Project, "Climate Equity Reference Calculator"].

133 *Statista*, *supra* note 13.

134 "National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada-Part 1" (2019) at 1, online (pdf): *Environment and Climate Change Canada* <publications.gc.ca/collections/collection_2019/eccc/En81-4-2017-1-eng.pdf> [Environment and Climate Change Canada, "2019 National Inventory Report"].

135 *Ibid* at 1.

136 *Ibid* at 11.

137 *Ibid* at 5.

138 "Brown to Green: The G20 Transition to a Low-Carbon Economy-Canada" (2018) at 1, online (pdf): *Climate Transparency* <www.climate-transparency.org/wp-content/uploads/2019/01/BROWN-TO-GREEN_2018_Canada_FINAL.pdf>.

139 "Canada's 7th National Communication and 3rd Biennial Report: Actions to Meet Commitments Under the United Nations Framework Convention on Climate Change" (2017) at 14, online (pdf): *Environment and Climate Change Canada* <unfccc.int/files/national_reports/national_communications_and_biennial_reports/application/pdf/82051493_canada-nc7-br3-1-5108_eccc_can7thncomm3rdbi-report_en_04_web.pdf>.

Table One: Canada's International Climate Commitments[140]

Year	***International Agreement***	***Federal Commitment***	***Canada's Emissions as Reported in Year the Commitment was Made* (Co2eq)**	***Canada's Emission Target Contained in Commitment (Co2eq)***
1992	Rio Earth Summit	Reduce emissions to 1990 levels by 2000	610 million tonnes	613 million tonnes
2005	Kyoto Protocol	Reduce emissions to 6 percent below 1990 levels by 2012	730 million tonnes	576 million tonnes
2010	Copenhagen Accord	Reduce emissions by 17 percent below 2005 levels by 2020	693 million tonnes	620 million tonnes
2015	Paris Agreement	Reduce emissions by 30 percent below 2005 levels by 2030	722 million tonnes	511 million tonnes

As the Commissioner of the Environment and Sustainable Development to the Parliament of Canada notes, "[e]ach federal commitment pushed the timeline for meeting the emission target further into the future."[141] As detailed above, Canada's first emissions target allowed for emission levels in 2000 to total more than the levels both in which the year the target was set (1992) as well as the baseline year (1990, in which total national emissions were reported to be 602 million tonnes of Co2eq).[142] Canada's 2005 target was markedly more ambitious, calling for a 154 million tonne reduction in a seven-year period, which averages to a 22 million tonne reduction each year. In 2010, however, Canada adopted a significantly less ambitious target, calling for a 73 million tonne reduction in emissions over a ten-year period. At this time, Canada

[140] Commissioner of the Environment and Sustainable Development to the Parliament of Canada, "Report 1-Progress on Reducing Greenhouse Gases-Environment and Climate Change Canada" (2017) at Exhibit 1.4, online: *Office of the Auditor General of Canada* <www.oag-bvg.gc.ca/internet/English/parl_cesd_ 201710_01_e_42489. html>; See also Government of Canada, "GHG Emissions", *supra* note 11; Environment and Climate Change Canada, "Canadian Environmental Sustainability", *supra* note 40 at 5.

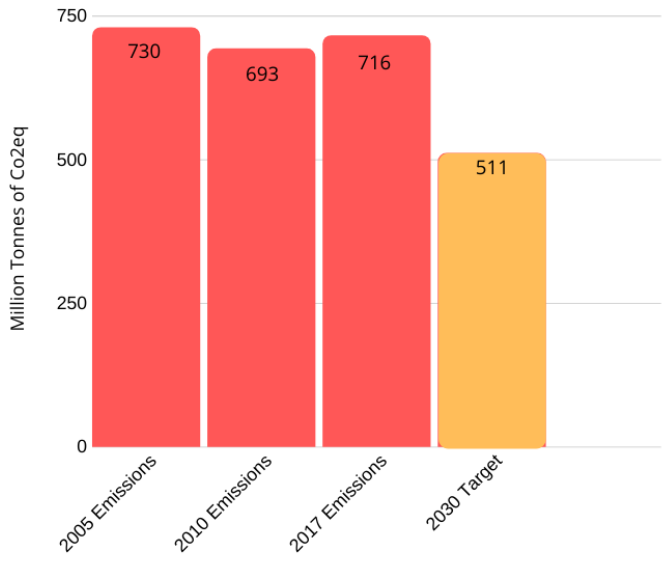
[141] *Ibid.*

[142] *Ibid.*

also changed the baseline year in its target from 1990 to 2005 likely due to the fact that its new target only sought to reduce emissions to two percent *above* 1990 levels.[143]

Canada's most recent commitment was made in May 2015 when the Stephen Harper administration submitted its INDC to the UNFCCC.[144] This target, which calls for emissions to be reduced by 211 million tonnes over a 15-year period (or just over 14 million tonnes each year) is still markedly less ambitious than the pace of reduction set by Canada in 2005. Prime Minister Justin Trudeau has referred to this target as a "floor" or minimum level of ambition to be undertaken,[145] but has not officially strengthened this commitment to date. The following chart illustrates Canada's recent and present emissions alongside its emissions reduction target.

Figure Three: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target[146]



143 While Canada's 2010 target called for emissions to be reduced to 620 million tonnes of Co2, Canada's emissions in 1990 totaled 602 million tonnes of Co2. See Government of Canada, "GHG Emissions", *supra* note 11. See also "Backgrounder: Canada & Climate Change" (14 December 2012), online: *Elizabeth May MP* <elizabethmaymp.ca/publications/backgrounder/2012/12/14/backgrounder-canada-climate-change/>.

144 Government of Canada, "Canada's INDC Submission", *supra* note 14.

145 Bruce Cheadle, "Catherine McKenna says Canada won't set emissions target, Tory targets will be 'floor'" (9 November 2015), online: *CBCNews* <www.cbc.ca/news/politics/catherine-mckenna-paris-talks-tory-target-1.3311482>.

146 Government of Canada, "GHG Emissions", *supra* note 11; Environment and Climate Change Canada, "Canadian Environmental Sustainability", *supra* note 40 at 5.

In 2016, Canada released a Mid-Century Strategy which examined pathways to reduce Canada's emissions by 80 percent below 2005 levels by 2050.[147] During the 2019 election campaign, Justin Trudeau pledged, if re-elected, to introduce a net-zero 2050 emissions reduction target and exceed Canada's 2030 target.[148] As no new climate plan has been released at the time of writing, however, this paper focuses on Canada's existing 2030 emissions reduction target.

C. Where We're Going: Canada's Projected Emissions

In December 2016, Canada adopted the Pan-Canadian Framework on Clean Growth and Climate Change ("Pan-Canadian Framework").[149] This framework is Canada's first climate plan "to include joint and individual commitments by federal, provincial and territorial levels of government".[150] This plan set out two key measures which have been taken to enact a price on carbon pollution in Canada. Firstly, the government allowed each province and territory until the end of 2018 to enact a carbon tax or cap-and-trade system that met its pricing backstop.[151] In 2019, the federal pricing system (*i.e.*, carbon tax) was applied in Ontario, New Brunswick, Manitoba, and Saskatchewan.[152]

Second, an output-based pricing system was developed for large industry actors who report annual emissions of at least 50,000 tonnes of Co2eq. This system charges participants whose emissions exceed a sector-specific allowable annual emissions limit, and awards "surplus"

147 "Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy" (2016) at 1, online (pdf): *Environment and Climate Change Canada* <unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf>.
148 For more information on this pledge, see Section VII of paper.
149 "Pan-Canadian Framework on Clean Growth and Climate Change: Canada's Plan to Address Climate Change and Grow the Economy" (2016), online: *Government of Canada* <www.canada.ca/content/dam/themes/environment/documents/weather1/20161209-1-en.pdf>.
150 Environment and Climate Change Canada, "2019 National Inventory Report", *supra* note 151 at 2.
151 "Pan-Canadian Approach to Pricing Carbon Pollution" (last modified 3 October 2016), online: *Government of Canada* <www.canada.ca/en/environment-climate-change/news/2016/10/canadian-approach-pricing-carbon-pollution.html>.
152 "Government of Canada fighting climate change with price on pollution" (23 October 2018), online: *Justin Trudeau, Prime Minister of Canada* <pm.gc.ca/en/news/news-releases/2018/10/23/government-canada-fighting-climate-change-price-pollution>.

credits to participants who emit less than their annual limit, which can be saved for future use or traded to other participants.[153]

Despite these efforts—and Canada's other existing climate policy measures—Canada is not on track to meet its 2030 target of 511 million tonnes of Co2. Environment and Climate Change Canada uses two cases to estimate Canada's projected emissions reduction:

- The "Reference" case includes policies implemented since 2015, such as a quickened phase out of coal-fired electricity and methane regulations, but assumes no further policies as of September 2018. This scenario leads to emission levels of 701 million tonnes of Co2eq in 2030; and
- The "Additional Measures" case, which includes policies that have been announced (including under the Pan-Canadian Framework) but have not been fully implemented. This case results in emission levels of 616 million tonnes of Co2eq in 2030.[154]

Neither policy trajectory will reduce Canada's emissions to the extent needed to meet its 2030 target. Environment and Climate Change Canada predicts that Canada's emissions in 2030 will exceed our emissions target by approximately 93 or 178 million tonnes of CO2eq for the "Reference" and "Additional Measures" cases, respectively.[155] An additional 93 million tonnes, however, is more than all of Quebec's emissions in 2017.[156] In its annual Emissions Gap Report, the UNEP states that only half of the G20 members are currently projected to achieve the targets expressed in their NDCs.[157]

153 Andrew T R Chachula, Sarah E Gilbert & Thomas W McInerney, "New Details on Application of Federal Carbon-Pricing Backstop" (6 November 2018), online: *Bennett Jones* <www.bennettjones.com/Blogs-Section/New-Details-on-Application-of-Federal-Carbon-Pricing-Backstop>.

154 "2018 Canada's Greenhouse Gas and Air Pollutant Emissions Projections" (2018) at vi, online (pdf): *Environment and Climate Change Canada* <publications.gc.ca/collections/collection_2018/eccc/En1-78-2018-eng.pdf> [Environment and Climate Change Canada, "2018 Canada Projections"].

155 *Ibid*; Government of Canada, "GHG Emissions", *supra* note 11.

156 *Ibid*; Barry Saxifrage, "Canada's climate gap widens yet again" (30 January 2019), online: *National Observer* <www.nationalobserver.com/2019/01/30/analysis/canadas-climate-gap-widens-yet-again>.

157 The countries currently projected to fall short of achieving their targets are Australia, Brazil, Canada, Japan, the Republic of Korea, South Africa and the United States. The report notes that it is not possible to say whether another three member states (Argentina, Indonesia and Saudi Arabia) are on track to meet their commitments. See UNEP, "Emissions Gap Report 2019", *supra* note 9 at xvi.

While Canada is not on track to meet its 2030 target, simply meeting this target would not fulfill Canada's commitments under the Paris Agreement to limit warming to 2°C and strive to limit warming to 1.5°C. Additional efforts must also be pursued to bridge the gap between Canada's present target and its international climate commitments. Although this paper critiques Canada's emissions target based on burden sharing or "fair" approaches, Höhne et al note that there are several other ways to assess the ambition of states' NDCs.[158]

D. What's Holding Us Back: The Oil & Gas Sector

According to Canada's 2019 National Inventory Report, oil sands emissions have increased by 420 percent since 1990.[159] Recalling that Canada has been setting emissions reduction targets since 1992, consider how the oil and gas sector's emissions have grown since this time:

Table Two: Canada's Oil and Gas Sector Emissions (Co2eq)[160]

Year	***Total Oil & Gas Sector Emissions***	***Canada's Total Emissions***	***Total Oil & Gas Sector Emissions as a Percent of Canada's Total Emissions***
1992	113.5 million tonnes	610 million tonnes	18.6%
2005	157.5 million tonnes	730 million tonnes	21.6%
2017	194.5 million tonnes	716 million tonnes	27.16%

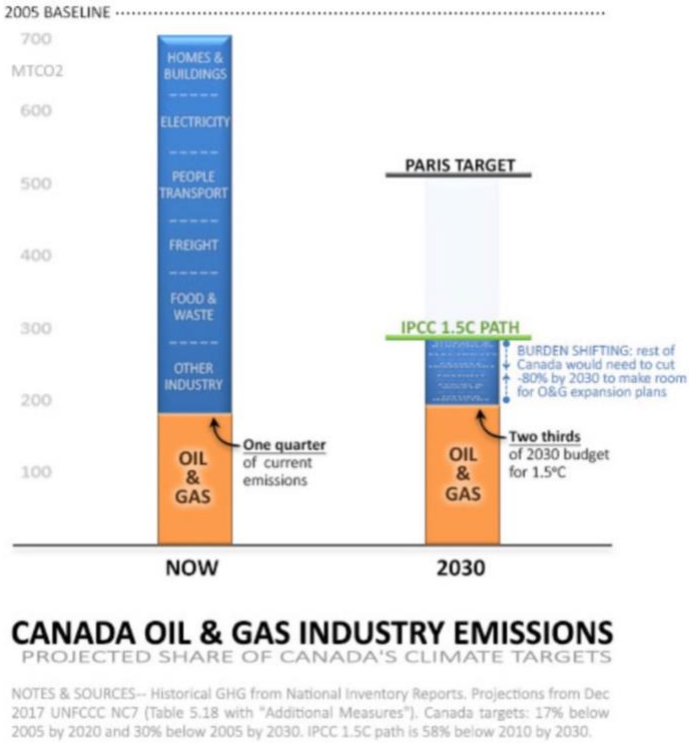
As shown in the above table, Canada's oil and gas sector's total emissions increased by 71 percent between 1992 and 2017. This sector has also grown to represent a larger proportion of Canada's total emissions during this time, and is presently the highest-emitting economic sector in Canada.[161] The oil and gas sector is projected to contribute 211 million tonnes of Co2eq to

[158] Höhne et al divide possible assessment approaches into two categories: 1) A category related to moral obligations includes fair share approaches, as well as emissions reduction from 1990 levels (the base year named in the UNFCCC, 1992), a change in recent trends, and the timing and level of per capita emissions; and 2) A category which contains several approaches related to technical necessity. See Höhne et al, 2018, *supra* note 76 at 427-8.
[159] Environment and Climate Change Canada, "2019 National Inventory Report", *supra* note 151 at 59.
[160] Government of Canada, "GHG Emissions", *supra* note 11.
[161] Environment and Climate Change Canada, "2019 National Inventory Report", *supra* note 151 at 11.

Canada's total emissions in 2030,[162] which would comprise more than 40 percent of the 511 million tonnes of emissions permissible under Canada's 2030 target.[163]

These figures help make clear Oil Change International's stance that there is "no scenario in which tar sands production increases and the world achieves the Paris goals."[164] Prominent Canadian ENGOs Stand.earth and Environmental Defence agree. Their 2018 report, *Canada's Oil and Gas Challenge: A Summary Analysis of Rising Oil and Gas Industry Emissions in Canada and Progress Towards Meeting Climate Targets*, depicts how the oil and gas sector's emissions will dominate Canada's carbon budget under a 1.5°C pathway.

Figure Four: Industry's Projected Share of Canada's Climate Targets[165]



[162] Environment and Climate Change Canada, "2018 Canada Projections", *supra* note 171 at 10.

[163] Environment and Climate Change Canada, "Canadian Environmental Sustainability", *supra* note 40 at 5.

[164] "Climate on the line: Why new tar sands pipelines are incompatible with the Paris goals" (January 2017) at 5, online (pdf): *Oil Change International* <priceofoil.org/content/uploads/2017/01/climate_on_the_line_FINAL-OCI.pdf>.

[165] This graph is presented in megatonnes. 1 megatonne = 1 million tonnes of Co2eq. See Environmental Defence & Stand.Earth, "Canada's Oil & Gas Challenge: A Summary Analysis of Rising Oil and Gas Industry Emissions in Canada and Progress Towards Meeting Climate Targets" (2018) at 12, online (pdf): *Stand.Earth* <www.stand.earth/sites/stand/files/Canadas_Oil%2BGas_Challenge_0.pdf>.

It is unrealistic to expect Canada's remaining sectors to reduce their emissions by 80 percent by 2030 to accommodate the continued expansion of the oil and gas sector. Alternatively, Stand.earth and Environmental Defence cite the IPCC's conclusion that global oil production needs to decline by 37 and 87 percent below 2010 levels by 2030 and 2050, respectively.[166] Given that Canada's oil sands comprise 14 percent of global reserves[167] and are one of the most carbon-intensive methods of production,[168] Stand.earth and Environmental Defence call for Canada to, at minimum, reduce its production by equivalent amounts. This would translate to a 60 percent reduction in Canada's total GHG emissions from 2005 levels—which is twice as ambitious as its current 2030 target.[169]

The incompatibility of expanding the oil and gas sector and meeting Canada's climate commitments highlight the importance of setting and implementing a more ambitious emissions reduction target in Canada. The following section maps out the equity approaches to be used in the analyses regarding Canada's fair share emissions reduction target.

V. Equity Approaches to Derive a "Fair Share"

Over the last thirty years, academics have grappled with how to apply various equity principles to "fairly" allocate emissions from a global carbon budget amongst states.[170] These approaches frequently create an annual emissions allowance for individual states, which can then be compared against a state's projected emissions to create a "fair share" target. If a state's fair

[166] Oil Change International, *supra* note 181 at 6.
[167] Alex D Charpentier, Joule A Bergerson & Heather L MacLean, "Understanding the Canadian oil sands industry's greenhouse gas emissions" (2009) 4 Envtl Research Letters 1 at 2.
[168] Christophe McGlade & Paul Ekins, "The geographical distribution of fossil fuels unused when limiting global warming to 2°C" (2015) 517 Nature 187 at 190.
[169] Stand.Earth, *supra* note 182 at 6-7.
[170] Adam Rose, "Reducing conflict in global warming policy: The potential of equity as a unifying principle" (1990) 18:10 Energy Pol'y 927. See also Adam Rose et al, "International Equity and Differentiation in Global Warming Policy: An Application to Tradeable Emission Permits" (1998) 12 Envtl & Resource Econ 25; Peter Bohm & Bjorn Larsen, "Fairness in a Tradable-Permit Treaty for Carbon Emissions Reductions in Europe and the former Soviet Union" (1994) 4:3 Envtl & Resource Econ 219; Jae Edmonds, Marshall Wise & David W Barns "Carbon Coalitions: The Cost and Effectiveness of Energy Agreements to Alter Trajectories of Atmospheric Carbon Dioxide Emissions" (1995) 23:4-5 Energy Pol'y 309; Richard Richels et al, "The Berlin Mandate: The Design of Cost-Effective Mitigation Strategies" in John Weyant, ed, *Energy and Environmental Policy Modeling* (New York: Springer US, 1999) 67; Adam Rose & Brandt Stevens "The Efficiency and Equity of Marketable Permits for Co2 Emissions" (1993) 15:1 Resource & Energy Econ 117; Ringius, Torvanger & Holtsmark, *supra* note 99.

share target is a negative allowance, then the country is meant to eliminate its own emissions as well as undertake additional mitigation efforts in other countries to fulfill this target. In some instances, a state's emissions may be less than its annual allowance, meaning that the state can "fairly" continue to emit (typically to allow the state to achieve additional development).

According to a 2016 review by P. Zhou and M. Wang, 106 papers had been published in "major environmental and climate economics journals" since 1990 on allocating emissions.[171] Two-thirds of the studies in this review considered emissions allocations by fairness, while another 28 percent considered allocation by efficiency, and the remaining five percent considered both principles.[172] Over three-quarters of the studies concentrated on national emissions allocations (the remainder focused on regional allocations and the distribution of permits amongst firms).[173]

An oft-cited comparison of studies is Nikolas Höhne, Michel den Elzen and Donovan Escalante's 2014 paper, "Regional GHG reduction targets based on effort sharing: a comparison of studies".[174] In this paper, Höhne, den Elzen and Escalante analyzed more than forty studies which considered the equitable allocation of emissions, and classified them in seven categories of effort-sharing approaches to allow for easier comparison: responsibility; responsibility, capability and need; capability-need; cost-effectiveness; staged approaches; equality; and equal cumulative emissions per capita ("ECEPC").[175]

In 2014, the IPCC's fifth assessment report adopted these categories of equity-sharing approaches, with the exception of cost-effectiveness, "explaining that it can be distinguished from effort sharing per se in the sense of determining which country should pay for the reductions on normative grounds, although it helps in determining the geographical location of cost-effective mitigation opportunities".[176]

171 P Zhou & M Wang, "Carbon dioxide emissions allocation: A review" (2016) 125 Ecological Econ 47 at 55.
172 *Ibid* at 53.
173 *Ibid* at 52.
174 Niklas Höhne, Michel den Elzen & Donovan Escalante, "Regional GHG reduction targets based on effort sharing: a comparison of studies" (2014) 14:1 Climate Pol'y 122.
175 *Ibid* at 125.
176 As explained by Takeshi Kuramochi et al, "Comparative assessment of Japan's long term carbon budget under different effort sharing principles" (2016) 16:8 Climate Pol'y 1029 at 1032.

The six equity categories allocate national emissions allowances from a global carbon budget based on the following metrics:[177]

1. *Responsibility*: Allocates national emissions allowances based on states' historical or cumulative emissions;
2. *Capability*: Allocates national emissions allowances based on a country's capability to finance climate mitigation efforts as determined by its gross domestic product ("GDP") or the human development index ("HDI");[178]
3. *Equality*: Allocates national emissions allowances on a per capita basis;
4. *Responsibility-capability-need*: Determines a country's emissions allowance based on responsibility and capability indicators, as well as a country's need to sustainably development;
5. *Equal cumulative per capita*: Allocates per capita emissions rights collectively to a state; and
6. *Staged Approaches*: Allocates national emissions allowances in various stages with differing commitments.

These six categories each promote a different distribution of the global mitigation burden. Some categories, such as responsibility, consider the "appropriate moral agent" to be the state, and thus assign emission allowances based on the state's emitting history. Other categories, while still assigning the burden to the state, consider the individual to be the moral agent and base a state's emissions based on the country's population.[179]

Each equity category contains several allocation schemes which yield significantly varied emissions allowances. As several papers and reports already provide a fulsome review of the

[177] Leon Clarke et al, "Assessing Transformation Pathways", in O Edenhofer et al, eds, *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom: Cambridge University Press, 2014) 413 at 458. See also: Takeshi Kuramochi et al, *supra* note 193 at 1031-2; Pan et al, 2017, *supra* note 143 at 50.
[178] The Human Development Index is a well-known ranking system created by the United Nations Development Programme, and is based on the average longevity, education and income of a country's population. See "Human Development Index" (last visited 2 November 2019), online: *United Nations Development Programme* <hdr.undp.org/en/content/human-development-index-hdi>.
[179] For more discussion on appropriate moral agents in climate policy, see Klinsky & Dowlatabadi, *supra* note 46 at 101.

many approaches, this paper will not do so.[180] The following section will, instead, briefly summarize the approaches to be used later in this paper to analyze Canada's fair share of the global mitigation burden.

A. Responsibility

1. Historical Responsibility Approach

During the 1997 Kyoto Protocol negotiations, the Brazilian government suggested that the global mitigation burden be allocated amongst developed countries based on their historical cumulative emissions.[181] Although not adopted at the negotiations, this approach—particularly as an expanded version that includes all states—has frequently been considered as one fair method to allocate emissions.

The IPCC's fifth assessment report lists three main grounds to justify this approach:

- Climate change was caused by these historic emissions;
- There is a finite amount of greenhouse gases that can be emitted to the atmosphere; and
- These historical emissions created benefits that should be paid for and used to provide capacity to undertake mitigation efforts.[182]

As Bas J van Ruijven et al note, this approach will allocate a greater portion of the mitigation burden to those countries which industrialized earlier and thus have a longer emitting period than countries which industrialized later.[183]

[180] See for e.g. Daniel Bodansky, "International Climate Efforts Beyond 2012: A Survey of Approaches" (December 2004), online (pdf): *Pew Centre on Global Climate Change* <www.c2es.org/site/assets/uploads/2004/11/international-climate-efforts-beyond-2012-survey-approaches.pdf>; Pan et al, 2017, *supra* note 143 at 51; Xunzhang Pan et al, "Equitable Access to Sustainable Development: Based on the comparative study of carbon emission rights allocation schemes" (2014) 130 Applied Energy 632 at 635.
[181] UNFCCC Secretariat, *Paper No 1: Brazil - Proposed Elements of a Protocol to The United Nations Framework Convention on Climate Change, Presented By Brazil in Response to The Berlin Mandate*, 7th Sess (1997).
[182] IPCC, "Sustainable Development and Equity", *supra* note 17 at 318.
[183] Bas J van Ruijven et al, "Emission allowances and mitigation costs of China and India resulting from different effort-sharing approaches" (2012) 46 Energy Pol'y 116 at 118.

There are several perspectives on the appropriate year to begin accounting for emissions under this approach. Izzet Ari & Ramazan Sari distinguish between these views by using the phrase "historical contribution" to consider a state's emissions dating as far back as 1751 (to account for the impact of the industrial revolution).[184] Alternatively, the phrase "historical responsibility" accounts for emissions produced since 1990, the year in which the first IPCC report was published and the UNFCCC negotiations began, bringing an end to the period of "excusable ignorance".[185]

Von Lucke believes that 1990 is too late to begin accounting for a state's historical responsibility, however, noting that climate change was well understood by the late 1980s onwards.[186] Others advocate for including historical emissions when "climate change became reasonably suspected of being a problem, and greenhouse gas emissions thus identifiable as a pollutant worthy of policy action", beginning in the 1960s or 1970s.[187] Von Lucke disputes the idea of not accounting for emissions prior to this time period, however, stating that it "effectively allocate[s] them to all states equally, which does not seem fair either".[188]

Since the Brazilian proposal, several variations of this approach have emerged. While most iterations consider emissions used within a nation's borders, one alternative approach is to account for a state's embodied emissions,[189] which include "all emissions associated with consumed goods back to the original source that produced the emissions even if products were transshipped through other countries/regions or were intermediate constituents in a multiregional supply chain".[190] This approach can greatly alter a state's total amount of emissions. For

[184] Izzet Ari & Ramazan Sari, "Differentiation of developed and developing countries for the Paris Agreement" (2017) 18 Energy Strategy Reviews 175 at 176. Ari is the Head of Turkey's Department of Environment and Sustainable Development, and Sari is a professor at Middle East Technical University, Department of Business Administration, Department of Earth System Sciences, and is a co-editor of the Routledge Handbook on Energy Economics.
[185] Lucas Bretschger, "Climate policy and equity principles: fair burden sharing in a dynamic world" (2013) 18 Envt and Devt Econ 517 at 526; Benito Müller, Niklas Höhne & Christian Ellermann, "Differentiating historic responsibilities for climate change" (2009) 9:6 Climate Pol'y 593 at 604; Ari & Sari, *supra* note 201 at 176.
[186] Von Lucke, *supra* note 147 at 11.
[187] IPCC, "Sustainable Development and Equity", *supra* note 17 at 318.
[188] Von Lucke, *supra* note 147 at 11.
[189] IPCC, "Sustainable Development and Equity", *supra* note 17 at 318.
[190] Steven J Davis & Ken Caldeira, "Consumption-based accounting of Co2 emissions" (2010) 107:12 Proc Natl Academy Sci USA 5687 at 5687.

instance, Mark Lee notes that nearly half of the carbon extracted in Canada is exported beyond its borders, and is thus not accounted for in its quantification of emissions.[191]

Another variation of this approach considers whether specific individuals should be accountable for their emissions, as well as whether individuals should also be held accountable for their ancestors' emissions. In addition to ethical questions about accountability for someone else's actions, this iteration is highly unpractical due to the difficulty in tracing historical emissions of specific individuals.[192]

The historical responsibility approach has several shortcomings. Firstly, it excludes any consideration of a country's population or economic status. For instance, this approach would soon require large emissions reductions from emerging economies such as China and India—who still have large amounts of poverty. Failing to account for a country's level of development in allocating emissions allowances could perpetuate poverty rates and free the richer high-emitting nations of their full historical responsibility.[193]

This approach also considers all emissions produced over a period of time to be equal. Some may consider this unfair, given that technological advances may allow developing countries to reach similar levels of development with lower emissions than countries who undertook such development earlier.[194] This approach is heavily impacted by the scope of emissions considered. Some developed countries are responsible for significant forestry and land-use change emissions, which are frequently excluded from emissions analyses due to data uncertainty.[195]

Finally, such an approach may not be practical. The Expert Group that developed the Oslo Principles on Global Climate Change Obligations detail the difficulties in determining the

[191] Marc Lee, "Extracted Carbon: Re-examining Canada's Contribution to Climate Change through Fossil Fuel Exports" (January 2017) at 10, online (pdf): *Canadian Centre for Policy Alternatives* <www.policyalternatives.ca/sites/default/files/uploads/publications/National%20Office%2C%20BC%20Office/2017/01/ccpa_extracted_carbon_web.pdf>.
[192] Von Lucke, *supra* note 147 at 9-10.
[193] *Ibid* at 13.
[194] See Höhne et al, 2018, *supra* note 76 at 432.
[195] Van Ruijven et al, *supra* note 200 at 118.

legal impact of historical emissions and states that "the debate about "historical contributions" has been rather vague and undetermined."[196] They go on to state that a formula based on vague criteria will "unnecessarily complicate things" and "be a stumbling block for global solutions... [and] also for the protection of the most vulnerable countries".[197]

B. Capability

1. Ability to Pay Approach

In 2017, Andries F Hof et al examined the global abatement cost for states to fulfil their NDCs in 2030, finding that fulfilling the unconditional NDCs would cost states between $58 billion to $135 billion USD, while implementing the conditional domestic NDCs would cost an additional $39 billion to $56 billion USD.[198] According to Hof et al, the additional global abatement costs required to adhere to 2°C pathways range from $234 billion USD to $400 billion USD, and that "[f]or 1.5°C, the additional costs are about twice as high."[199]

While such costs are exceptionally high, the "cost of the consequences of climate change in the case of inaction will far exceed the cost of preventing them."[200] A report published by the Global Commission on Adaptation in September 2019 noted that a $1.8 trillion investment in weather warning systems, infrastructure, dry-land farming, mangrove protection and water management would lead to $7.1 trillion in net benefits.[201]

Given these high costs, some fair share approaches consider the fair distribution of costs associated with reducing global emissions amongst states. The Ability to Pay approach considers a country's means to fund mitigation efforts as determined by a country's average standard of living, and "assumes that richer countries need to take more responsibility in reducing Co2

196 Oslo Principles on Global Climate Change Obligations" (2015) at 2, online: *Expert Group on Global Climate Obligations* <climateprinciplesforenterprises.files.wordpress.com/2017/12/osloprincipleswebpdf.pdf>.
197 *Ibid* at 20-21.
198 The large range in figures is due to the use of different baseline scenarios. See Andries F Hof et al, "Global and regional abatement costs of Nationally Determined Contributions (NDCs) and of enhanced action to levels well below 2°*C* and 1.5°*C"* (2017) 71 Envtl Sci & Pol'y 30 at 33.
199 *Ibid* at 35.
200 Expert Group on Global Climate Obligations, *supra* note 213 at 44.
201 "Adapt Now: A Global Call for Leadership on Climate Resilience" (September 2019) at 3, online: *Global Commission on Adaptation* <cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf>.

emissions than poorer countries".[202] Under this methodology, emissions allocations are inversely derived from a global carbon budget based on a state's national GDP per capita.[203] Such an approach might exclude portions of a developing country's population from binding targets until their GDP reaches a pre-determined "development threshold".[204] A proposed variation of this framework allocates a greater proportion of the reduction burden based on the number of high-emitting individuals that live within a country by using a luxury threshold. Once an income reaches the development threshold, "a linearly increasing percentage of that income (and the associated emissions) are counted towards national capability (and responsibility), until, when the luxury threshold is reached, it is fully counted toward national capability.[205]

While this approach considers "fairness" to be an equitable distribution of emission costs, it does not consider the most efficient use of funds to minimize total abatement costs globally.[206] Richie Merzian and Rod Campbell also note that this approach is difficult to implement due to its reliance on economic projections which "are inherently unreliable, particularly over the decadal timeframes associated with global mitigation efforts".[207]

While this approach focuses on a state's capability to fund mitigation efforts, an important consideration which merits further discussion is whether and how the corporations headquartered or operating within a country ought to reduce their emissions. This issue is discussed further in Section VII of this paper.

C. Equality

1. Equal Annual Emission Per Capita Approach

This population-based approach, which assumes universal participation, asserts that a global carbon budget ought to be divided amongst countries either on a per capita basis or based

[202] Zhou & Wang, *supra* note 188 at 49.
[203] See, for e.g. Bodansky, *supra* note 197**.**
[204] *Ibid* at 19. See also Christoph Böhringer & Carsten Helm, "On the fair division of greenhouse gas abatement cost" (2008) 30 Resource & Energy Econ 260.
[205] Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.
[206] Bretschger, *supra* note 202 at 525.
[207] Richie Merzian & Rod Campbell, "Advance Australia's fair share: Assessing the fairness of emissions targets" (12 June 2018) at 10, online (pdf): *Australia Institute* <www.tai.org.au/sites/default/files/P507%20Advance%20Australias%20Fair%20Share%20FINAL_1.PDF>.

upon projected population levels over a pre-determined period.[208] After creating a global budget, an annual limit is derived, which is then shared amongst countries. This approach typically categorizes countries as "developed" or "developing", with differing emissions targets for the two groups.

The Expert Group that developed the Oslo Principles on Global Climate Change Obligations support this approach's "fairness" in that it allocates equal emissions to every human being. However, Klinsky & Dowlatabadi point out that allocating emissions to a nation on a per capita basis does not ensure that the emission allocations are distributed equally within the country.[209] The Oslo Principles' Expert Group calls for this approach to further limit obligations for developing countries to fulfill the CBDR principle.[210]

A further weakness of this approach is its failure to consider the highly unequal distribution of cumulative emissions that have already caused 1°C of warming in the atmosphere.[211] As mentioned above, however, the Expert Group finds criteria regarding historical contribution to be vague and advocate that some sophistication ought to be sacrificed for certainty, noting that a per capita approach is easy to calculate.[212]

Additionally, allocating emissions equally does not necessarily correlate with an equal mitigation burden, given the global variation in a state's population density, technological lock-in, the extent of natural resources it possesses, differing climates and several other circumstances.[213] Given these clear weaknesses, most fair share approaches that seek to consider equality combine facets of this approach with other effort-sharing approaches, rather than relying solely on this approach.

[208] *Ibid* at 9.
[209] Klinsky & Dowlatabadi, *supra* note 46 at 92.
[210] Expert Group on Global Climate Obligations, *supra* note 213 at 73.
[211] IPCC, "Summary for Policymakers 2018", *supra* note 1 at 6.
[212] Expert Group on Global Climate Obligations, *supra* note 213 at 20-21.
[213] Klinsky & Dowlatabadi, *supra* note 46 at 92.

2. Contraction and Convergence Approach

This approach is grounded in the belief that the atmosphere is a global common.[214] Here, a long-term global carbon budget is created (forming the "contraction"), and emissions are allocated to states to reduce from current levels to equal per capita emissions by a pre-determined year ("convergence"). This approach assumes that emissions trading would be used to balance the differing supply and demand of emissions allowances.[215]

A significant flaw with this approach is its lack of consideration for the differing capabilities of countries to decrease emissions or their ability to subsume mitigation costs,[216] as well as its exclusion of historical responsibility.[217] Additionally, as allowances are initially distributed on a per capita basis, this may allocate surplus emissions to developing countries.[218]

D. Responsibility-Capability-Need

1. Greenhouse Development Rights Framework

The Greenhouse Development Rights ("GDR") framework is perhaps the most fair stand-alone approach. The GDR framework uses a global responsibility-capacity index ("RCI"), which assesses a state's cumulative per capita emissions since a given year as well as its per capita income. The framework also uses a "development threshold" to address inequity within a country which excludes the income (and thereby emissions) of individuals who make below this threshold, which was set at $7,500 – or 1.25 times above the global poverty line of $6,000 in 2009.[219] A state's fair share of mitigation is then derived by considering its portion of the difference between a global carbon budget and a baseline scenario (typically no climate

[214] Michel den Elzen & MM Berk, "Bottom-Up Approaches for Defining Future Climate Mitigation Commitments" (26 April 2004) at 29, online (pdf): *National Institute for Public Health and the Environment* <pdfs.semanticscholar.org/36b5/0391560b8e39ffcd098fc484a1ef3ac1b12c.pdf?_ga=2.4896565.70959157.1566493553-1164268795.1566493553>.

[215] Niklas Höhne, Michel den Elzen & Martin Weiss, "Common but differentiated convergence (CDC): a new conceptual approach to long term climate policy" (2006) 6:2 Climate Pol'y 181 at 183.

[216] Niklas Höhne et al, "Evolution of Commitments under the UNFCCC: Involving Newly Industrialized Economies and Developing Countries" (February 2003) at 41, online (pdf): *ECOFYS GmbH on behalf of the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, Germany* <www.researchgate.net/publication/265670626_Evolution_of_Commitments_under_the_UNFCCC_Involving_Newly_Industrialized_Economies_and_Developing_Countries> [Höhne et al, 2003].

[217] Höhne, den Elzen & Weiss, *supra* note 232 at 195.

[218] Van Ruijven et al, *supra* note 200 at 118.

[219] Paul Baer et al, "Greenhouse Development Rights: A Proposal for a Fair Global Climate Treaty" (2009) 12 Ethics Place & Env 267.

policy).[220] The Climate Equity Reference Project's ("CERP") online calculator (discussed in Section VI of this paper) is an interactive tool that allows the user to determine the start year for considering historical responsibility, the minimum development threshold, and how to weigh the two indicators.[221]

This approach's use of individual income, instead of average per capita values, allows for consideration of income inequality—both between and within countries—to be accounted for,[222] ensuring that wealthy individuals residing in poorer countries are included in global calculations.[223]

However, Narasimha Rao notes that this approach does not ensure that those exempt from the threshold receive any benefit from this exemption or are shielded from mitigation measures that impose nation-wide costs.[224] The approach's creators acknowledge this shortcoming, stating that it "offers no way to prevent national elites from escaping all burdens and shifting them to their poorest citizens."[225]

Further criticism has been raised regarding this approach's simplistic definition of capacity. Political and International Affairs Professor David Schlosberg, while deeply appreciative of the framework, notes that it reduces climate justice to "minimal development" and focuses on accumulating capital, which ignores the ample scholarly work done to advance the definition of development as "the attainment of a range of capabilities necessary to have a functioning life."[226] Philosophy Professor Kenneth Shockley agrees with such sentiments, calling the GDR framework "one of the most interesting and promising [burden-sharing] efforts" while

220 Holz, Kartha & Athanasiou, *supra* note 138 at 122.
221 Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.
222 *Ibid* at 122.
223 Baer et al, *supra* note 236 at 268.
224 Narasimha D Rao, "International and intranational equity in sharing climate change mitigation burdens" (2014) 14 Intl Envtl Agreements 129 at 130, 139.
225 Baer et al, *supra* note 236 at 275.
226 David Schlosberg, "Capacity and Capabilities: A Response to the Greenhouse Development Rights Framework" (2009) 12:3 Ethics Place & Env 287 at 287, 288.

also finding fault with its inability to "miss any features of development that are not reducible to individual financial standing."[227]

Despite these valid shortcomings, the approach's ability to consider both historical and present-day responsibility for emissions alongside the distribution of wealth between and within states renders it a more fulsome approach than those approaches which consider a single factor.

E. Equal Cumulative Emissions per Capita

The ECEPC approach is founded in the belief that all humans have equal value as well as "equal claims to global collective goods".[228] This framework, which incorporates the equal annual emission per capita approach, posits that all countries should receive equal per capita emission allowances over an agreed period of time (which may consider years that have already occurred as well as future years). After determining a global carbon budget and pathway, emissions allowances are calculated based on the per capita cumulative emissions for each country during the pre-determined period of time.[229]

While Gibson et al suggest that this approach is the most fair emissions-based sharing approach,[230] the author of this paper disagrees with this finding. Unlike the GDR framework, this approach ignores capability considerations. As such, a country with both high historical responsibility and high levels of poverty would be called upon to more aggressively reduce emissions under this approach than the GDR framework. Further, the ECEPC approach would be practically challenging to execute, given both the ever-changing populations of states and the unknown and imprecise populations of some areas in developing countries. Similar to the historical responsibility approach, challenges may also arise regarding the appropriate year to start considering cumulative emissions.

227 Kenneth E Shockley, "A gentle critique of the Greenhouse Development Rights framework" (2013) 4 WIREs Clim Change 225 at 225, 227.
228 Xunzhang Pan, Fei Teng & Gehua Wang, "Sharing emission space at an equitable basis: Allocation scheme based on the equal cumulative emission per capita principle" (2014) 113 Applied Energy 1810 at 1811.
229 Shengmin Yu et al, "Study on the Concept of per Capita Cumulative Emissions and Allocation Options" (2011) 2:2 Advances in Climate Change Research 79 at 80.
230 Gibson et al, *supra* note 69 at 49.

F. Staged Approaches

1. Multi-Stage Approach

This approach uses differing stages to allow developing countries to gradually work towards increasingly stringent commitments. Within this approach, various stages have been proposed. For instance, den Elzen and Berk suggest a three-tiered system in which states graduate from having no commitment (Stage 1) to emissions limitation or intensity targets (Stage 2), and finally, having absolute reduction targets (Stage 3).[231] Others have proposed a four-staged system, which also begins with no commitments in the initial stage. Countries then create pledges for sustainable development (Stage 2), set a moderate absolute target (Stage 3), and, lastly, establish an absolute target to align with a sustainable per capita level of emissions (Stage 4).[232] The multi-stage approach can also be classified under a capability principle.

2. Triptych Approach

This staged sectoral approach analyzes key emitting sectors to create a national target. While different iterations of this approach include different sectors, its original iteration assessed emissions from the power sector, energy-intensive industries and the domestic sector.[233] Technological opportunities and states' differing technological baselines are taken into consideration in creating sectoral emissions allowances. Phylipsen et al also state that "differences in standard of living, in fuel mix, in economic structure and the competitiveness of internationally oriented industries" are considered in creating these allowances.[234] Combining these allowances determines a country's national emissions target.[235]

This approach is exemplified by the EU's Burden Sharing Agreement, which utilized some of the above-listed considerations to allocate emissions reductions amongst its member states to fulfill its Kyoto target.[236] Zhou and Wang note that while this approach considers the

[231] den Elzen & Berk, *supra* note 231 at 28.
[232] Höhne et al, 2003, *supra* note 233 at 28.
[233] Tommi Ekholm et al, "Effort sharing in ambitious, global climate change mitigation scenarios" (2010) 38 Energy Pol'y 1797 at 1798.
[234] G J M Phylipsen et al, "A Triptych sectoral approach to burden differentiation; GHG emissions in the European bubble" (1998) 26:12 Energy Pol'y 929 at 934.
[235] Höhne et al, 2003, *supra* note 233 at 44-45. See also den Elzen & Berk, *supra* note 231 at 25.
[236] Paul Boothe & Félix-A Boudreault, "Sharing the Burden: Canadian GHG Emissions" (2016) at 5, online: *Lawrence National Centre for Policy and Management* <www.ivey.uwo.ca/cmsmedia/2169603/ghg-emissions-report-sharing-the-burden.pdf> [Boothe & Boudreault, 2016(b)].

differing potentials of emissions reduction amongst countries, it requires a cumbersome amount of data to set the efficiency indicators.[237] Ekholm et al also clarify that, as only the national target is binding, this approach simply "uses sectoral mitigation potentials to arrive on a more accurate estimate on how much reductions are feasibly attainable in a given country and leaves the country free to choose how to pursue its target."[238]

G. Fair Share Range

Many of the above approaches provide valuable insight into suggesting a country's possible "fair share". As there is a lack of consensus in the international community as to the superior approach, some scholars have advocated that a "fair share range" be created using multiple approaches or sources. With this approach, a country's target that falls within this range is considered to be fair by at least one of the included approaches.

A fair share range based on multiple approaches calculates several fair share targets or allocations, which can then be averaged to provide an average fair share target, or can be used to form the lower and upper bounds of a fair share range. For instance, ActionAid et al used an "equity range" that considered a country's fair share based on a 50 percent weighting of two indicators that assessed fair share allocations in line with principles of responsibility and capability to assess states' NDCs.[239]

Some scholars have instead opted to create a fair share range based on the compilation of other's studies. For example, the fair share range of emissions reduction levels for developed countries presented in Box 13.7 (see Section II of this paper) was developed through consideration of the findings and information presented in more than twenty studies.[240]

A key benefit of a fair share range is its compilation of several emissions reduction strategies "that would be expected from different groups of countries under a wide range of different burden-sharing proposals".[241] As a 1990 paper by Adam Rose astutely pointed out,

[237] Zhou & Wang, *supra* note 188 at 51.
[238] Ekholm et al, *supra* note 250 at 1799.
[239] ActionAid et al, *supra* note 75 at 2.
[240] Den Elzen & Höhne, *supra* note 106 at 252-3.
[241] Lahn & Sundqvist, *supra* note 109 at 13.

differing criteria on what constitutes equity results in greatly differing policy implications for states.[242] ActionAid et al also noted that there are "a range of interpretations" of the equity principles outlined in the UNFCCC.[243] A fair share range incorporates several equity considerations, minimizing the need to form a political consensus on a single equity approach.[244]

This idea is also exemplified by CAT, who compiled a database of more than 40 studies and conducts its own analyses to assess fair shares for a set of countries who collectively emitted 81 percent of global emissions in 2010.[245] Their methodology is fully detailed later in this paper.

H. Conclusion

The Historical Responsibility approach intuitively seems fair in that it accounts for states' historical emissions. However, is this approach a realistic solution? As there is no set start year, it may prove difficult for the international community to agree upon a time to begin accounting for emissions. Further, this approach does not factor in a state's level of development or economic status. As such, if a state with high poverty levels was tasked with a large mitigation burden, funding for social services could be reallocated to climate action, which could exacerbate poverty rates.

The Ability to Pay approach is perhaps more realistic than the Historical Responsibility approach, given its focus on a state's capability to fund mitigation efforts. The use of a development threshold also accounts for inequality within states, a component which is not accounted for in most of the other approaches. However, this approach is based on economic projections, which could prove to be unreliable.

The Equal Annual Emission per Capita approach treats every human as equal, and allocations are simple to calculate. In a similar nature to the Historical Responsibility approach, this approach could unduly burden developing countries and increase poverty rates. While the

[242] Rose, *supra* note 187 at 933.
[243] ActionAid et al, *supra* note 75 at 1.
[244] Lahn & Sundqvist discuss this in terms of the potential of Box 13.7 to "resolve the complex issue of equity between the North and the South". See Lahn & Sundqvist, *supra* note 109 at 13.
[245] "Global Pathways" (last visited 12 October 2019), online: *Climate Action Tracker* <climateactiontracker.org/methodology/global-pathways/> [Climate Action Tracker, "Global Pathways"].

Contraction and Convergence Approach similarly works towards equal per capita emissions, its multi-decade convergence period seems inappropriate, however, given the urgent need for far-reaching action. Both of these approaches ignore a state's historical actions and its ability to fund mitigation efforts.

The ECEPC approach also incorporates equality considerations into its approach, and accounts for previous emissions, however, both this approach and the Equal Annual Emission per Capita approach would be difficult to implement, as states' populations are always-changing. The Multi-Stage approach respects the CBDR principle by allowing states to have more or less stringent commitments, however, it is unclear how states would be allocated to each stage.

The GDR framework is perhaps the most fair standalone approach, due to its consideration of a state's historical responsibility and its per capita income, and the ability to account for inequality within a country by use of development and luxury thresholds. Similar difficulties arise, however, in terms of determining a start year to account for emissions.

The Fair Share range similarly incorporates several considerations into determining allocations. This is beneficial as it negates the need to agree on which approach ought to be used, and allows for states' differing priorities to be included within such an analysis. However, this figure may be misleading, as a country which adopts a target within the lower portion of its fair share range is still not meeting its true "fair share" of the mitigation burden. If this approach is used, it is important to make clear that a state must meet at least the middle point of their fair share range in order to truly be undertaking its "fair share".

VI. Where We Need to Go: Canada's Fair Share Emissions Target

With a population of 37.5 million people, Canada presently accounts for 0.48 percent of the world's population,[246] yet in 2014, its emissions comprised 1.6 percent of global annual GHG

[246] "Canada Population 2019" (last modified 10 October 2019), online: *World Population Review* <worldpopulationreview.com/countries/canada-population/>.

emissions.[247] Canadians' Co2 emissions per capita are amongst the highest of all states,[248] and its energy-related emissions per capita are the highest of the G20 members.[249] It is worth reiterating that these emissions exclude the full life-cycle emissions of products that are produced in Canada but used outside of Canada, and that the inclusion of such emissions would render Canada responsible for a much greater portion of the global mitigation burden.

Over the last two decades, several scholars and practitioners have grappled with the matter of establishing a fair emissions target or allocation for Canada. During this time, two phenomena have shifted the goalposts of climate policy. First, understanding of climate science has evolved. In the 1990s, many believed that the limit for atmospheric Co2 was 550 parts per million ("ppm").[250] The IPCC's fifth assessment report states, however, that this level of Co2eq concentrations in 2100 would be "more unlikely than likely" to limit warming below 2°C.[251] The IPCC advocates for limiting warming to 1.5°C, which likely requires atmospheric concentrations below 430 ppm of Co2eq by 2100.[252]

This increased understanding of climate science has, unfortunately, not been accompanied by sufficiently-amplified global efforts. The continued growth of global emissions now require that more drastic efforts occur within a shorter period of time.

This paper's consideration of Canada's fair share focuses on analyses that aligns with the IPCC's call for limiting atmospheric concentrations to below 430ppm of Co2eq. However, two "outdated" studies which used a higher limit for atmospheric concentration are first highlighted. These studies, which also call for Canada to adopt a more ambitious emissions reduction target,

[247] "Global greenhouse gas emissions" (30 May 2019), online: *Government of Canada* <www.canada.ca/en/environment-climate-change/services/environmental-indicators/global-greenhouse-gas-emissions.html>.
[248] "CO2 emissions (metric tons per capita)" (last visited 3 November 2019), online: *The World Bank* <data.worldbank.org/indicator/EN.ATM.CO2E.PC?most_recent_value_desc=true>.
[249] Climate Transparency, *supra* note 155 at 1.
[250] Joseph Romm, "What is the safe upper limit for atmospheric CO2?" (1 January 2008), online: *Grist* <grist.org/article/parting-company-with-mckibben-and-maybe-hansen/>.
[251] "Climate Change 2014 Synthesis Report Summary for Policymakers" (2014) at 22, online (pdf): *IPCC* <www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf> [IPCC, "Summary for Policymakers 2014"].
[252] *Ibid* at 21.

further emphasize the inadequacy of Canada's present target. After the initial review of these two studies, the following sections will examine the recent works that delineate interpretations of Canada's fair share.

A. Outdated Studies & Findings

1. Can multi-criteria rules fairly distribute climate burdens? OECD results from three burden sharing rules[253]

Ringius, Torvanger and Holtsmark's 1998 paper was excluded from this paper's analysis as it calls for OECD countries to collectively reduce emissions by 20 percent below 1993 levels but does not translate this figure into a quantifiable figure nor set targets for non-OECD countries.[254]

Ringius, Torvanger and Holtsmark created three formulas to illustrate different burden-sharing approaches to inform subsequent climate negotiations. Recognizing that countries may differ in their preferred distribution of weight amongst the formula's indicators, each formula was adopted with different weighting of its components to produce four cases.

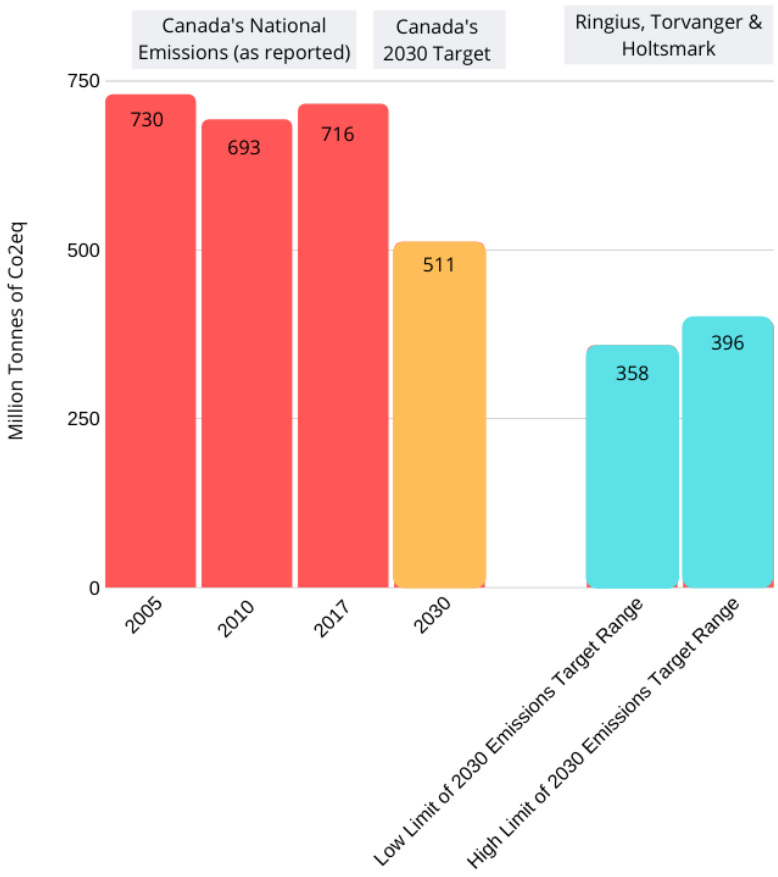
Despite being published more than twenty years ago, their findings call for more stringent reductions than Canada's emissions or 2030 target.[255] Figure Six compares the low and high limits of the range generated by Ringius, Torvanger and Holtsmark's twelve cases for Canada's emissions target.

[253] Ringius, Torvanger & Holtsmark, *supra* note 99**.** At the time of publication, the three authors were affiliated with the Center for International Climate and Environmental Research in Oslo, Norway.

[254] This is in part due to the inability to obtain data for Iceland, as well as the exclusion of Czech Republic, Korea and Mexico (who were recent OECD members and non-Annex 1 parties) and Hungary and Poland (who are OECD members but economies in transition countries).

[255] See Section IX of this paper.

Figure Five: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by Ringius, Torvanger and Holtsmark for 2030[256]



Even the least stringent emissions reductions called for by Ringius, Torvanger and Holtsmark is significantly more ambitious than Canada's 2030 target; this fact is especially significant when considering that this paper was published 22 years ago.

256 Government of Canada, "GHG Emissions", *supra* note 11; Environment and Climate Change Canada, "Canadian Environmental Sustainability", *supra* note 40; Ringius, Torvanger & Holtsmark, *supra* note 99.

2. Effort sharing in ambitious, global climate change mitigation scenarios[257]

This 2010 paper by Tommi Ekholm et al utilizes two reduction targets which would lead to the stabilization of emissions at concentration levels of 485 and 550 ppm Co2eq by 2100.[258] As detailed above, concentration levels of 550ppm are "more unlikely than likely" to limit warming below 2°C, while concentration levels of 485 ppm are "unlikely" to limit warming to 1.5°C.[259]

Given the dated atmospheric limits, it is alarming that Ekholm et al's findings call for Canada's emissions to fall to approximately 360 to 410 million tonnes of Co2eq by 2020.[260] To arrive at these findings, Ekholm et al utilize a multistage approach and a triptych approach. The multistage approach is comprised of four stages: In the initial stage, states do not have binding commitments. Upon entering the second stage, countries commit to moderate reductions (*i.e.*, 10 percent below the baseline scenario). In the third stage, countries commit to positively binding targets which are more stringent than in the previous stage. In the final stage, states set substantial reduction targets.

The triptych approach utilized by Ekholm et al includes the following six sectors: electricity, industry, fossil fuel production, agriculture, domestic, and waste. After establishing targets for each sector, a country's emissions allocations are determined by adding these sectoral targets.[261]

The figure below details the range of emissions allocated to Canada under each approach for the year 2020, as based upon two atmospheric limits.

[257] Ekholm et al, *supra* note 250. At the time of publication, all six authors of this study were associated with the VTT Technical Research Centre of Finland, Ecofys Germany GmbH and/or TKK Helsinki University of Technology.

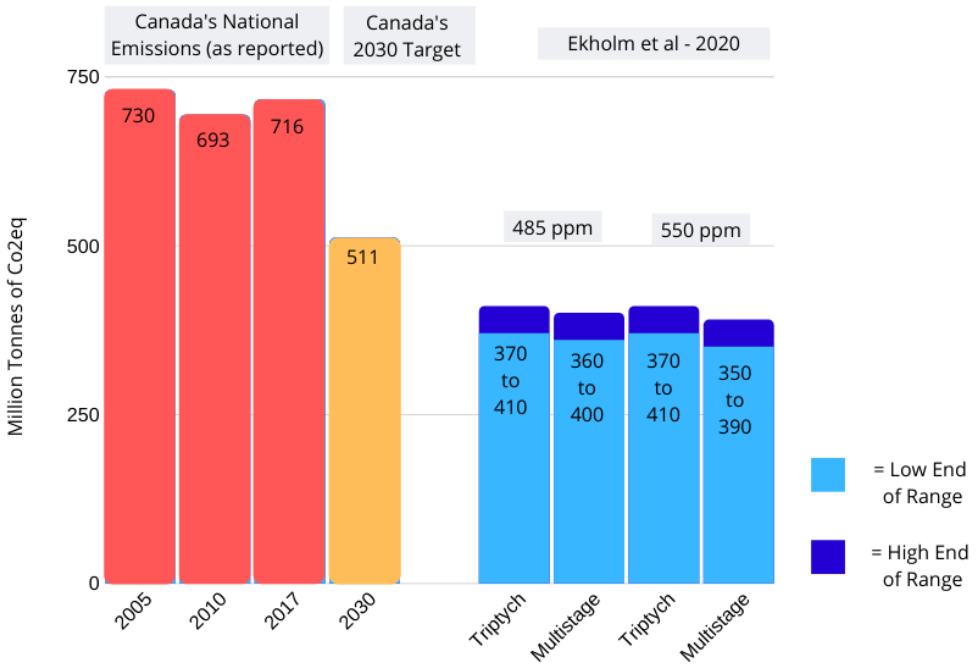
[258] Here, the authors state that the stabilization of emissions at concentration levels of 485 and 550 ppm Co2eq by 2100 would lead to average global warming of approximately 1.8°C and 2.1°C, respectively. *Ibid* at 1800. Recall, however, that the IPCC has stated that a concentration level of 550ppm is "more unlikely than likely" to limit warming to 2°C. See IPCC, "Summary for Policymakers 2018", *supra* note 1 at 22.

[259] IPCC, "Summary for Policymakers 2014", *supra* note 268 at 22.

[260] See Appendix.

[261] Ekholm et al, *supra* note 250 at 1798-99.

Figure Six: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the 2020 Emissions Targets Suggested by Ekholm et al[262]

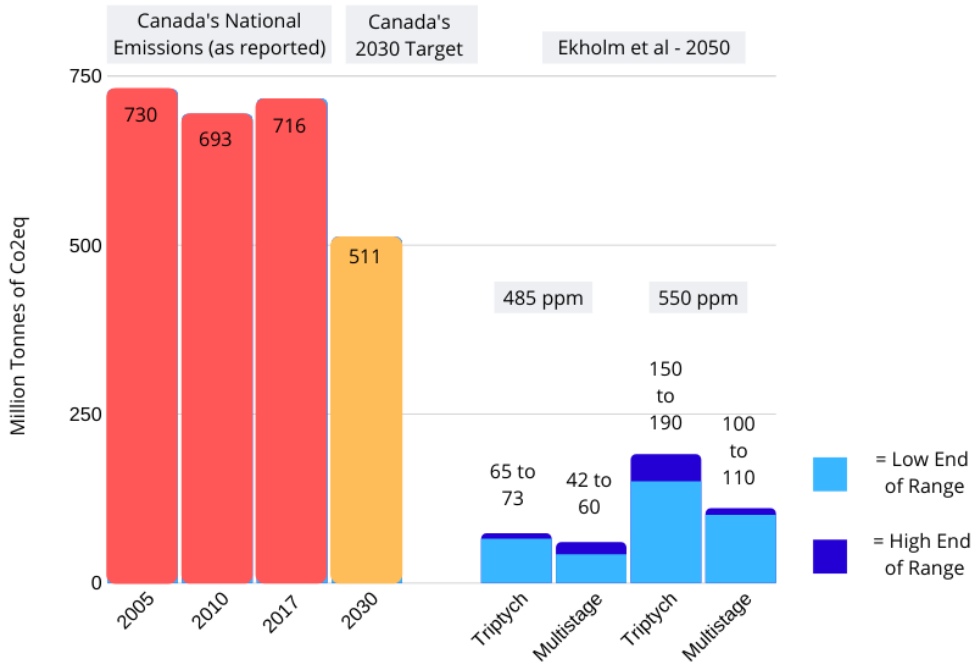


It bears repeating that the atmospheric limits in this study are significantly higher than the limits called for by the IPCC in recent years. It should also be noted that such emissions allocations are for the year *2020*, while Canada's target—which is significantly higher—calls for less emissions reductions a full decade later.

The following figure utilizes the same two atmospheric limits and details the range of emissions allocated to Canada under each approach for the year 2050.

262 *Ibid*; Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5.

Figure Seven: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the 2050 Emissions Allocations Suggested by Ekholm et al[263]



While there is presently a strong call in the international community for emissions to reach net zero by 2050 (see Section VII of this paper), this was not the case when Ekholm et al's paper was published in 2010. This graph also illustrates the shortcomings of Canada's 2030 target in that meeting this target would still require Canada to undertake significantly more ambitious climate efforts in order to meet the ranges suggested by Ekholm et al above.

3. Summary/Conclusion

Although these studies have less stringent emissions reductions scenarios than called for by climate scientists today, these studies call for Canada to have a significantly more stringent emissions reduction target than it presently does. The twelve cases presented in Ringius, Torvanger and Holtsmark's 1998 paper called for Canada to reduce its emissions to 358 to 396 million tonnes of Co2 in 2010, which is nearly half of Canada's actual 2010 emissions (693 million tonnes of Co2). Ekholm et al's 2010 paper called for Canada's emissions to fall to

263 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; *Ekholm* et al, *supra* note 250.

approximately 360 to 410 million tonnes of Co2eq by 2020, which is close to half of Canada's 2017 emissions levels (716 million tonnes of Co2). Both studies, despite considering earlier target years, advocate for significantly more stringent targets than Canada's 2030 target (511 million tonnes of Co2eq).

B. Studies and Findings for Analysis

It is important to compare like with like. The following three studies all considered Canada's fair share emissions allowance or reduction target within their analysis or supplementary data, and included both Co2 and non-Co2 gases. All three analyses excluded LULUCF emissions, as this data is "subject to very large uncertainties and fluctuations".[264] As the Climate Equity Reference Calculator notes, "including LULUCF emissions in a single framework together with Co2 emissions from fossil fuel and industry and non-Co2 gases, presupposes the problematic view that emissions from LULUCF and other sources are essentially fungible and emissions reductions in either space perfectly equivalent".[265] Emissions reductions through LULUCF activities, such as planting and rehabilitating trees, differ in that they are non-permanent and can be reserved by the cutting down of such trees.[266] CAT states that it excludes LULUCF emissions from its assessments for several reasons, including the various approaches used to account for LULUCF emissions and the different "drivers and dynamics between fossil fuel and industrial GHG emissions and LULUCF."[267]

Some slight differences occurred within these calculations, however, which are important to note. One of the studies excluded emissions from international shipping and aviation sectors, stating a lack of current policies to ground strong mitigation scenarios in these areas and noting that "[l]ower emissions from this sector would reduce the mitigation burden on all countries."[268]

[264] "The Climate Equity Reference Calculator database" (last visited 12 October 2019), online: *Climate Equity Reference Project* <climateequityreference.org/calculator-information/the-climate-equity-reference-calculator-database/> [Climate Equity Reference Project, "CERP Calculator Database"].
[265] *Ibid.*
[266] "Land Use, Land-Use Change and Forestry (LULUCF)" (last visited 11 December 2019), online: *United Nations Framework Convention on Climate Change* <unfccc.int/topics/land-use/workstreams/land-use--land-use-change-and-forestry-lulucf>.
[267] "NDC Ratings and LULUCF" (last visiting 11 December 2019), online: *Climate Action Tracker* <climateactiontracker.org/methodology/indc-ratings-and-lulucf/>.
[268] du Pont et al, 2016, *supra* note 140 at 44.

The authors of these three studies also used slightly different global mitigation pathways to derive the carbon budgets which are then distributed amongst nations. Several of the studies provided information that drew from both 1.5°C and 2°C compliant pathways; the information presented in this paper uses only the information from the former pathways. Du Pont et al's study[269] uses the average calculations from two pathways where emissions peak by 2020 and there is more than a 50 percent chance of returning to a maximum of 1.5°C by 2100.[270] While the CERP calculator allows the user to select from various pathways, all of the information provided in this paper utilizes a "1.5°C low energy demand" scenario, a pathway which minimally exceeds 1.5°C and has nearly a 66 percent chance of limiting warming to 1.5°C in 2100.[271] Finally, CAT uses several models to create a 1.5°C pathway that limits GHG concentration levels to 440 ppm.[272]

Slight variations were also present in the outputs chosen to detail the studies' findings. Some studies allocated presented emissions allowances, whereas others detailed mitigation burdens, and different baseline and target years were used within the latter. To allow for easier comparison between the studies, the author of this paper has translated the studies' findings to conform under one indicator: Canada's percentage of emissions reduction below 2005 levels by 2030. This baseline year also allows for easy comparison against Canada's present emissions reduction target. The figures presented in the following sections may not add up, due to the rounding of figures by either the studies' author(s) or the author of this paper.

1. Climate Equity Reference Project

The CERP is an initiative created by EcoEquity and the Stockholm Environment Institute which includes an interactive calculator that can be used to determine countries or regions' fair

[269] *Ibid.*
[270] The two models used are IMAGE 2.4; GCAM 2.0. See *Ibid* at 40; Yann Robiou du Pont et al, "Equitable mitigation to achieve the Paris Agreement Goals", Supplementary Information (2016) Nature Climate Change 1 at 3 [du Pont et al, 2016(b)].
[271] Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.
[272] The models used by CAT are GCAM, IMAGE, MERGE, MESSAGE, REMIND, and WITCH. See Climate Action Tracker, "Global Pathways", *supra* note 262. Note, however, that the IPCC stated that a concentration level of 450 ppm is "more unlikely than likely" to limit warming to 1.5°C. See IPCC, "Summary for Policymakers 2014", *supra* note 268 at 22.

share of emissions reduction under several approaches.[273] This calculator uses both responsibility and capability indicators, which can be weighted according to the user's preferences, to determine a country's fair share target. This flexibility allows for consideration of a country's fair share emissions target under three equity approaches: responsibility, capability, and responsibility-capability-need. The CERP was recently used by Climate Action Network Canada to detail Canada's fair emissions reduction target.[274]

With this approach, Canada's share of the global RCI is impacted by the starting year for counting emissions as well as the use and value of a development and/or luxury threshold. While excluding a development threshold or failing to consider a meaningful threshold is considered "regressive", [275] this paper has done so in calculating Canada's fair share under a responsibility approach, as the responsibility equity approach does not consider a country's capability. When calculating fair shares with a capability and responsibility-capability-need approach, however, an iteration without a development threshold is not included in this paper, given the incompatibility of this exclusion with a climate justice lens.

a) Responsibility

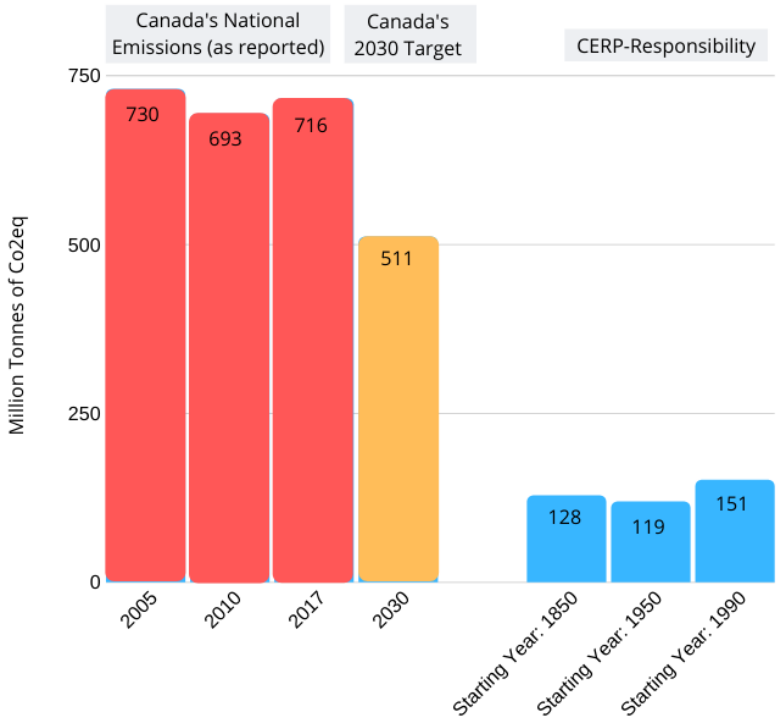
For the purposes of this analysis, the author of this paper weighted the responsibility indicator of the Climate Equity Reference Calculator at 100 (to exclude capability considerations from this analysis); development and luxury thresholds were not used. Different 'starting years' (the year to begin accounting for emissions) were then assigned to yield the following fair share emissions reduction targets for Canada in 2030:

273 Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.

274 Climate Action Network Canada rounded the average of six iterations to detail that Canada's fair emissions reduction target would be 140 percent below 2005 levels by 2030. See "Canada's Fair Share Towards Limiting Global Warming to 1.5°C" (2 December 2019), online: *Climate Action Network Canada* <climateactionnetwork.ca/2019/12/02/canadas-fair-share-towards-limiting-global-warming-to-1-5c/>.

275 As stated by the Climate Equity Reference website and affirmed in literature. See Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149**;** ActionAid et al, *supra* note 75 at 12; Holz, Kartha & Athanasiou, *supra* note 138 at 124.

Figure Eight: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by CERP Under the Responsibility Approach for 2030[276]



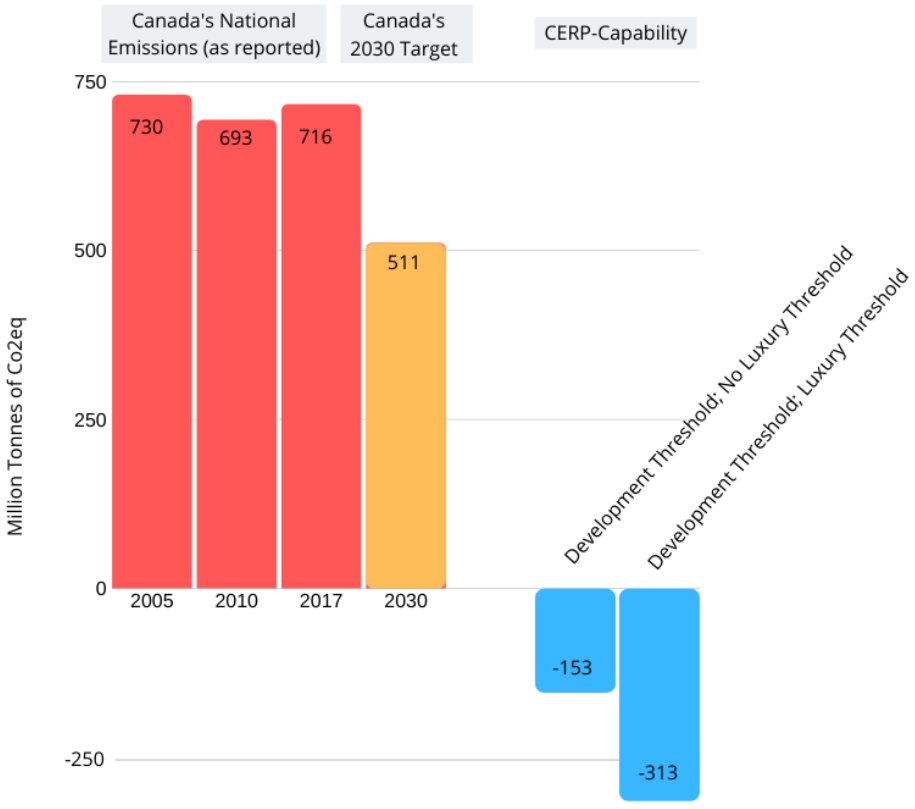
Using these criteria, the CERP calculator finds Canada responsible for 1.7 to 1.8 percent of cumulative emissions, and as such, suggests that Canada's fair share emissions reduction target is 79 or 82 percent below 2005 levels by 2030. It is interesting that Canada's "fair share" of emissions reduction is not significantly impacted by the year in which emissions begin to be accounted for. The least generous allocation (119 million tonnes of Co2eq) is a mere 16 percent of Canada's 2005 emissions levels, while the most generous allocation (151 million tonnes of Co2eq) is only 21 percent of Canada's 2005 emissions levels.

276 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.

b) Capability

To consider a country's fair share using a capability approach, the author of this paper weighted the capability indicator of the Climate Equity Reference Calculator at 100 (to exclude responsibility considerations from this analysis). As such, the starting year has no bearing on the findings. A 'development threshold' was used to exclude portions of a country's population whose GDP has not reached the $7,500 threshold, and a 'luxury threshold' of $50,000 was used, which places a greater proportion of the global reduction burden on the number of high-emitting individuals that live within the country whose GDP is more than this figure. These criteria generate the following results:

Figure Nine: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by CERP Under the Capability Approach for 2030[277]



277 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.

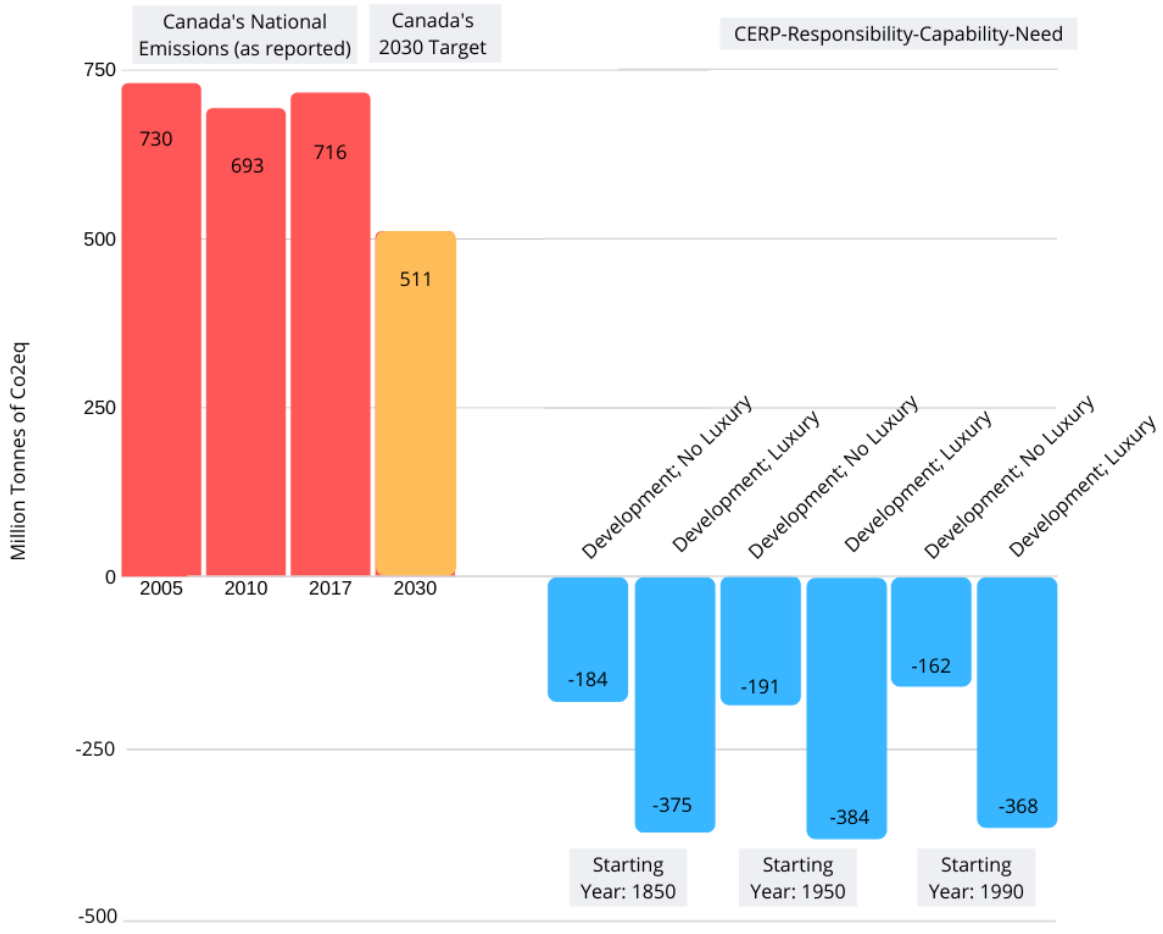
These figures call for Canada to reach net zero emissions before 2030 as well as undertake additional mitigation efforts to fulfill its fair share. With just a development threshold, CERP calls for Canada to reduce its emissions to 121 percent below its 2005 emissions levels. The inclusion of a luxury threshold, which shifts "obligation up the global income scale",[278] greatly increases the ambition of Canada's fair share target to 143 percent below Canada's 2005 emissions levels.

c) Responsibility-Capability-Need

As this approach combines the responsibility and capability approaches, here the responsibility and capability indicators of the Climate Equity Reference Calculator were equally weighted. Three different starting years were then used alongside a development threshold and, in some cases, a luxury threshold: these conditions provided six cases for consideration as presented below:

[278] Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.

Figure Ten: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by CERP Under the RCN Approach for 2030[279]



Similar to CERP's capability findings, all six analyses under this approach call for Canada to reach net zero emissions before 2030, and a more stringent target is required when a luxury threshold is included. While the starting year to begin accounting for emissions does not drastically alter the level of emissions reduction, the calculator's inclusion of a luxury threshold—all other variables held consistent—increases the stringency of Canada's fair share target by 26 to 28 percent (depending on the starting year).

279 *Ibid*; Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5.

2. Equitable mitigation to achieve the Paris Agreement goals[280]

This 2016 article by Yann Robiou du Pont et al[281] uses five equity approaches to distribute national emissions from five sets of global mitigation scenarios that align with the *Paris Agreement* goals of limiting warming to 2°C.

One of the five equity approaches used (the constant emissions ratio) allocates emissions based on the current national distribution of emissions, suggesting that each country undertake an equal reduction of emissions. du Pont et al recognized that developed countries may support this approach, which perpetuates the unequal "status quo". However, as this approach violates principles of climate justice, the results from this approach are not included in this paper.

For the remaining four approaches, du Pont et al provide emissions allocations for Canada for the years 2025, 2030, 2040, and 2050 as a percentage of 2010 levels.[282] The author of this paper has translated these figures into a percentage of Canada's 2005 emissions levels.

a) Capability

This approach allocates each country its "fair share" of the pathway based on its population divided by its per capita GDP, and uses a 30-year convergence period to transition from the present-day international emissions ratios to an equitable ratio.[283]

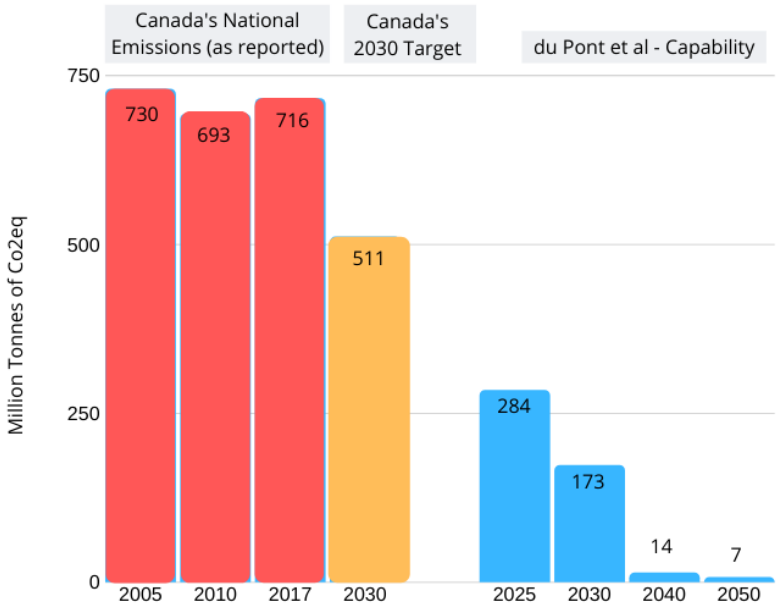
[280] du Pont et al, 2016, *supra* note 140.

[281] At the time of publication, du Pont was affiliated with the Australian-German Climate & Energy College at the University of Melbourne. The remaining authors were affiliated with the same college, the Potsdam Institute for Climate Impact Research, the Energy Program at the International Institute for Applied Systems Analysis in Austria, the Institute for Atmospheric and Climate Science in Switzerland and/or the School of Geography at the University of Melbourne.

[282] These figures are then converted into emissions allocations and fair-share targets using the Canadian government's emissions data for 2010 (693 million tonnes of Co2eq). See Government of Canada, "GHG Emissions", *supra* note 11.

[283] After this period, two formulas are used. *i* is the index of the sum over all countries. 1) If the target pathway's net emissions are positive: $E_c\,(y) = E_{global}(y)$ x $Pop_c\,(y)_2\,GDP_c\,(y) / \sum_{i = \{countries\}}\ Pop_i\,(y)_2\,GDP_i\,(y)$; and 2) If the target pathway's net emissions are negative: $E_c\,(y) = E_{global}(y)$ x $GDP_c\,(y) / \sum_{i = \{countries\}}\ GDP_i\,(y)$. See Yann Robiou du Pont et al, "National Contributions for decarbonizing the world economy in line with the G7 agreement", Supplementary Information (2016) Envtl Research Letters 1 at 10 [du Pont et al, "National Contributions Supplementary"].

Figure Eleven: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by du Pont et al Under the Capability Approach[284]



Du Pont's emissions allocations under this approach are significantly less stringent than those provided under the CERP calculator (which called for Canada to reduce its emissions to 121 percent or 143 percent below 2005 emissions levels by 2030). One such reason for this is because du Pont et al include a convergence period to transition to an equitable emissions ratio, while the calculator does not. However, Du Pont's figures still suggest that Canada's targets would need to greatly decrease to meet a fair share approach based on capability, and would need to almost reach net-zero emissions by 2050.

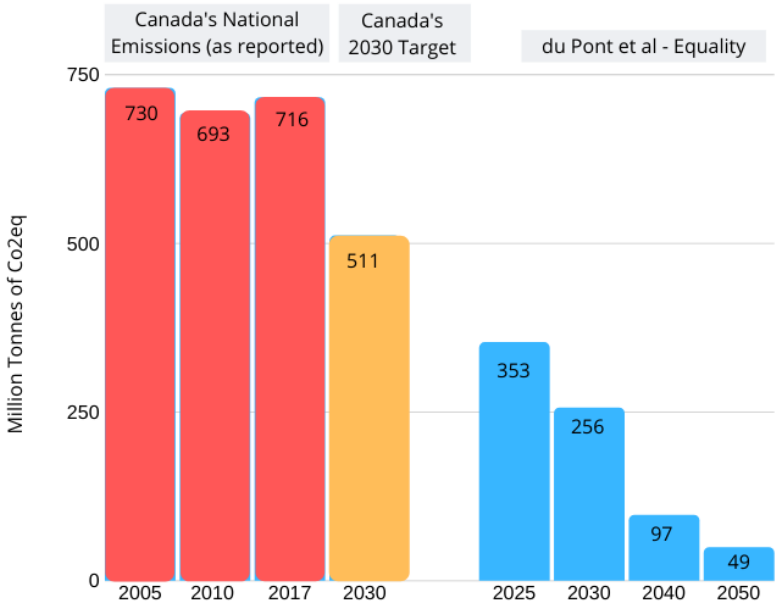
b) Equality (Contraction and Convergence approach)

After the 30-year convergence period, this approach allocates emissions based on a country's population compared against the global population.[285]

284 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; du Pont et al, 2016, *supra* note 140.

285 After the convergence period, national emissions allowances are calculated through the following formula: $E_c(y) = E_{global}(y) \times Pop_c(y)/Pop_w(y)$, "where *Pop* is the population, *E(y)* represents the emissions at a year, $E_{global}(y)$ represents the 'Target' scenario's emissions at a year *y* to be shared, and the subscripts *c* and *w* stand respectively for the considered country and the world." See du Pont et al, "National Contributions Supplementary", *supra* note 300 at 8.

Figure Twelve: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by du Pont et al Under the Equality Approach[286]



Even with the inclusion of a convergence period until 2040, Canada's 2030 emissions reduction target under this approach is significantly more stringent than its present-day target.

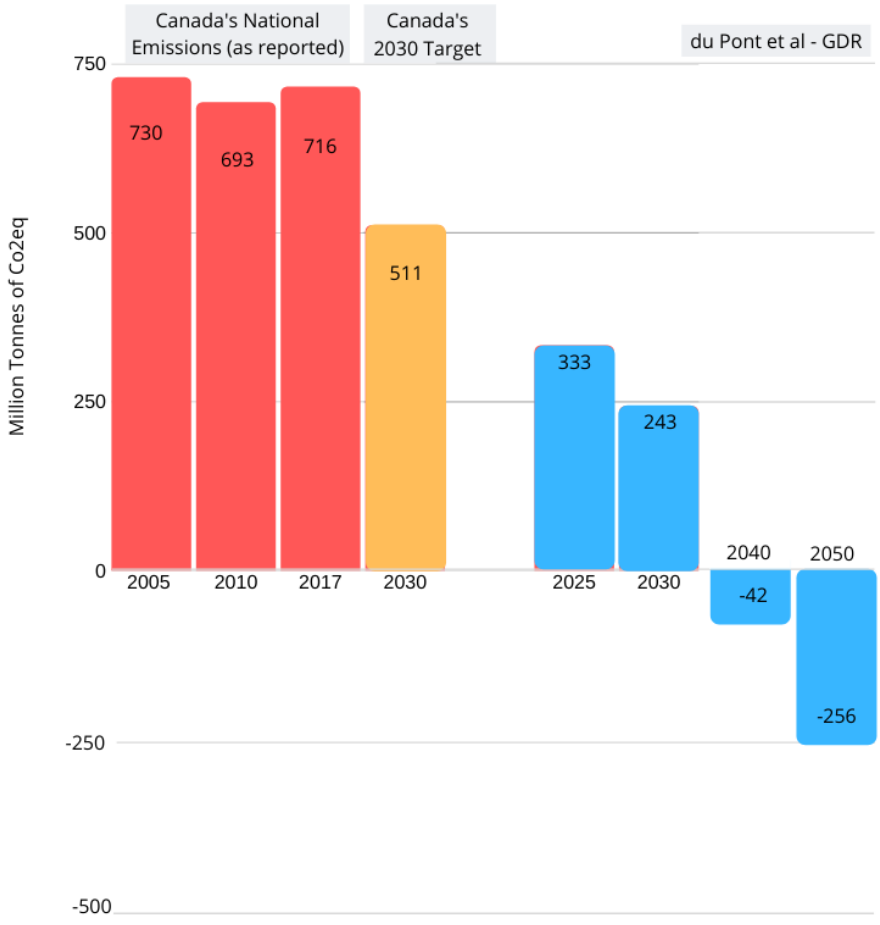
c) GDR

du Pont et al's article also analyzed the distribution of national emissions under a GDR approach. Here, du Pont et al used the standard development threshold of $7,500 and started accounting for cumulative emissions in 1990. Their RCI was informed by the total emissions of the population who live above the development threshold (responsibility) and the total wealth of the population whose incomes are above the threshold (capability).[287] This index yielded the following figures for Canada's emissions allocations:

286 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; du Pont et al, 2016, *supra* note 140.

287 The formula used is $RCI_i = a\ R_i / \sum_{Nj=1} R_j + (1 - a)\ C_i / \sum_{Nj=1} C_j$. See du Pont et al, "National Contributions Supplementary", *supra* note 300 at 10-11.

Figure Thirteen: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by du Pont et al Under the GDR Approach[288]



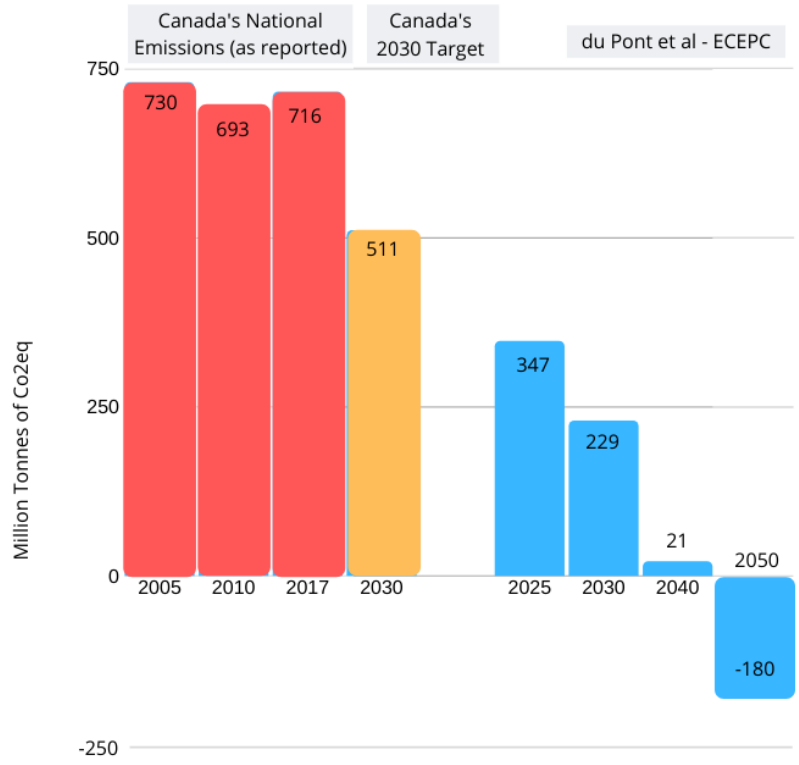
This approach calls for Canada to reach net-zero emissions prior to 2040 and to undertake significant mitigation efforts internationally thereafter to meet its full fair share of the mitigation burden. All four analyses conducted with the CERP's calculator call for Canada to reach net zero emissions prior to 2030 *as well as* undertake significant international mitigation efforts to fulfill this fair share.

288 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; du Pont et al, 2016, *supra* note 140.

d) ECEPC

In considering the distribution of national emissions under an ECEPC approach, du Pont et al created an Autonomous Energy Efficiency Index to account for technological gains in efficiency. This index begins at "1" in the year 2010 and decreases incrementally to 1990 (when cumulative emissions begin to be accounted for under this approach). Historical emissions are multiplied by this index to ensure that these emissions contribute less to a country's cumulative budget than its future emissions.[289] This approach yielded the following figures for Canada's emissions allocations:

Figure Fourteen: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by du Pont et al Under the ECEPC Approach[290]



[289] The formula used is as follows: $\sum_{y=y_h}^{y_e} r(y).E_c(y) = \sum_{y=y_h}^{y_e} r(y).E_{global}(y).\frac{\sum_{y=y_h}^{y_e} Pop_c(y)}{\sum_{y=y_h}^{y_e} Pop_w(y)}, with\ r(y) = \begin{cases} 1\ if\ y \geq y_s \\ (1-X)^{(y_s-y)}\ if\ y < y_s \end{cases}$ See du Pont et al, "National Contributions Supplementary", *supra* note 300 at 8.

[290] Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; du Pont et al, 2016, *supra* note 140.

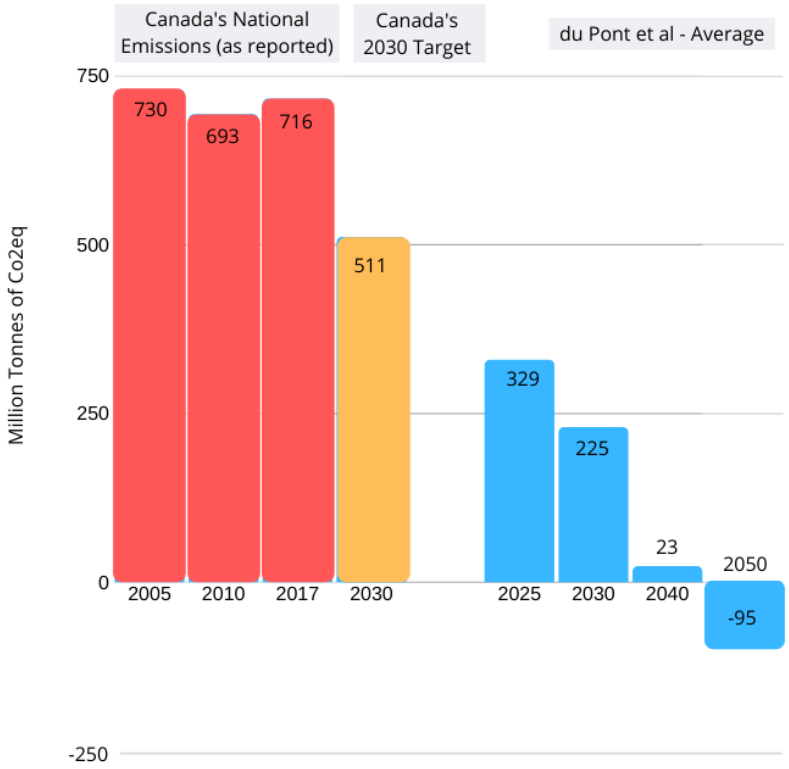
These figures call for Canada to greatly reduce its emissions more than its 2030 emissions reduction target, and calls for Canada to become net-zero by 2042.

e) Average of Multiple Approaches

In addition to individually analyzing five equity approaches, du Pont et al also determined the average of these approaches. This average is significant, in that it illustrates that an international consensus on the superior equity approach is not necessary to compel stronger targets. Agreeing on a set of equity approaches to aid in informing or creating national targets would result in more ambitious fair share targets.

As highlighted earlier, the paper before you excludes the findings of du Pont et al's iteration of the constant emission ratio approach, and, as such, the author of this paper has not used du Pont et al's average figures, but instead calculated the average of the remaining four equity approaches (capability, equal per capita, GDR, and ECEPC) to provide a revised fair share average of Canada's emissions:

Figure Fifteen: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by the Average of Four Approaches Expressed by du Pont et al[291]



The average of these four prominent equity approaches results in a 2030 target of 69 percent below Canada's 2005 emissions levels, which is more than twice as ambitious as Canada's present 2030 target. This approach also calls for Canada to near net-zero emissions by 2040.

A complementary paper by Yann Robiou du Pont and Malte Meinshausen carried out domestic emissions allocations using three equity approaches (capability to pay, equal per capita, and ECEPC).[292] In this paper, du Pont and Meinshausen cleverly eliminated the need to reach international consensus by assigning each country the least stringent emissions allocation of the

291 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; du Pont et al, 2016, *supra* note 140.

292 Yann Robiou du Pont & Malte Meinshausen, "Warming Assessment of the bottom-up Paris Agreement emissions pledges" (2018) 9 Nature Communications 1. At the time of publication, du Pont was affiliated with the Australian-German Climate & Energy College at the University of Melbourne. Meinshausen was also affiliated with this centre as well as the Potsdam Institute for Climate Impact Research.

three approaches for the year 2030.[293] While the methods of allocating emissions are identical to du Pont et al's findings presented above, du Pont and Meinshausen's approach is interesting in that it recognizes the challenges in trying to persuade countries to agree on a common equity approach, particularly due to "national preferences for relative gain",[294] and reflects countries' tendency to advocate for equity approaches that serve their self-interest.[295] Of the three approaches analyzed, Du Pont and Meinshausen found that Canada's most generous emissions allocation in the year 2030 was afforded through the equal per capita approach.

3. Climate Action Tracker[296]

For each country it assesses, CAT draws from seven effort sharing categories (responsibility, capability/need, equality, ECEPC, responsibility/capacity/need, capability/cost, and staged) to compile effort-sharing ranges. The 10th to 90th percentile of these ranges comprise CAT's fair share range, and is used to assess countries' ambition levels. If a country's commitment falls within this range, the target is considered fair by at least one of the equity principles. However, a country's target that falls within the upper portion of the fair share range relies on other countries' commitments to accordingly fall below the upper portion of the range to meet the global pathway. In these instances, CAT classifies these countries' ambition levels as "insufficient", as they require other countries to act 'more fairly'. Conversely, countries whose pledges call for emissions reductions below their fair share range are deemed "role models", as they are committing to more than their fair share.[297]

By comparing the global effort-sharing scenarios against their selected 1.5°C and 2°C global emissions pathways (to the year 2100), CAT determines "the minimal emissions reduction level that would be required in order to make sure that the global target is met without relying on other countries making a comparably bigger effort to reduce emissions."[298] Countries who meet

[293] *Ibid* at 3.
[294] *Ibid* at 2.
[295] *Ibid* at 3.
[296] "Climate Action Tracker" (last visited 29 October 2019), online: *Climate Action Tracker* <climateactiontracker.org/> [Climate Action Tracker, "Climate Action Tracker"].
[297] "Rating System" (last visited 24 October 2019), online: *Climate Action Tracker* <climateactiontracker.org/countries/rating-system/> [Climate Action Tracker, "Rating System"].
[298] "Comparability of effort" (last visited 24 October 2019), online: *Climate Action Tracker* <climateactiontracker.org/methodology/comparability-of-effort/>.

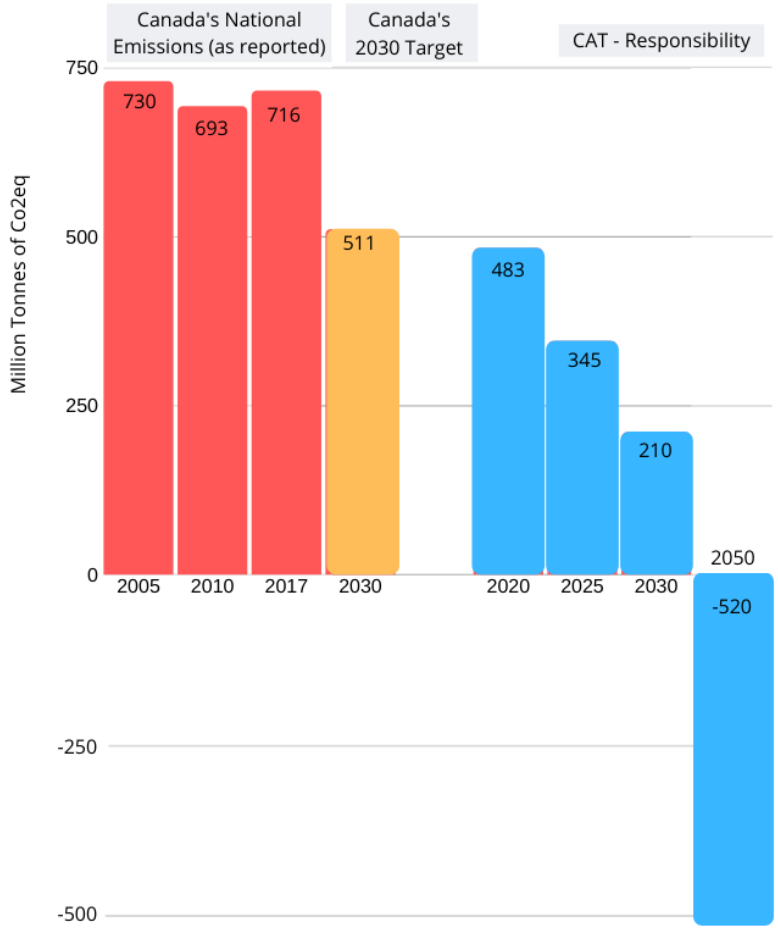
this level of emissions reduction fall within their fair share range, and are deemed to be "2°C compatible" or "1.5°C Paris Agreement Compatible".[299]

Lastly, CAT uses its individual country analyses to map out three global pathway scenarios based upon countries' current policy projections, short-term pledges to the year 2030, and long-term pledges to the year 2050.[300] Those countries whose ambitions levels would allow warming to reach between 3°C and 4°C or go above 4°C are deemed "highly insufficient" and "critically insufficient", respectively.[301] Using the averaged results of studies categorized under these equity principles provided Canada's emissions allocations under a 1.5°C pathway as presented below.

a) Responsibility

[299] Climate Action Tracker, "Rating System", *supra* note 314.
[300] For the countries it does not analyze, CAT includes their Kyoto Protocol commitments in the pledge pathways, or otherwise assumes that their emissions will follow a business-as-usual pathway. See Climate Action Tracker, "Global Pathways", *supra* note 262.
[301] Climate Action Tracker, "Rating System", *supra* note 314. Historically, CAT has considered Canada's NDC to be "highly insufficient", due in part to uncertainty "around the extent to which it would rely on its forestry sector sink to meet its target." In 2018, however, Canada clarified that by 2030, accounting for contributions from LULUCF would lower Canada's emissions by approximately 24 million tonnes of Co2eq by 2030. With this understanding, CAT upgraded Canada's ranking to "insufficient". See "Climate crisis demands more government action as emissions rise" (June 2019) at 10-11, online (pdf): *Climate Action Tracker* <climateactiontracker.org/documents/537/CAT_2019-06-19_SB50_CAT_Update.pdf>; Environment and Climate Change Canada, "2018 Canada Projections", *supra* note 171 at 33.

Figure Sixteen: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and CAT's Emissions Targets Under the Responsibility Approach for 2030[302]

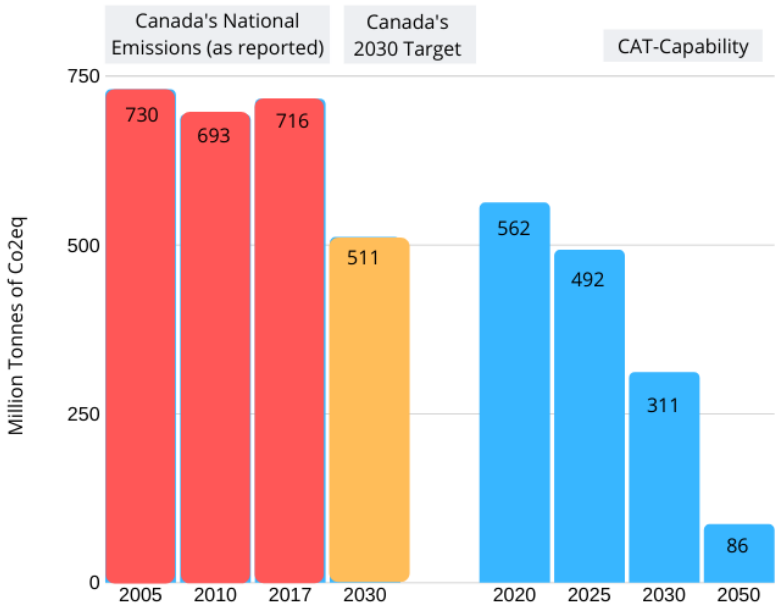


Under this approach, CAT suggests that Canada's fair share emissions reduction target is a 71 percent reduction of Canada's 2005 emissions by 2030—more than twice as ambitious as Canada's present-target. By 2050, this approach suggests that Canada should not only be net-zero, but also undertake mitigation efforts to reduce emissions in developing countries by 500 million tonnes.

302 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; "Detailed effort sharing data" (last modified 28 November 2018), online: *Climate Action Tracker* <climateactiontracker.org> [Climate Action Tracker, "Detailed effort sharing"]. Copyright © 2018 by Climate Analytics, Ecofys and NewClimate Institute. All rights reserved.

b) Capability

Figure Seventeen: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and CAT's Emissions Targets Under the Capability Approach for 2030[303]



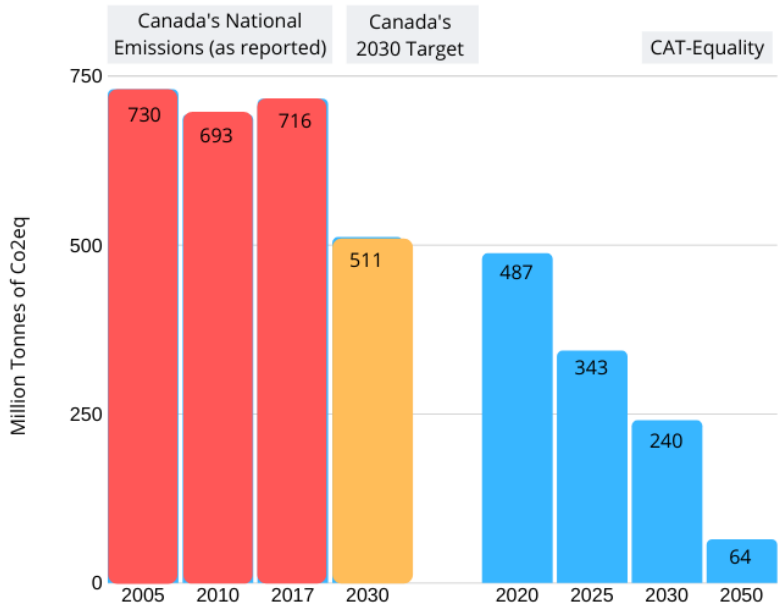
Although CAT's average 2030 target under this approach is more generous than that provided by the CERP (121 or 143 percent below Canada's 2005 emissions levels) and Du Pont et al (76 percent below Canada's 2005 emissions levels), the target presented by CAT (57 percent below Canada's 2005 emissions levels) is still nearly twice as ambitious as Canada's present 2030 target. Du Pont et al's figures, while more stringent than CAT's, still fall within the fair share range suggested by CAT (the target is based on the median figure). The scope of emissions included and slight differences within CERP, Du Pont et al and CAT's formulas may have also impacted these findings.[304]

303 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; Climate Action Tracker, "Detailed effort sharing", *supra* note 319.

304 For instance, du Pont et al use cumulated wealth to inform its capability indicator of the RCI, whereas the CERP calculator does not tally capacity on a cumulative basis. See du Pont et al, "National Contributions Supplementary", *supra* note 300 at 10; Climate Equity Reference Project, "CERP Calculator Database", *supra* note 281. While both the Calculator and du Pont el al exclude LULUCF emissions, the latter also

c) Equality

Figure Eighteen: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by CAT Under the Equality Approach for 2030[305]



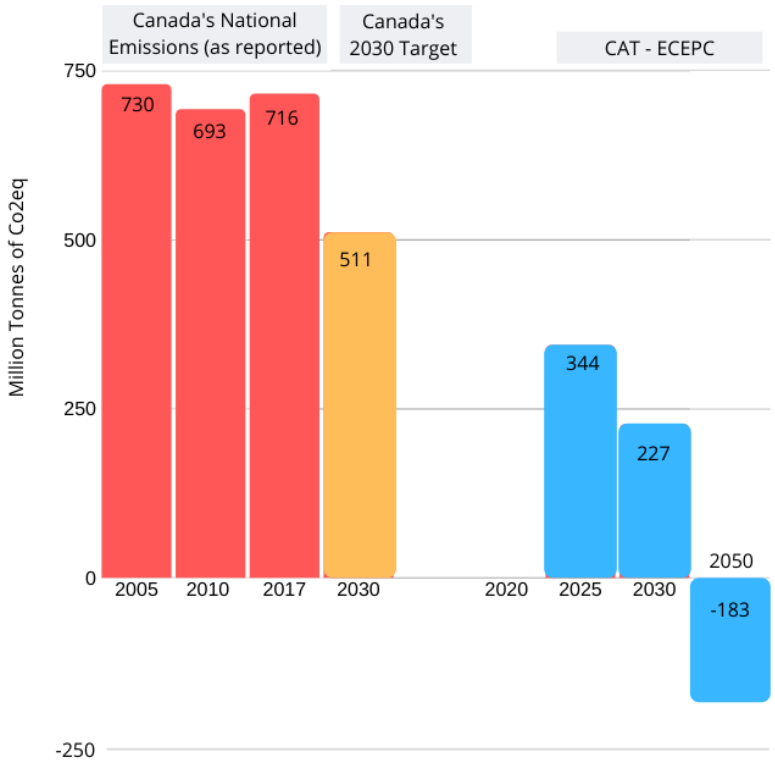
CAT's 2030 target under this approach (67 percent below Canada's 2005 emissions levels) is very similar to the target advanced by du Pont et al (65 percent below Canada's 2005 emissions levels). As an equality approach compares a country's population in relation to the global population, it is not surprising that these studies suggest a similar target. While du Pont et al used a 30-year convergence period, CAT uses an average of studies and is thus likely drawing from sources that both include and exclude a convergence period. The slight variations in these figures may also be explained by the use of differing national or global population statistics.

excluded international shipping and aviation emissions from its analysis. For further information, see du Pont et al, 2016, *supra* note 140 at 44.

305 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; Climate Action Tracker, "Detailed effort sharing", *supra* note 319.

d) ECEPC

Figure Nineteen: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by CAT Under the ECEPC Approach for 2030[306]

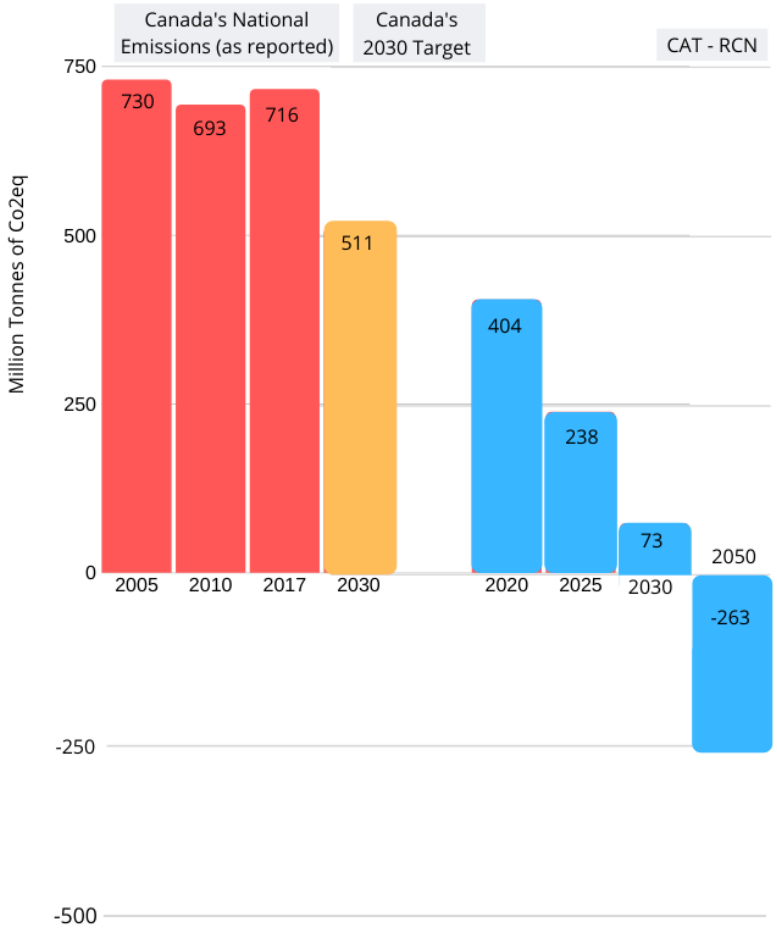


Under this approach, CAT advances the same target as suggested by du Pont et al for the year 2030: a 69 percent reduction below Canada's 2005 emissions levels. It is not surprising that these iterations arrived at a similar finding given that the information populating these figures is less susceptible to variation.

306 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; Climate Action Tracker, "Detailed effort sharing", *supra* note 319.

e) RCN

Figure Twenty: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by CAT Under the RCN Approach for 2030[307]



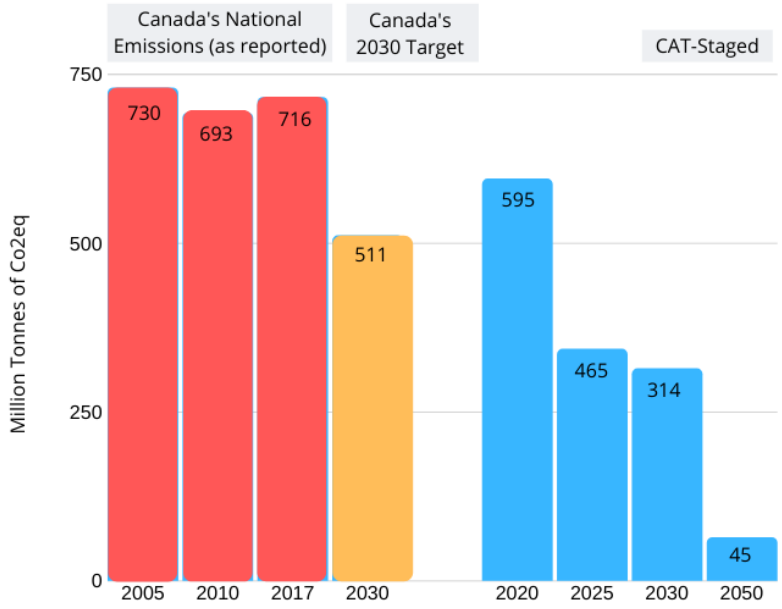
As this approach combines the responsibility and capability approaches, the previously-explained variations between the studies in those approaches are also relevant here (*i.e.,* the use of a convergence period, differing formulas, and scope of emissions included). CAT's 2030 target suggested here (90 percent below Canada's 2005 emissions level) is more stringent than the target suggested by du Pont et al under this approach (67 percent below Canada's 2005

307 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; Climate Action Tracker, "Detailed effort sharing", *supra* note 319.

emissions level), but less stringent than all four of the targets advanced by CERP (which ranged from 122 to 151 percent below Canada's 2005 emissions levels).

f) Staged

Figure Twenty-One: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by CAT Under the Staged Approach for 2030[308]

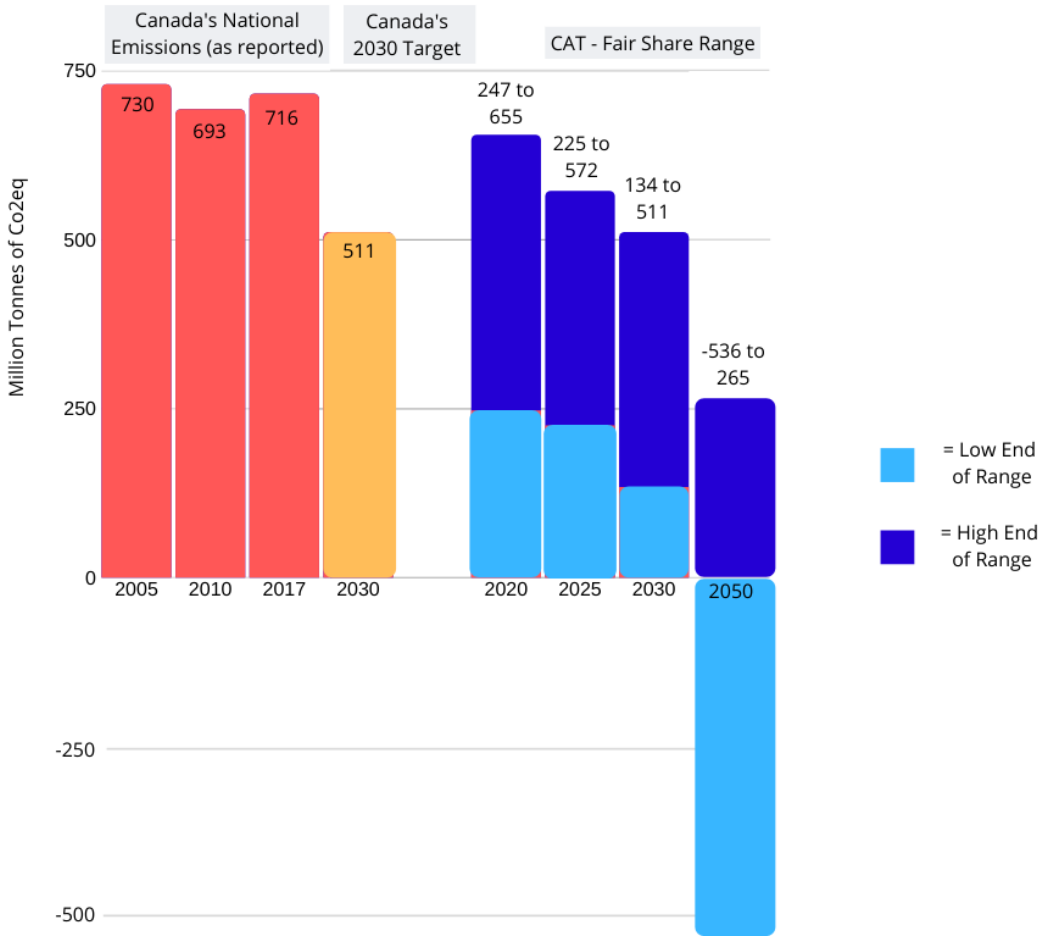


Under this approach, the burden of reducing emissions falls largely upon developed countries, either for a period of time or until states reach a certain level of development. According to CAT's findings, allowing for these differentiated commitments within the international community would mean that Canada's emissions reduction target would need to become nearly twice as ambitious. This approach was not used by the CERP or du Pont et al.

308Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; Climate Action Tracker, "Detailed effort sharing", *supra* note 319.

g) All – Lower & Upper bound

Figure Twenty-Two: Canada's Total Emissions for Selected Years in Comparison to its 2030 Target and the Emissions Targets Suggested by CAT's Fair Share Range for 2030[309]



Canada's present target, if met, would result in emissions of 511 million tonnes of Co2eq in 2030.[310] While this emissions level would technically fall within the upper portion of Canada's fair share range (30 to 82 percent below 2005 levels by 2030), such a level would still be deemed "insufficient", as it requires other countries to take on a greater portion of their fair share to meet a global pathway. Canada's target would thus have to call for at least a 56 percent

309 Government of Canada, "GHG Emissions", *supra* note 11; "Canadian Environmental Sustainability", *supra* note 40 at 5; Climate Action Tracker, "Detailed effort sharing", *supra* note 319.

310 Environment and Climate Change Canada, "Canadian Environmental Sustainability", *supra* note 40 at 5.

reduction below 2005 levels by 2030 (the middle of this range) to avoid placing a larger burden on other countries and be deemed "fair".

C. Summary & Conclusion

Regardless of the equity approach invoked or supported, these findings detail the inadequate nature of Canada's present emissions reduction target. It is significant that each finding requires more ambition than Canada's fair share emissions reduction target, with some proposed targets calling for more than four times the ambition of Canada's present target. The following table summarizes the targets presented above:

Table Three: Canada's Fair Share Emissions Targets as Suggested by CERP, Du Pont et al, and CAT [311]

	Fair 2030 Emissions Reduction Target	***Comparison to Canada's Present 2030 Emissions Reduction Target (30% below 2005 levels)*** [312]
RESPONSIBILITY		
CERP	79-84% below 2005 levels	2.60-2.80x as ambitious
CAT	71% below 2005 levels	2.36x as ambitious
CAPABILITY		
CERP	121-143% below 2005 levels	4.03-4.76x as ambitious
Du Pont et al	76% below 2005 levels	2.53x as ambitious
CAT	57% below 2005 levels	1.90x as ambitious
RESPONSIBILITY-CAPABILITY-NEED		
CERP	122-153% below 2005 levels	4.07-5.10x as ambitious
Du Pont et al	67% below 2005 levels	2.23x as ambitious
CAT	90% below 2005 levels	3.00x as ambitious
EQUALITY		
Du Pont et al	65% below 2005 levels	2.17x as ambitious
CAT	67% below 2005 levels	2.23x as ambitious
ECEPC		
Du Pont et al	69% below 2005 levels	2.30x as ambitious
CAT	69% below 2005 levels	2.30x as ambitious

311 "Canadian Environmental Sustainability", *supra* note 40 at 5; Ekholm et al, *supra* note 250; du Pont et al, 2016, *supra* note 140; Climate Action Tracker, "Detailed effort sharing", *supra* note 319.

312 "Canadian Environmental Sustainability", *supra* note 40 at 5.

STAGED		
CAT	57% below 2005 levels	1.90x as ambitious
MULTIPLE APPROACHES		
Du Pont et al (Average of 4 approaches)	69% below 2005 levels	2.30x as ambitious
CAT (Middle of Fair Share Range)	56% below 2005 levels	1.87x as ambitious

Every "fair" target suggested by these three studies is significantly larger than Canada's present emissions reduction target. At minimum, these proposed targets call for Canada to nearly double its emissions reduction target, however, multiple suggested targets call for Canada to reach net-zero emissions by 2030 *and* undertake mitigation efforts to further reduce emissions beyond its own borders.

The author of this paper finds the GDR framework (under the RCN equity principle) to be the most fair standalone approach, as it considers both a state's historical responsibility and its per capita income. The outcome of this approach is greatly impacted by several factors, including the start year to begin accounting for emissions, the use of a convergence period, and the use of development and luxury thresholds. Even the least stringent iteration of this approach included in this analysis, however, calls for Canada to more than double its present emissions reduction target.

CAT's Fair Share Range is attractive in that it negates the need to latch onto a specific equity approach. As each state may have different ideas on which equity approach is preferable, this approach (which includes calculations from the six equity approaches) perhaps has the best chance of being integrated into climate negotiations. Under this approach, Canada would also need to almost double its 2030 emissions reductions target.

While these equity approaches suggest varying levels of ambition for Canada to contribute its fair share of global emissions reduction, each approach calls for, at minimum, a near doubling of ambition. Considering that Canada is not presently on track to meet its 2030 target, significant changes must be made to Canada's mitigation efforts in order to meet either

this present target or any of the proposed fair targets. The following section considers how Canada could undertake efforts to meet its fair share of the global emissions reduction burden.

VII. How Do We Get There: Meeting our Fair Share

In a February 2019 letter to Prime Minister Justin Trudeau, several ENGOs suggested that the federal government follow BC's lead in closing the gap between its planned initiatives and its 2030 emissions reduction target.[313] BC's recent climate strategy, "CleanBC", acknowledges that its current initiatives will only provide 75 percent of the emissions reductions needed to meet its target. This plan differs from the Pan-Canadian Framework, however, in that it also sets a timeline (of 18 to 24 months) to identify the additional initiatives that will reduce BC's emissions to its target level, and provides a list of possible initiatives.[314]

While closing the emissions gap between Canada's policy trajectory emissions and its reduction target is an important first step, Canada must do more than meet this target. If Canada is to bear its fair share of the global mitigation burden, a significantly more stringent target is required. This section of the paper introduces several approaches to consider how Canada can work to introduce and meet such a target.

A. Set Stronger Targets

1. Revise Canada's 2030 target to align with a fair share target

Canada's NDC to the UNFCCC states that "[w]ith this contribution Canada is affirming our continued commitment to developing an international climate change agreement that is fair, effective and includes meaningful and transparent commitments from all major emitters."[315] To demonstrate its commitment to a fair international climate change agreement, Canada could simply revise its emissions reduction target to align with a fair share target under one or more equity approaches as detailed in Table Two.

[313] The group of ENGOs included West Coast Environmental Law, Clean Energy Canada, Ecojustice, Georgia Strait Alliance, Pembina Institute, Sierra Club BC, Stand.earth, and the Wilderness Committee. See Letter from West Coast Environmental Law et al to Prime Minister Justin Trudeau (25 February 2019) on "CleanBC: An Accountability Model for the Pan-Canadian Framework", online (pdf): *West Coast Environmental Law* <www.wcel.org/sites/default/files/publications/pcf-cleanbc-letter-2019.pdf>.
[314] "CleanBC: Our Nature. Our Power. Our Future." (last updated March 2019) at 59, online (pdf): *Government of British Columbia* <blog.gov.bc.ca/app/uploads/sites/436/2019/02/CleanBC_Full_Report_Updated_Mar2019.pdf>.
[315] Government of Canada, "Canada's INDC Submission", *supra* note 14.

Recognizing that some "fair" emissions reduction targets would be very difficult to implement, Climate Action Network Canada suggests that Canada at least double the ambition of its 2030 target (leading to an amended target of reducing emissions by 60 percent below 2005 levels), and engage in international efforts to reduce the remaining portion of its fair obligation.[316]

2. Carbon neutrality targets

During the 2019 election campaign, Prime Minister Trudeau pledged, if re-elected, to introduce a net-zero 2050 emissions reduction target and legally-binding five-year targets to work towards this goal.[317] Setting a net-zero emissions target would align Canada with the 65 other countries who have already committed to net-zero emissions by, at the latest, the year 2050.[318] These commitments are frequently expressed through policy documents, as was done in Uruguay, Finland, Iceland, Denmark, Portugal, Costa Rica, Fiji, and the Marshall Islands.[319]

Other countries have opted to legislate a net-zero target. Following a strong recommendation by its Committee on Climate Change in May 2019,[320] the United Kingdom ("UK") became the first major economy to pass legislation binding its 2050 net-zero target.[321]

316 Christian Holz, "Deriving a Canadian Greenhouse Gas Reduction Target in Line with the Paris Agreement's 1.5°C goal and the Findings of the IPCC Special Report on 1.5°C" (December 2019), online: *Climate Action Network* <climateactionnetwork.ca/wp-content/uploads/2019/12/CAN-Rac-Fair-Share-%E2%80%94-Methodology-Backgrounder.pdf>.

317 Victoria Gibson, "Liberals promise net-zero emissions by 2050, offer sparse detail on path ahead" (24 September 2019), online: <ipolitics.ca/2019/09/24/liberals-promise-net-zero-emissions-by-2050/>.

318 65 other countries had committed at the time of the following press release in September 2019. See "In the face of worsening climate crisis, UN Summit delivers new pathways and practical actions to shift global response into higher gear" (23 September 2019), online: *UN Sustainable Development Goals* <www.un.org/sustainabledevelopment/blog/2019/09/in-the-face-of-worsening-climate-crisis-un-summit-delivers-new-pathways-and-practical-actions-to-shift-global-response-into-higher-gear/>.

319 Owen Gaffney et al, "Meeting the 1.5°C Climate Ambition: Moving from Incremental to Exponential Action" (2019) at 31, online (pdf): *Exponential Roadmap* <exponentialroadmap.org/wp-content/uploads/2019/09/Meeting-the-1.5%C2%B0C-Climate-Ambition-September-19-2019.pdf>.

320 "Net Zero: The UK's Contribution to stopping global warming" (May 2019) at 8, online: *Committee on Climate Change* <www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf>.

321 Chris Skidmore, "UK becomes first major economy to pass net zero emissions law" (27 June 2019), online: *Department for Business, Energy & Industrial Strategy* <www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law>.

Net-zero targets have also been legislated by Denmark and France,[322] as well as Sweden, who committed to achieving net-zero emissions by 2045.[323]

Whether legislated or embedded in policy, a long-term target can help inform short and medium-term milestone targets. For instance, Sweden adopted several interim targets to marshal a path towards its longer-term target, including:

- To reduce emissions by 40 percent below 1990 levels by 2020;
- To reduce emissions by 63 percent below 1990 levels by 2030; and
- To reduce emissions by 75 percent below 1990 levels by 2040.[324]

Denmark's newly-elected Prime Minister Mette Frederiksen also recently passed a law that calls for the creation of emissions reduction targets to be set every five years beginning in 2020.[325]

3. Legislated carbon budgets

While some countries have legislated emissions reduction targets, other jurisdictions have alternatively, or additionally, opted to legislate carbon budgets to assist with planning. With the passing of the *Climate Change Act* in 2008,[326] the UK "became the first country in the world to require mandatory economy-wide carbon budgets".[327] These carbon budgets, which are set for

[322] "New climate plan to make Denmark carbon neutral by 2050" (9 October 2018), online: *Copenhagen Capacity* <www.copcap.com/newslist/2018/new-ambitious-climate-plan-will-make-denmark-carbon-neutral-by-2050>; Felix Bate, "France sets 2050 carbon-neutral target with new law" (27 June 2019), online: *Reuters* <www.reuters.com/article/us-france-energy/france-sets-2050-carbon-neutral-target-with-new-law-idUSKCN1TS30B>. Norway has also conditionally pledged carbon neutrality by the year 2030 "as part of an ambitious global climate agreement where other developed nations also undertake ambitious commitments". While this goal has also been approved by its parliament, Climate Action Tracker excluded it from its assessment given its "vague character and the fact that it was not yet adopted by the government." See "Norway" (last modified 19 September 2019), online: *Climate Action Tracker* <climateactiontracker.org/countries/norway/pledges-and-targets/>.

[323] "Sweden's Climate Act and Climate Policy Framework" (last modified 24 September 2019), online: *Swedish Environmental Protection Agency* <www.swedishepa.se/Environmental-objectives-and-cooperation/Swedish-environmental-work/Work-areas/Climate/Climate-Act-and-Climate-policy-framework-/>.

[324] *Ibid.*

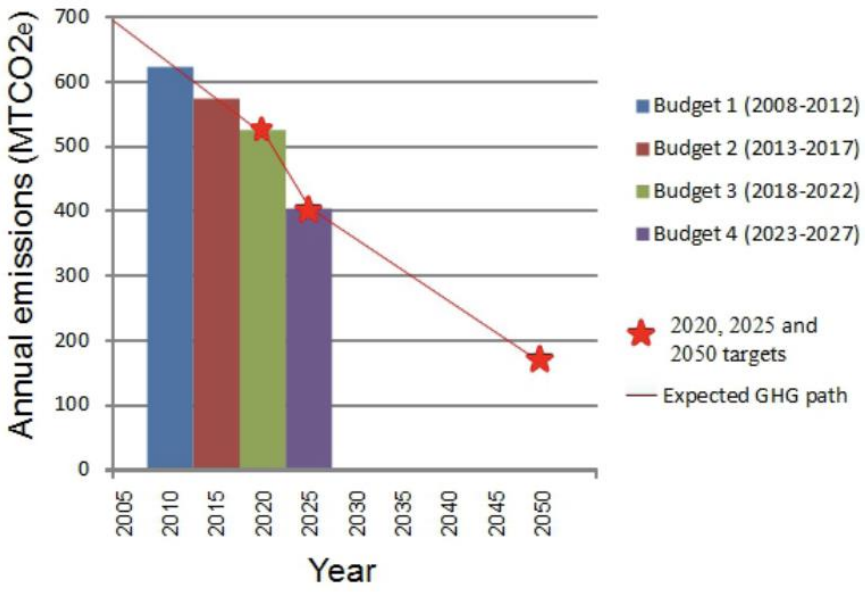
[325] Jocelyn Timperley, "Denmark adopts climate law to cut emissions 70% by 2030" (6 December 2019), online: *Climate Change News* <www.climatechangenews.com/2019/12/06/denmark-adopts-climate-law-cut-emissions-70-2030/>.

[326] *Climate Change Act 2008* (UK) [*Climate Change Act, UK*].

[327] Andrew Gage, "A Carbon Budget for Canada: A Collaborative Framework for Federal and Provincial Climate Leadership" (December 2015) at 13, online (pdf): *West Coast Environmental Law* <www.wcel.org/sites/default/files/publications/CarbonBudget%20(Web)_0.pdf>.

five-year periods, help "ensure that government decision makers stay within a carbon budget, similar to a financial budget."[328] The following graph by Andrew Gage details how the UK has achieved its carbon budgets and is on track to meet its emissions reduction targets.

Figure Twenty-Three: UK's Carbon Budget Compared against its Emissions Reduction Targets[329]



The UK's *Climate Change Act* also establishes a Committee on Climate Change, which the federal government must consult with to set each carbon budget.[330] In 2008, this Committee recommended that the UK adopt a target of reducing emissions by at least 80 percent below 1990 levels by 2050, as informed by "an equal per capita share of global emissions in 2050" based on the pathways the Committee analyzed at the time.[331] The UK recently updated this target to set a net-zero target for 2050.[332]

Shortly after the UK's Act was passed, Scotland passed its *Climate Change Act* in 2009.[333] Although largely similar to the UK's Act, Scotland's carbon budgets are set annually,

[328] Gibson et al, *supra* note 69 at 84.
[329] This chart is presented in megatonnes. 1 megatonne = 1 million tonnes of Co2eq. See Gage, *supra* note 344 at 13-14.
[330] *Climate Change Act, UK*, *supra* note 343, s32.
[331] Committee on Climate Change, *supra* note 337 at 19.
[332] *Climate Change Act, UK*, *supra* note 343, s1.
[333] *Climate Change (Scotland) Act* 2009 (Scot), ASP 12 [*Climate Change Act, Scotland*].

which increases accountability.[334] Scotland's Act initially prescribed a minimum 80 percent reduction of emissions below 1990 levels by 2050,[335] however, a recent amendment set a new net-zero emissions target by the year 2045.[336] Scotland also has "interim" targets to reduce emissions by at least 42 and 75 percent below 1990 levels by 2020 and 2030, respectively.[337]

When setting its annual carbon budget, the Scottish Ministers are to consider several criteria, the first of which is "the objective of not exceeding the fair and safe Scottish emissions budget".[338] The Act defines the "fair and safe Scottish emissions budget" as

> the aggregate amount of net Scottish emissions for the period 2010-2050 recommended by the relevant body as being consistent with Scotland contributing appropriately to stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.[339]

4. Compel more stringent targets through climate litigation

Net zero targets, interim targets, and legislated carbon budgets are all productive means to help countries take on their fair share of the global mitigation burden. These measures also require significant political will and capital to be introduced and adopted into law. When this will or capital is not present, citizens may turn to the courts to try and compel more stringent national emissions reduction targets.

This precedent was set by a case brought by the Urgenda Foundation in the Netherlands, which was recently affirmed by the Dutch Supreme Court.[340] The foundation claimed that the Netherlands government had breached its duty of care towards its citizens by failing to adopt a

[334] *Ibid*, s3(1). Gage, *supra* note 344 at 16.
[335] *Ibid*, s1.
[336] "Climate change: MSPs approve beefed up emissions target" (25 September 2019), online: *BBCNews* <www.bbc.com/news/uk-scotland-49819905>.
[337] For Scotland's 2020 target, see *Climate Change Act, Scotland*, *supra* note 350, s2. For more information on Scotland's recently passed 2030 target, see BBCNews, *supra* note 353.
[338] *Climate Change Act, Scotland*, *supra* note 350, s4(4)(a).
[339] *Ibid*, s 4(6).
[340] "Supreme court upholds Urgenda ruling, Dutch state must cut pollution" (20 December 2019), online: *DutchNews.Nl* <www.dutchnews.nl/news/2019/12/supreme-court-upholds-urgenda-ruling-dutch-state-must-cut-pollution/?fbclid=IwAR0Sn5rishT18rxyxMSSIjdiFXakKOnQwoQ4eXfFfC8gWLKIXzt1ayZsJJs>; *Urgenda v Government of the Netherlands (Ministry of Infrastructure and the Environment* (20 December 2019) ECLI: NL: HR: 2019: 2006 (Netherlands). See also *Urgenda v Government of the Netherlands (Ministry of Infrastructure and the Environment* (9 October 2018) C/09/00456689 (English translation) (Netherlands).

sufficient emissions reduction target.[341] The Hague District Court found the emissions reduction target—to reduce emissions by 17 percent below 1990 levels by 2020— insufficient, as it did not meet the norm for developed countries to reduce emissions by 25 to 40 percent below 1990 levels (as put forth in Box 13.7 of the IPCC's fourth assessment report).[342] The government was ordered "to limit the joint volume of Dutch annual greenhouse gas emissions (...) by at least 25% at the end of 2020 compared to the level of the year 1990".[343]

It is notable that the Court rejected the government's defence that the brunt of emissions reduction ought to be undertaken by higher-emitting countries.[344] In doing so, the Court stated that "[t]he fact that the amount of the Dutch emissions is small compared to other countries does not affect the obligation to take precautionary measures in view of the State's obligation to exercise care. After all, it has been established that any anthropogenic greenhouse gas emission, no matter how minor, contributes to an increase of CO2 levels in the atmosphere and therefore to hazardous climate change."[345]

As Patrícia Galvâo Ferreira notes, this case was the first time that a court "issued a mandatory order for a government to adopt nationwide mitigation targets, outside a statutory mandate" as well as the first time that a court "determined a mandatory minimum emissions-reduction target for a developed state."[346] Du Pont & Meinshausen are mindful, however, that the Court did not pick a specific approach of equity, instead ruling that the Dutch government must "follow the least-ambitious end of an equity range"—an approach which "would be insufficient to achieve the Paris Agreement."[347]

Despite meaningful efforts, this case has yet to be successfully replicated in other jurisdictions. In Ireland, Friends of the Irish Environment sought a court order to quash the government's decision to approve its National Mitigation Plan, claiming that the plan violated

[341] *Urgenda v Government of the Netherlands (Ministry of Infrastructure and the Environment* (24 June 2015) C/09/00456689 (English translation) (Netherlands) at 3.1 [*Urgenda*].
[342] See Section II of this paper for further discussion of Box 13.7.
[343] *Urgenda*, *supra* note 358 at 5.1.
[344] *Ibid* at 4.79.
[345] *Urgenda*, *supra* note 358 at 4.79.
[346] Patrícia Galvão Ferreia, "'*Common But Differentiated Responsibilities' in the National Courts:* Lessons from Urgenda *v*. The Netherlands" (2016) 5:2 Transnational Envtl L 329 at 330-1.
[347] du Pont & Malte Meinshausen, *supra* note 309 at 2.

Ireland's Climate Act and lacked mitigation measures to urgently reduce emissions and meet its international obligations. In September 2019, the Dublin High Court dismissed the claim, stating that "[i]t cannot be concluded that it is the Act itself which places rights at risk, and I couldn't reasonably conclude as specified in legislation that it is contrary to national policy for climate change."[348] In November 2019, Friends of the Irish Environment appealed the ruling at the Court of Appeal, and filed an application to appeal directly to the Supreme Court.[349]

Over the last four years, a group of American youth have been forging a different path to try and compel adequate domestic climate action through the courts. In *Juliana v United States*, 21 students (represented by Our Children's Trust) sought to hold the US government accountable for continuing to use fossil fuels, as their current policies and plans will fail to achieve the needed emissions reduction, violating the youths' constitutional rights to equal protection, life, liberty, and property, and failing to protect essential public trust resources.[350] The youth asked the court to compel the government to stop violating their rights and "swiftly phase-down Co2 emissions aimed at atmospheric Co2 concentrations that are no more than 350 ppm by 2100"[351]—which Burger & Wentz remind readers is "a science-based target consistent with the goal of limiting global warming to 1.5 degrees C."[352] In January 2020, this case was dismissed, with the Court calling for emissions policies to be addressed by Congress or the electorate.[353]

A similar case was launched in Canada in October 2019 by fifteen youth who claim that the Federal government is violating their Charter rights to life, liberty, and security, as well as equality. The plaintiffs are seeking an order from the Federal Court requiring the Federal government to "develop and implement an enforceable plan that is consistent with Canada's fair

348 Aoife Moore, "Court rules for Irish government in historic climate case" (19 September 2019), online: *Independent.Ie* <www.independent.ie/breaking-news/irish-news/court-rules-for-irish-government-in-historic-climate-case-38514770.html>.

349 Sabin Center for Climate Change Law, "Friends of the Irish Environment v Ireland" (last visited December 21 2019), online: *Climate Case Chart* <climatecasechart.com/non-us-case/friends-of-the-irish-environment-v-ireland/>.

350 *Juliana v United States* "Complaint for Declaratory and Injunctive Relief" 28 U.S.C. § 1331 (US DC-Oregon, Eugene) at paras 8,9 and 91.

351 *Ibid* at para 12.

352 Michael Burger & Jessica Wentz, "A Preview of How Climate Science Could Play Out in 'Juliana v. United States' Courtroom" (11 January 2019), online: *Sabin Center for Climate Change Law* <blogs.ei.columbia.edu/2019/01/11/climate-courtroom-juliana-v-us/>.

353 *Juliana v United States*, No 18-36082 DC No 6:15-cv-01517- AA (US CA 9th Cir 2020).

share of the global carbon budget necessary to achieve GHG emissions reductions consistent with the protection of public trust resources subject to federal jurisdiction and the plaintiffs' constitutional rights".[354]

This youth-led case is not Canada's first. In November 2018, a youth-led class action lawsuit was filed by ENvironnement JEUnesse ("ENJEU") on behalf of people aged 35 and under in Quebec. ENJEU alleged that the federal government had violated its international obligations in failing to meet its emissions reduction targets, and that its climate inaction interfered with human rights protected under the Canadian Charter of Rights and Freedom and the Quebec Charter of Human Rights and Freedoms.[355]

This claim declared that states' failure to "take today the necessary measures to prevent dangerous global warming" places a much higher burden on younger generations than "on the generations that precede them"[356], and forces young people to assume "higher economic and social costs than their elders."[357] In its motion for authorization of a class action, ENJEU detailed that a national emissions reduction target ought to be determined based on a global temperature limit target, the total global emissions that are compatible with this target, and each country's fair share of the total emissions.[358]

ENJEU demonstrated the inadequacy of the Canadian government's 2030 target by calling for Canada to reduce its emissions in alignment with the reduction range advocated for in the IPCC's fourth assessment box (25 to 40 percent below its 1990 levels by 2020), which would result in emissions of 362 to 452 million tonnes of Co2 in 2020.[359]

In July 2019, Justice Gary Morrison of the Superior Court of Quebec rejected the case's class action status,[360] finding that ENJEU had failed to justify its choice of age, rendering the

354 La Rose et al, "Statement of Claim", *supra* note 88 at para 9.
355 Theroux, Gill & Gagne, *supra* note 87.
356 EnJeu, "Motion for Authorization", *supra* note 86 at 2.92.
357 *Ibid* at 2.94.
358 *Ibid* at 2.43.
359 *Ibid* at 2.66-71.
360 *Environnement Jeunesse c Procureur Général du Canada* (2019), 2019 QCCS 2885 (Canlii).

class arbitrary, subjective and inappropriate.[361] Justice Morrison noted, however, that the issues raised by ENJEU were justiciable and rejected the government's argument that the Court lacked the jurisdiction to hear the case.[362]

Lastly, the "People's Climate Case" was filed at the European General Court in May 2018 by a group of 37 applicants from Kenya, Fiji, Portugal, Germany, France, Italy, Romania, and the Swedish Saami Youth Association.[363] These applicants were comprised of children and their parents who worked in agriculture and tourism "who are and will increasingly be adversely affected in their livelihoods and their physical well-being by climate change effects", alongside an association of equally-affected indigenous Saami youth.[364] The applicants argued that the EU was "obliged under higher rank legal norms to avoid harm caused by climate change and associated infringements of fundamental human rights."[365] The applicants noted that climate change is "already causing damage" and, as subsequent emissions will contribute to its dangers, "any target set for the reduction of emissions must be based on an assessment of capability, in light of the EU's legal obligations and the trade threat posed by climate change."[366] The applicants argued that the EU set its reduction target without "seeking to inquire into the feasibility of requiring more, so as to avoid the harm prohibited by higher rank law, and so as to fulfil the commitments made most recently in the 2015 Paris Agreement".[367]

This action sought a court order to set aside several laws that comprise part of the EU's 2030 Climate and Energy Framework (and are to be implemented between 2021 and 2030), and order the implementation of more stringent emissions reduction measures.[368]

361 Theroux, Gill & Gagne, *supra* note 87.
362 *Ibid.*
363 *Armando Ferrão Carvalho and others v The European Parliament* (2018), "Application for Annulment Pursuant to Article 263 TFEU and Application/Claim for Non-Contractual Liability Pursuant to Articles 268 and 340 TFEU and Application for Measures of Inquiry Pursuant to Articles 88 and 91 of the Rules of Procedure of the General Court" (Case T-330/18-resubmitted) [Armando Ferrão Carvalho, "Application for Annulment"].
364 *Ibid* at para 1.
365 *Ibid* at para 3.
366 *Ibid* at para 3.
367 *Ibid* at para 3.
368 The laws include the Emissions Trading Directive, the Effort Sharing regulation, and the LULUCF Regulation. See Annalisa Savaresi & Juan Auz, "Climate Change Litigation and Human Rights: Pushing the Boundaries" (2019) Climate L 1 at 10.

The applicants detailed how the EU's 2030 target (to reduce emissions by 40 percent below 1990 levels) violate their duty not to exceed their equitable share of the global budget. They created a global carbon budget using IPCC budgets from 2011 that seek to limit temperature increases to 1.5°C and 2°C. After accounting for emissions from 2011 to 2016, they projected the remaining global carbon budget to 2021.Their findings were as follows:

- 342 to 992 billion tonnes of Co2 (with a 66 percent change of limiting warming to 2°C); and
- 142 to 192 billion tonnes of Co2 (with a 50 percent change of limiting warming to 1.5°C). [369]

The applicants also conducted a second analysis that accounted for historical emissions from 1990 to 2010.

Using these figures, the applicants applied a per capita allocation (using the EU's projected population for 2020) to determine the EU's share of the global budget.[370]

Table Four: Range of CO2 emissions available to the EU in 2021[371]

	Start Date: 1992	***Start Date: 2021***
66% of staying below 2°C	-18.5 to +24.1 billion tonnes of Co2	22.4 to 65.0 billion tonnes of Co2
50% of staying below 1.5°C	-31.6 to -28.3 billion tonnes of Co2	9.3 to 12.6 billion tonnes of Co2

Finally, the applicants used a constant emissions and linear reduction rate to derive a timeline of when the EU's fair share of the carbon budget would be exhausted. In each instance, the EU would need to reduce emissions by greater than its 2030 target of reducing emissions by 40 percent below 1990 levels.[372] Based on its analysis for limiting warming to 1.5°C, the EU would be required to reach net-zero emissions before 2030.[373]

[369] Armando Ferrão Carvalho, "Application for Annulment", *supra* note 380 at paras 194-6.
[370] In 2020, the EU's projected population is 6.55 percent of the global population. See *Ibid* at para 192.
[371] *Ibid* at para 196.
[372] *Ibid* at para 208.
[373] *Ibid* at para 209(a).

This is a reiteration of the ECEPC approach. As described earlier in this paper, a key benefit of this approach is the ease of calculating emissions allocations. However, this approach ignores a state's ability to fund mitigation efforts and can thus unduly burden developing countries. Given the relative prosperity of the EU, however, this was likely not a concern of the applicants.

Unfortunately, this case was dismissed in May 2019 based on the Court's finding that, since climate change affects everyone, the plaintiffs lacked the specific harm needed to grant their standing. The judgment stated that the applicants were "neither directly nor individually concerned by the legislative package."[374] The plaintiffs filed an appeal in July 2019.[375]

B. Corporations' role in national emissions reduction targets

Over the last several years, groundbreaking research by Richard Heede has revolutionized discussions about holding corporations accountable for their roles in causing climate change. Heede's first report, released in 2014, analyzed historic data to trace emissions back to 83 of the world's largest oil, gas and coal companies, as well as 7 of the largest cement companies. Cumulative emissions were attributed to these companies for the years 1854 through to 2010, which were then compared to the cumulative emissions in our atmosphere to estimate each company's contribution to climate change. Together, these 'carbon majors' "represent 63.4 percent of global industrial Co2 emissions from fossil fuel combustion, flaring, and cement over the period from 1751 to 2010".[376] Chevron alone is responsible for 3.52 percent of the global emissions between 1751 to 2010.[377]

Should these companies be required to meet a similar reduction target to that of the state in which it is headquartered and/or operating in? Further, can a state achieve the level of

[374] *Armando Ferrão Carvalho and others v The European Parliament* (2018) at para 33 (EU).
[375] Dana Drugmand, "EU Families Appeal 'People's Climate Case' Dismissal" (11 July 2019), online: *Climate Liability News* <www.climateliabilitynews.org/2019/07/11/eu-climate-case-emissions/>.
[376] Richard Heede, "Carbon Majors: Accounting for carbon and methane emissions 1854-2010-Methods & Results Report" (7 April 2014) at 16, online: *Climate Accountability* <climateaccountability.org/pdf/MRR%209.1%20Apr14R.pdf>.
[377] *Ibid* at 27.

emissions reduction needed to accomplish its mitigation "fair share" without incorporating a mandated corporate emissions reduction target or other legal obligations to compel these companies to reduce their emissions? A recent report by Carbon Tracker Initiative suggests that the world will not be able to accomplish its international climate targets unless the major oil and gas companies reduce their combined production by 35 percent by 2040,[378] highlighting the importance of corporate emissions reductions.

Each country bears the onus of determining how it will meets its emissions reduction target. In some developed countries, including Canada, the oil, gas and coal companies represent a sizeable portion of the state's total GHG emissions (as discussed in Section IV of this paper). Without a mandated emissions reduction target or other legal obligations to compel emissions reduction, these companies are likely to continue producing and expanding their operations. While many frameworks propose fair methods for allocating a global carbon budget amongst nations, there has been little dialogue on the role of large oil and gas companies in reducing their emissions to "fairly" contribute to a state's national emissions reduction target.

A group of legal experts, many of whom developed the Oslo Principles on Global Climate Change Obligations, have developed a set of Climate Principles for Enterprises to consider the legal obligations of companies in responding to climate change. They state that companies have four sets of obligations: to reduce the emissions from their own activities; to reduce emissions from their products and services; to consider the emissions of their suppliers; and procedural obligations regarding disclosure and impact assessment.[379]

1. Corporations' emissions reduction efforts

A 2018 paper analyzing 138 companies in seven high-emitting sectors—who collectively account for 21 percent of the global emissions for listed companies—found that most of these companies had not yet set quantified emissions reduction targets.[380]

[378] "Balancing the Budget: Why deflating the carbon bubble requires oil & gas companies to shrink" (1 November 2019), online: *Carbon Tracker Initiative* <www.carbontracker.org/reports/balancing-the-budget/>.
[379] "About" (last visited December 11 2019), online: *Climate Principles for Enterprises* < climateprinciplesforenterprises.org/about/>.
[380] Simon Dietz et al, "An assessment of climate action by high-carbon global corporations" (2018) 8 Nature Climate Change 1072 at 1072.

According to an analysis conducted by Transition Pathway Initiative, the emissions intensity performance and targets (where applicable) for the world's top ten oil and gas companies were all well above 2°C and 'below 2°C' scenarios.[381] The Union of Concerned Scientists also analyzed eight major oil, gas and coal companies, and found that "[n]one of these companies have demonstrated a level of ambition consistent with keeping global temperature rise within the Paris climate agreement limits that some of them claim to support."[382]

The following Canadian companies were included in Heede's analysis and are thus deemed carbon majors:

Table Five: Canadian Carbon Majors and their Historical Emissions[383]

Entity	***Total Emissions (Co2eq)***	***Percent of global emissions: 1751-2010***
EnCana[384]	1.69 billion tonnes	0.12%
Suncor	1.41 billion tonnes	0.10%
Canadian Natural Resources	0.96 billion tonnes	0.07%
Talisman[385]	0.92 billion tonnes	0.07%
Husky Energy	0.66 billion tonnes	0.05%
Nexen[386]	0.65 billion tonnes	0.04%

381 Simon Dietz et al, "Carbon Performance Assessment in Oil and Gas: Discussion Paper" (November 2018), online (pdf): *Transition Pathway Initiative* <www.lse.ac.uk/GranthamInstitute/tpi/wp-content/uploads/2018/11/Oil_and_gas_discussion_paper_061118.pdf>. This paper (at 9) defines a "below 2 °" scenario as being "consistent with a more ambitious interpretation of the Paris Agreement's overall aim."

382 "The 2018 Climate Accountability Scorecard: Insufficient Progress from Major Fossil Fuel Companies" (October 2018) at 1, online: *Union of Concerned Scientists* <www.ucsusa.org/sites/default/files/attach/2018/10/gw-accountability-scorecard18-report.pdf>.

383 *Ibid* at 27-8.

384 Encana recently announced, however, that it plans to relocate its corporate headquarters to the US, and change its name to Ovintiv Inc. See Nicole Gibillini, "Encana sheds Canadian identity with name change, U.S. domicile" (31 October 2019), online: *BNN Bloomberg* <www.bnnbloomberg.ca/encana-sheds-canadian-roots-with-name-change-and-u-s-domicile-1.1340681>.

385 Talisman went defunct in 2015.

386 Nexen was acquired by Hong Kong–based CNOOC Limited in 2012.

While these six companies were amongst those most responsible for global cumulative emissions, only three (Suncor, Canadian Natural Resources Limited, and Husky Energy) remain part of an oligopoly in Canada's oil sands today. These three companies, alongside Cenovus Energy and Imperial Oil, collectively control nearly 80 percent of Canada's productive capacity of bitumen as well as 90 percent of the existing upgrading capacity of bitumen.[387]

Which portion of Canada's emissions reduction should be allocated either to the carbon majors headquartered within its jurisdiction or the five companies monopolizing Canada's highest-emitting sector today? The Expert Group of the Climate Principles for Enterprises believes that companies should generally reduce the emissions of their activities "to the same extent as the country or countries in which those activities take place", as this places the primary burden on such companies.[388]

For instance, should Suncor be required to reduce its emissions by 30 percent below its 2005 levels by 2030 (mirroring Canada's present emissions reduction target)? Even matching Canada's present target would require a pivotal shift from its projected emissions increase. Suncor's absolute GHG emissions increased from 2016 to 2017, and the company predicts that its company-wide emissions will increase by 19 percent between 2017 to 2022.[389] Although Suncor has made some effort to diversify its products and services, approximately 99 percent of its revenue still comes from high carbon products,[390] and in 2018, Suncor more than doubled its spending for exploring the oil sands from the previous year.[391] Its emissions management

[387] Ian Hussey et al, "Boom, Bust, and Consolidation: Corporate Restructuring in the Alberta Oil Sands" (November 2018) at 1, online: *Parkland Institute* <d3n8a8pro7vhmx.cloudfront.net/parklandinstitute/pages/1664/attachments/original/1542129868/boombustconsolidation.pdf?1542129868>.

[388] Climate Principles for Enterprises, *supra* note 396.

[389] Suncor, "2018 Climate Risk and Resilience Report" (2018) at 6, online: *Suncor* <sustainability.suncor.com/-/media/project/ros/2018/documents/2018-climate-risk-and-resilience-report-en.pdf?modified=20180810193032>.

[390] Suncor, "2018 Suncor CDP Climate Response" (2018) at 40-2, online: *Suncor* <sustainability-prd-cdn.suncor.com/-/media/project/ros/2018/documents/2018-suncor-cdp-climate-response-en.pdf?modified=20190129211405&la=en&hash=D5CE678437702024E4ABA37139B2B3CB35500134> [Suncor, "2018 CDP"].

[391] *Ibid* at 47; Suncor, "Annual Information Form", (1 March 2018) at 47, online: *Suncor* <www.suncor.com/-/media/Files/PDF/Investor-Centre/Annual-Reports/2017-AR/English/2017_Annual_AIF_EN.pdf?la=en-CA&modified=20180517215507&hash=99432E472051442B73F248A21ADEADD0DBC0BE11>.

approach focuses on reducing emissions intensity from the production of oil and petroleum products but it does not specify a numerical target for absolute emission reductions.

These figures illustrate the incompatibility of Suncor's business plans with playing a role in *any* emissions reduction path in Canada. In 2017, Suncor's emissions comprised 2.89 percent of Canada's total GHG emissions.[392] This number, and the proportion of other large-emitting companies' emissions in Canada's total national emissions, will only increase as Canada lowers its total emissions. Determining the role that large-emitting corporations ought to play in Canada's emissions reductions will be a pivotal consideration of planning to meet any of the proposed "fair" targets suggested in this paper.

2. Sectoral targets

Rather than requiring oil and gas companies to comply with a national target, or hoping that corporations will act on their own accord, some "fair share approaches" create sectoral targets to derive the national emissions reduction target. This focus allows states to consider the ease or difficulty of decarbonizing within an industry when setting targets.[393]

a) Multi-sector emission convergence

Similar to the triptych approach (described in Section V of this paper), this scheme considers emissions in several high-emitting sectors, including power, households, transportation, industry, services, agriculture and waste. For each sector, a yearly reduction rate in global per capita emissions is identified and the rate is transformed into a global sector emissions standard ("GSES"). A country-specific per capita emissions pathway is created for each sector to reach the GSES, and the summation of GSES within a state inform the national emissions target. The GSES for each sector are also added together to create the global per capita total emission standard.[394]

[392] Suncor, "2018 CDP", *supra* note 407 at 47, 59. Suncor's contribution to Canada's total emissions were calculated using the greenhouse gas emissions figure listed by the Government of Canada in 2017. See Government of Canada, "GHG emissions", *supra* note 11.
[393] For example, heat and electricity sectors are easier to decarbonize than cement and aviation industries. See Gaffney et al, *supra* note 336 at 26.
[394] Bodansky, *supra* note 197 at 46.

b) Sectoral Development Approach

A newly-developed "fair share approach" translates a sectoral pathway into company-specific targets. The sectoral development approach ("SDA") is comprised of the following steps:

i) A global carbon budget is developed;
ii) This budget is allocated to different regions and sectors through an energy systems model;
iii) Within each sector, a benchmark path for emissions intensity (emissions divided by activity) is created to allow for comparison between various-sized companies;
iv) Individual company intensity pathways are based on the sectoral pathways; and
v) A company's intensity pathway can be multiplied with the company's projected activities to determine absolute emissions reduction targets for each year.[395]

This approach ensures that each company's emissions intensity reductions collectively align with an overall carbon budget. The SDA is one of six methods listed under the "sectoral approach" of the Science-Based Targets Initiative ("SBTI"), a project developed by the Carbon Disclosure Project, the UN Global Compact, the World Resources Institute, World Wildlife Fund, and We Mean Business.[396] The SBTI also includes an absolute-based approach and an economic-based approach, and the SBTI supports corporations in setting these science-based targets.[397] Corporate use of the SBTI approaches may be another successful avenue to reduce corporate emissions and help meet a country's fair share of the global mitigation burden.

3. Cap and trade systems

Cap and trade systems are another method countries can use to regulate industry emissions. For instance, the EU's Emissions Trading System ("ETS") uses a "cap", which decreases by nearly 2 percent each year, to set a maximum level on the total amount of emissions

[395] Oskar Krabbe et al, "Aligning corporate greenhouse-gas emissions targets with climate goals" (2015) 5 Nature Climate Change 1057 at 1058.
[396] "About the Science Based Targets Initiative" (last visited 25 October 2019), online: *Science Based Targets* <sciencebasedtargets.org/about-the-science-based-targets-initiative/>.
[397] "Methods" (last visited 25 October 2019), online: *Science Based Targets* <sciencebasedtargets.org/methods/>.

to be traded within the system.[398] Industrial products (such as steel or cement) are assigned a benchmark, which is determined in consideration with annual reduction rates.[399] Benchmarks are considered alongside an installation's output to determine a participant's free emissions allowances. The "trade" aspect allows participating parties to auction emission allowances to one another.

The ETS works in conjunction with EU member states. For instance, Germany's *Allocation Act 2012* specifies emissions budgets for participating and (non-participating) sectors to apportion its mitigation efforts, while France centrally creates sectoral approaches through consulting and negotiating with relevant stakeholders.[400] The European Council has stated that its ETS, if well-functioning, "will be the main European instrument to achieve the reduction target of at least 40% [below 1990 levels by 2030]".[401] In 2015, however, Corporate Europe Observatory reported that while the EU's emissions had fallen over the last decade, there is scant evidence that these reductions were caused by the scheme, suggesting that reductions could instead "by explained almost entirely by a combination of increases in renewable energy, the economic downturn post-2008, improved energy efficiency, and fuel switching (from coal to gas) in response to other policies and economic variables."[402]

4. Sectoral Approach in Canada

In July 2019, Canada finalized the regulations for its output-based pricing system ("OBPS") for large industry emitters. The OBPS has been implemented in the provinces which chose not to enact an equivalent industry tax, namely Manitoba, New Brunswick, Prince Edward

[398] "The EU Emissions Trading System: an Introduction" (last visited 14 October 2019), online: *Climate Policy Info Hub* <climatepolicyinfohub.eu/eu-emissions-trading-system-introduction>.
[399] See Directive (EU) 2018/410 of the European Parliament and of the Council: amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 (14 March 2018, Art 1,14(b), online: <eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0410&from=EN> [*Directive EU 2018/410*].
[400] The IPCC notes, however, that the French approach "risks a dilution of measures through the influence of lobbies that may lose from mitigation actions." See Eswaran Somanathan et al, "National and Sub-national Policies and Institutions" in O Edenhofer et al, eds, *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom: Cambridge University Press, 2014) 1141 at 1151.
[401] *Directive EU 2018/410*, *supra* note 416 at 2 (para 5), 6 (para 23).
[402] "EU emissions trading: 5 reasons to scrap the ETS" (26 October 2015), online: *Corporate Europe* <corporateeurope.org/en/environment/2015/10/eu-emissions-trading-5-reasons-scrap-ets>.

Island, Saskatchewan and Ontario. This system creates thresholds based on a portion (80, 90 or 95 percent) of an industry's average emissions intensity. Emitters who exceed this threshold must pay fines, while those who emit less than the threshold receive credits to sell or use in the future. The Pembina Institute notes that "[t]he federal system has set 80% standards for 42 sectors, 90% standards for 19 sectors, and 95% standards for 14 sectors," meaning "that the majority of sectors under the system will pay the price on pollution on 20% of their emissions."[403]

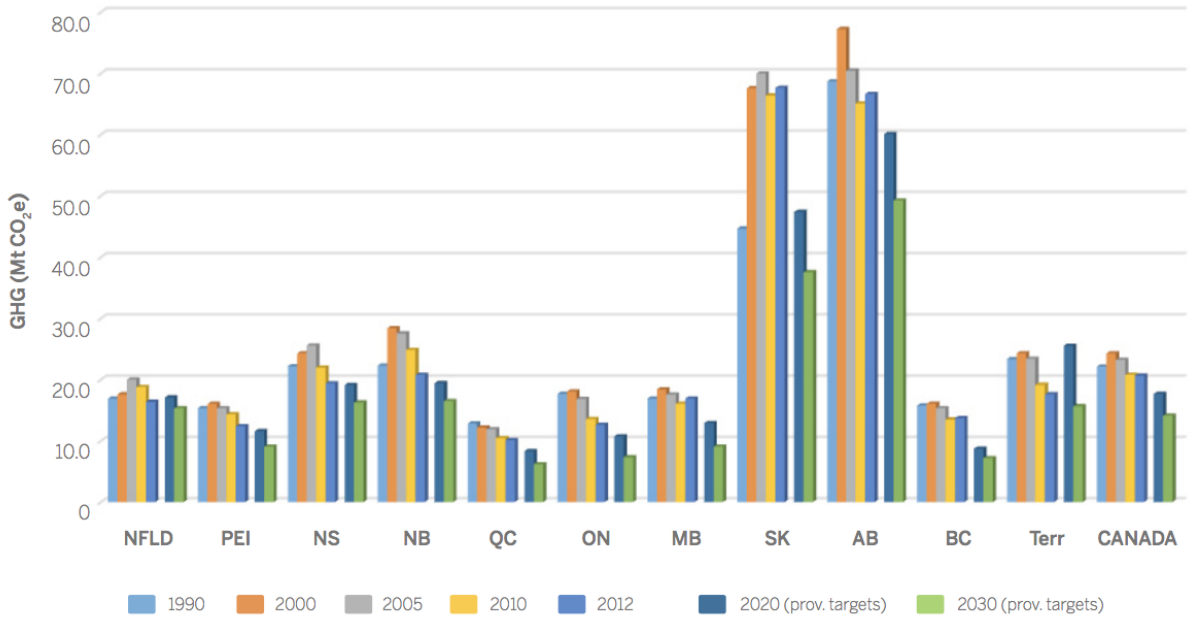
The Government of Canada states that "[t]his creates an ongoing financial incentive for facilities to reduce their emission intensity in order to reduce the amount owed for compensation or to emit below their limit and earn surplus credits."[404] While the system constitutes an important initial step, large industry actors will need to reduce their emissions beyond simply the least efficient of their peers in order to meet Canada's present or fair share emissions target.

C. Subnational allocation

As the IPCC notes, many countries delegate "the formulation and implementation of national mitigation approaches" to sub-national levels.[405] Just as states have disagreed at the international level on how to allocate emission reductions and allowances, however, so too have the provinces, regions, or states within a country. Such allocation is particularly difficult in a country such as Canada, whose provinces are immensely heterogeneous. Böhringer et al notes that "the significant geographic heterogeneity in emissions intensity across regions in Canada is unparalleled in other federations."[406] The following graph from Boothe & Boudreault illustrates the vast differences in provincial per capita emissions.

403 Isabelle Turcotte, Jan Gorski and Brianne Riehl, "Carbon Emissions: Who makes big polluters pay" (November 2019) at 15, online: *Pembina Institute* <www.pembina.org/reports/obps-comparative-analysis-final2.pdf>.
404 "Output-Based Pricing System: Regulatory Impact Analysis Statement" (28 June 2019), online: *Government of Canada* <www.gazette.gc.ca/rp-pr/p2/2019/2019-07-10/html/sor-dors266-eng.html>.
405 Somanathan et al, *supra* note 417 at 1152.
406 Christoph Böhringer et al, "Sharing the burden for climate change mitigation in the Canadian federation" (2015) 48:4 Cdn J Econ 1350 at 1354.

Figure Twenty-Four: Provincial per capita Emissions for 1990-2013, as well as projected levels for 2020 and 2030 provincial targets[407]



A fair subnational allocation must recognize these differing circumstances. For instance, given that Northern Canada must deal with the effects of warming at a quicker rate than the rest of Canada, should it be held to the same level of emissions reduction? Should the province's makeup (number of urban centres and the proportion of the population living in or near urban centres) be considered, due to the difficulties of reducing transport emissions in rural areas? Should a province's ability to transition to alternative energy sources, such as hydro energy, be a determining factor? These are but a few of the many relevant questions that would need to inform subnational allocation discussions in Canada.

In 2000, a federal-provincial process, known as the Joint Meeting of Ministers of Environment and Energy ("JMM"),[408] created an *Emissions Allocation and Burden Sharing*

[407] This chart is presented in megatonnes. 1 megatonne = 1 million tonnes of Co2eq. See Paul Boothe & Félix-A Boudreault, "By the Numbers: Canadian GHG Emissions" (2016) at 7, online: *Lawrence National Centre for Policy and Management* <www.ivey.uwo.ca/cmsmedia/2112500/4462-ghg-emissions-report-v03f.pdf>.
[408] The JMM refers to the regularly meetings that occurred, beginning in 1993, between federal and provincial ministers of energy and environment. See Douglas Macdonald et al, "Allocating Canadian Greenhouse Gas Emission Reductions Amongst Sources and Provinces: Learning from the European Union, Australia and Germany"

Working Group ("EABSWG") to analyze "possible approaches to provincial/territorial or sectoral allocations of any Canadian target, and how any resulting burden would be shared".[409] Academic Douglas Macdonald states that the EABSWG was created after Quebec left the JMM process due to the JMM's refusal to "explicitly negotiate provincial, as well as sectoral, reduction targets."[410] The EABSWG commissioned studies on burden-sharing approaches and equity principles as well as analyses on the varying financial implications for provinces and territories.[411] Unfortunately, the JMM process concluded in December 2002 without the EABSWG ever having issued a final report.[412]

Given the historical and continued lack of coordination in creating provincial and territorial targets, the summation of these figures does not achieve the level of emissions reduction needed to meet Canada's target. Andrew Gage compares the nonsensical relationship of provincial and federal emissions targets in Canada, stating:

> This type of management in finances would never be accepted. Little would be gained by setting a national goal of reducing the collective federal and provincial debt by 2020 by 17% relative to 2005 debt, but with a target for BC of reducing the share that it had in 2007 by 33%. Quite aside from whether those are good enough goals, the approach is confusing, and understanding the relationship between the BC goal and the federal goal requires some serious number crunching.[413]

To consider how Canada's mitigation efforts could be fairly allocated amongst the provinces, Böhringer et al used six different burden-sharing approaches to allocate provincial emissions allowances for 2020:

(April 2013) at 48, online (pdf): *University of Toronto* <tspace.library.utoronto.ca/bitstream/1807/77153/1/AllocatingGHGReductions2013.pdf>.

409 *Ibid* at 48.
410 *Ibid* at 52.
411 *Ibid* at 48.
412 *Ibid* at 49.
413 Gage, *supra* note 344 at 12.

Figure Twenty-Five: Allocation of Permits as Percent of Projected Benchmark Emissions[414]

	Ex Ante			*Ex Post*		
	Equal per capita	Sovereignty	Ability to pay	Horizontal equity ($\rho = 1$)	Utilitarian ($\rho = 0$)	Rawlsian ($\rho = 10$)
AB	24.54	82.40	78.10	77.19	79.21	41.49
BC	124.32	82.40	86.54	85.89	82.15	113.69
MB	147.91	82.40	85.45	88.45	87.17	116.95
NB	71.74	82.40	85.86	81.32	80.15	96.34
NL	67.64	82.40	81.03	89.90	92.76	77.02
NS	81.71	82.40	86.73	86.64	84.09	104.10
ON	124.23	82.40	85.28	86.27	85.44	112.01
QC	166.24	82.40	85.81	88.07	85.38	124.66
RC	47.00	82.40	71.19	89.50	95.98	0.00
SK	38.31	82.40	82.53	75.55	76.98	75.53

These figures demonstrate the significant impacts that a particular equity approach will have on provinces. For instance, Saskatchewan's allowance ranges from 38.31 percent to 82.53 percent of benchmark levels, depending on the equity approach used. Böhringer et al note that the equal per capita approach allows Quebec, Ontario, British Columbia, and Manitoba to emit more than their benchmark levels, while allocating Alberta less than one-fourth of its emissions.[415] This table elucidates that an equal per capita approach, which ignores the emissions intensity and different circumstances of provinces, is ill-suited for determining subnational allocation in Canada.[416]

Böhringer et al conclude that, while there are a wide range of potential equity approaches to consider burden-sharing methods, most will require larger reductions from emission-intensive provinces, such as Alberta and Saskatchewan, whose current emissions (351 million tonnes of

[414] The six criteria were: constant emissions ratio; equal per capita; ability to pay; ex-post (equal relative welfare losses); abatement costs; and Rawlsian (minimize cost to poorest region). The provincial and territorial codes are as follows: AB= Alberta; BC= British Columbia; MB= Manitoba; NB= New Brunswick; NL=Newfoundland and Labrador; NS= Nova Scotia; ON= Ontario; QC=Quebec; SK=Saskatchewan; RC= Rest of Canada (Nunavut, Prince Edward Island, Yukon, and the Northwest Territories). See Christoph Böhringer et al, *supra* note 423 at 1357, 1369.
[415] *Ibid* at 1351.
[416] Paul & Boudreault, 2016(b), *supra* note 253 at 5.

Co2) collectively account for nearly 70 percent of the emissions allowed under Canada's 2030 target. [417]

As the Ontario government has demonstrated through its abrupt cancellation of its cap and trade system, provincial efforts can also be abandoned. Subnational allocation can ensure that provinces and territories are working together towards a specific target or goal, and as a factum by the Intergenerational Climate Coalition noted, a federal climate framework can prevent "carbon leakage", whereby companies would otherwise relocate their emitting activities to provinces or territories with less stringent polluting or carbon pricing regulations.[418] Given that Canada's Constitution allocates jurisdiction over natural resources to the province (and both federal and provincial governments share jurisdiction over the environment), federal efforts in this area must tread carefully so as not to overstep this division of powers. Both the Saskatchewan and Ontario Court of Appeals have ruled that the federal *Greenhouse Gas Pollution Pricing Act* is a valid use of the federal government's "peace, order and good government" power, stating the federal government has the authority to set minimum national standards.[419] The Alberta Court of Appeal recently ruled, however, that this *Act* was not a valid use of the federal government's power. Would a minimum emissions reduction target fall within this power? This matter has yet to be defined by the courts or legislation.

VIII. Conclusion

In his recent report on human rights obligations regarding a healthy environment, UN Special Rapporteur on human rights and the environment David Boyd highlighted the alarming disconnect between the climate emergency and state actions.

> Climate change is already harming billions of people, violating human rights, exacerbating inequality and perpetuating injustice. Parties to the Paris Agreement are not on track to meet their commitments. Instead of falling, global emissions are rising.

[417] Christoph Böhringer et al, *supra* note 423 at 1372; Barry Saxifrage, "Surprise! Most of Canada is on track to hit our 2020 climate target" (27 May 2019), online: *National Observer* <www.nationalobserver.com/2019/05/27/analysis/surprise-most-canada-track-hit-our-2020-climate-target>.
[418] Pollution Pricing Reference, ICC Factum, *supra* note 85 at para 52.
[419] *Reference re Greenhouse Gas Pollution Pricing Act*, 2019 ONCA 544; *Reference re Greenhouse Gas Pollution Pricing Act*, 2019 SKCA 40; *Reference re Greenhouse Gas Pollution Pricing Act*, 2020 ABCA 74. The SCC was set to hear these cases in March 2020, however, the hearings have been postponed due to the coronavirus pandemic.

> Instead of phasing out fossil fuels, States provide subsidies and banks offer financing, both measured in trillions of dollars annually. New coal-fired power plants are still being built. Instead of reforestation, deforestation continues.[420]

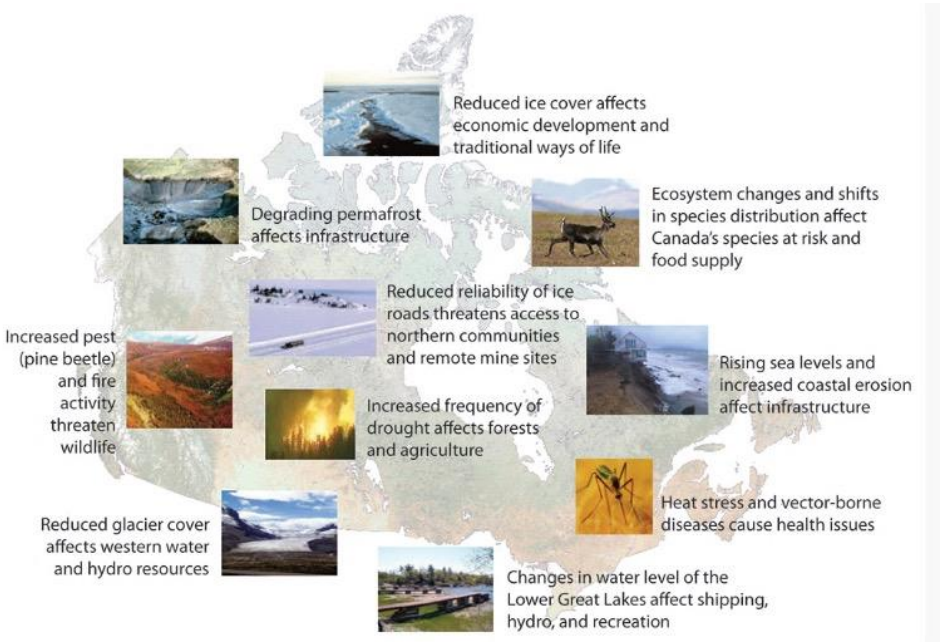
As of August 2019, more than 400 Canadian municipalities had declared climate emergencies,[421] as did the Canadian federal government in June 2019.[422] Prime Minister Justin Trudeau is well-aware of both the global and local impacts of climate change. In his speech regarding Canada's ratification of the Paris Agreement, he stated that

> If one lives in Canada's north or in our coastal communities, or really in any community that is subject to extreme weather conditions and the resulting floods, droughts, and wild fires, the effects of climate change itself cannot be denied. There is no hiding from climate change. It is real and it is everywhere.[423]

The existing and expected impacts of climate change in Canada are widespread. The following graphic from the Commissioner of the Environment and Sustainable Development to the Parliament of Canada details some of the environmental impacts of climate change:

[420] Boyd, *supra* note 51 at para 73.
[421] Melanie Woods, "All the Places in Canada that have Declared States of Climate Emergency" (28 August 2019), online: *Huffington Post* <www.huffingtonpost.ca/entry/climate-emergency-edmonton-declare_ca_5d671036e4b022fbceb5caff>.
[422] Hannah Jackson, "National climate emergency declared by House of Commons" (17 June 2019), online: *Global News* <globalnews.ca/news/5401586/canada-national-climate-emergency/>.
[423] *House of Commons Debates*, 42-1, No 086 (3 October 2016) at 12:15 (Right Hon Justin Trudeau).

Figure Twenty-Six: Examples of Climate Change Impacts Experienced Across Canada[424]



Despite these localized impacts—and cognizant of the climate impacts faced by the rest of the world—Canada has failed to undertake sufficient mitigation efforts. Although the Government of Canada's 2018 Submission to the Talanoa Dialogue stated that "[t]he [Pan Canadian Framework] plan sets Canada on a path towards meeting or exceeding its 2030 target,"[425] its 2018 emissions projection report confirmed that Canada is not on track to meet its 2030 target.[426]

Since setting its first emissions reduction target 28 years ago, Canada's national emissions have, in fact, increased by 116 million tonnes of Co2eq.[427] From 2010 to 2017, Canada's total emissions grew by 23 million tonnes of Co2eq.[428] The *Globe and Mail* columnist Gary Mason also notes that "[s]ince the government introduced its first climate plan in 2016, it

[424] Commissioner of the Environment and Sustainable Development to the Parliament of Canada, "Report 2-Adapting to the Impacts of Climate Change" (2017) at Exhibit 2.1, online: *Office of the Auditor General of Canada* <www.oag-bvg.gc.ca/internet/English/parl_cesd_201710_02_e_42490.html>.
[425] "Government of Canada: Submission to the Talanoa Dialogue" (2018) at 2, online (pdf): *Environment and Climate Change Canada* <publications.gc.ca/collections/collection_2019/eccc/En4-351-2018-eng.pdf> [Environment and Climate Change Canada, "Talanoa Submission"].
[426] Environment and Climate Change Canada, "2018 Canada Projections", *supra* note 171 at viii.
[427] Government of Canada, "GHG Emissions", *supra* note 11.
[428] *Ibid.*

has purchased a pipeline and approved a massive liquefied natural gas project in B.C."[429] The Climate Change Performance Index, which ranks the climate action of high-emitting countries, placed Canada 54th out of 60 in 2019, a decrease from its 51st place holding in 2018.[430]

Despite this duplicity, the Talanoa submission stated that Canada was "committed to explore the possibilities for stepping up our ambition."[431] According to the David Suzuki Foundation's factum in the recent carbon tax court challenge, the Federal government's use of the "national emergency" branch of the peace, order and good government power was in response to the "risk that Canada will miss the tight deadline to fulfill is [sic] commitments under the *Paris Agreement*, undermining the global effort to stave off the most disastrous effects of climate change".[432] To fulfill its Paris commitments, it is pivotal that Canada adopt and implement a more ambitious 2030 emissions reduction target.

The Oslo Principles on Global Climate Change state that "all States and enterprises have an immediate moral and legal duty to prevent the deleterious effects of climate change" and notes that under international law, "each State is legally responsible for the deleterious transborder effects that human activities in its territory have on other states."[433]

This paper has sought to organize sets of facts regarding the distribution of historic, current and projected emissions, alongside other indicators, to inform ideas regarding Canada's fair share of the global mitigation burden. While Canada ought to bear responsibility for all the emissions it produces, whether the final product is used within its borders or not, the nature of emissions reporting at this time only measures emissions that occur within Canada. The targets proposed in this paper thus only consider these emissions, but Canada's fair target is likely even

429 Gary Mason, "Meaningful climate action in Canada is doomed" (28 September 2019), online: *The Globe & Mail* <www.theglobeandmail.com/opinion/article-meaningful-climate-action-in-canada-is-doomed/>.
430 This index ranks the countries and the EU who collectively emit 90 percent of global emissions. See Jan Burck et al, "Climate Change Performance Index: Results 2019", online (pdf): *German Watch* <germanwatch.org/sites/germanwatch.org/files/CCPI-2019-Results-190614-WEB%20A3.pdf>; "Climate Change Performance Index 2018", online: *Climate Change Performance Index* <www.climate-change-performance-index.org/climate-change-performance-index-2018>.
431 Environment and Climate Change Canada, "Talanoa Submission", *supra* note 442 at 7.
432 *Reference re Greenhouse Gas Pollution Pricing Act*, 2019 ONCA 544 (Factum of the Intervenor, the David Suzuki Foundation at para 39).
433 Expert Group on Global Climate Obligations, *supra* note 213.

more ambitious than those proposed in this paper in light of these emissions.

Every "fair" target suggested by the three studies included in this paper (as well as the two "outdated" studies) is significantly larger than Canada's present emissions reduction target. At minimum, these proposed targets call for Canada to nearly double its emissions reduction target, however, multiple suggested targets call for Canada to reach net-zero emissions by 2030 *and* undertake mitigation efforts to further reduce emissions beyond its own borders.

The author of this paper finds the GDR framework to be perhaps the most fair standalone approach, given its consideration both of a state's historical responsibility in contributing to the emissions that caused climate change and a state's per capita income as an indicator of its capability to fund climate mitigation efforts. The least stringent iteration of this approach included in this analysis calls for Canada to more than double its present emissions reduction target, while the most stringent iteration calls for Canada to reach net-zero emissions by 2030 as well as undertake further mitigation efforts.

CAT's Fair Share Range is attractive in that it negates the need to latch onto a specific equity approach. As each country may advocate for the specific approach or approaches that create the least-stringent emissions reduction target for their state—and there is little time to quibble over philosophical considerations of equity—the creation of a fair share range that incorporates multiple categories of equity may be a fitting solution for international negotiations. CAT's fair share range for Canada calls for at least a 56 percent reduction below 2005 levels by 2030 (nearly doubling its 2030 emissions reductions target).

Regardless of the equity principle used to allocate emissions, however, it is evident that Canada's present 2030 emissions reduction target does not meet its fair share of the global mitigation burden. While the equity approaches suggest varying levels of ambition for Canada to contribute its fair share of global emissions reduction, each approach calls for, at minimum, a near doubling of ambition. The most stringent allocation (the GDR framework as iterated by the CERP) calls for a 2030 emissions reduction target that is four to five times as ambitious as Canada's 2030 target.

To meet such a target, Canada will need to develop a clearer climate plan. Some countries have legislated long-term reductions targets as well as short-term interim targets to guide efforts. While Prime Minister Justin Trudeau has pledged to introduce legislated targets, further details have not been reported at this time.

Canada also needs to consider who should bear responsibility for its emissions reductions. Subnational allocation of the national burden amongst Canada's provinces and territories will be a treacherous, but perhaps necessary, exercise. An alternative method is to develop sectoral targets or an economy-wide cap and trade system. The level of ambition required by Canada to meet any of the proposed "fair" targets is incompatible with Canada's projected continuation and expansion of fossil fuel production (as discussed in Section IV). The Expert Group of the Climate Principles for Enterprises also calls for corporations to bear some of a nation's responsibility in reducing emissions. Without laying out who is responsible for how much of its total national emissions reduction, Canada will not have a clear plan to meet its target.

Canada's highest court has repeatedly affirmed the importance of protecting the environment, recognizing it as "a fundamental value in Canadian society".[434] The IPCC has made clear that swift and far-reaching actions are immediately needed in order to limit warming to 1.5°C.[435] As the tenth highest-emitting state today,[436] Canada's continued failure to reduce emissions may derail global mitigation efforts. Canada must strengthen its emissions reduction target to comprise a fair share of the global mitigation burden and propose a detailed plan to meet this target.

In addition to strengthening its own emissions reduction target, Canada ought to advocate that a set of equity approaches be adopted to inform stronger emissions targets around the world.

[434] *Ontario v Canadian Pacific Ltd*, [1995] 2 SCR 1031 at para 55. See also *114957 Canada Ltée (Spraytech, Société d'arrosage) v Hudson (Town),* 2001 SCC 40 at para 1; *Friends of the Oldman River Society v Canada (Minister of Transport*), [1992] 1 SCR 3 at 16; *British Columbia v Canadian Forest Products Ltd*, 2004 SCC 38 at para 7.
[435] IPCC, "Summary for Policymakers 2018", *supra* note 1 at 17.
[436] Statista, *supra* note 13.

As states are presently invited to update their NDCs prior to the end of 2020,[437] such conversations ought to commence immediately. It is only once Canada pledges and undertakes to meet its fair share of the global mitigation burden, however, that it can then ask other countries to do the same.

[437] UNEP, "Emissions Gap Report 2019", *supra* note 9 at xx.

IX. Appendix

A. Outdated Studies & Findings

1. Can multi-criteria rules fairly distribute climate burdens? OECD results from three burden sharing rules[438]

This paper utilized three formulas to illustrate different burden-sharing approaches to inform subsequent climate negotiations. Each formula was carried out through four cases that weighted the components of the formula differently to reflect states' differing priorities and opinions.

Formula One calls for an "average OECD country" (in terms of Co2 emissions/capita, Co2 emissions/unit of GDP, GDP, and GDP/capita) to reduce its emissions by 20 percent.[439] This formula was defined as follows:

> $Y_i = \{w_A A_i/A + w_B B_i/B + w_c C_i/C + w_D D_i/D\}Z$, where Y_i is the percentage emission reduction target for country *i*. A_i is emissions per capita for country *i*, B_i is GDP for country *i*, C_i is emissions per unit of GDP for country *i*, and D_i is GDP per capita for country *i*. A, B, C and D represent OECD averages for the same indicators. ... Z is a scaling factor which is determined so as to make the total emissions abatement for OECD equal to 20%.[440]

Formula Two, which considers a state's percentage share of the OECD total for the following indicators: population, Co2 emissions, and GDP. Formula two was defined as: "$X_i = \{w_E E_i + w_F F_i + w_G G_i\}$", where "$X_i$ is the percentage share of country *i* of the total emission reduction commitment for OECD. E_i is the percentage population share of country *i,* and G_i is the percentage GDP share of country *i*."[441]

Formula Three is similar to Formula One, however it excludes Co2 emissions/capita from its consideration. This formula was defined as: "$V_i = \{w_B B_i + w_c C_i + w_d D_i\}/\sum_j \{w_B B_j + w_c C_j + w_d D_j\}$", where "$V_i$ is the percentage share of country *i* of the total emissions reduction commitment of OECD. B_i is GDP for country *i*, C_i is emissions per unit of GDP for country *i*, and D_i is GDP per capita for country *i*."[442]

[438] Ringius, Torvanger & Holtsmark, *supra* note 99**.** At the time of publication, the three authors were affiliated with the Center for International Climate and Environmental Research in Oslo, Norway.

[439] *Ibid* at 784.

[440] *Ibid* at 784.

[441] *Ibid* at 786.

[442] *Ibid* at 788.

Table Six: Canada's Emissions Reduction Under Three Burden-Sharing Formulas[443]

	Canada's emissions reduction as a percentage of OECD total reduction	***Canada's emissions reduction as a percentage of national emissions***
Formula One *Indicators**:** Co2 emissions per capita, GDP, Co2 emissions per unit of GDP and GDP per capita*		
Case 1: Equal weights 25 (Co2/pop +GDP + CO2/GDP + GDP/pop)	2.3%	10.5%
Case 2: Extra weight on CO2/pop 55 Co2pop + 15 (GDP + Co2/GDP + GDP/pop)	2.7%	12.4%
Case 3: Extra weight on Co2/GDP 55 Co2/GDP + 15 (Co2/pop + GDP + GDP/pop)	2.9%	13.7%
Case 4: Extra weight on GDP/pop 70 GDP/pop +10 (Co2/pop + GDP +Co2/GDP)	2.7%	12.7%
Formula 2 *Indicators: Each OECD country's % share of population, CO emissions and GDP of the OECD total*		
Case 1: Equal weights 1/3(Co2 + pop + GDP)	3.7%	17.0%
Case 2: Extra weight on emissions 0.05pop + 0.6Co2 + 0.35GDP	3.9%	18.2%
Case 3: Even more weight on emissions 0.05pop + 0.8Co2 +0.15 GDP	4.1%	19.1%
Case 4: Extra weight on GDP 0.05pop + 0.35Co2 + 0.6GDP	3.7%	17.1%
Formula 3 *Indicators: GDP, emissions per unit of GDP, and GDP per capita*		
Case 1: Equal weights 33.3(GDP +Co2/GDP + GDP/pop)	3.6%	16.5%
Case 2: Extra weight on GDP 10(GDP/pop + Co2/GDP)+ 80GDP	3.4%	15.7%
Case 3: Extra weight on GDP/pop 20(GDP +Co2/GDP) + 60GDP/pop	3.6%	16.7%
Case 4: Extra weight on emissions/GDP 20(GDP + GDP/pop) + 60Co2/GDP	3.8%	17.8%

[443] *Ibid* at 792.

Based on these twelve cases, Ringius, Torvanger and Holtsmark submit that Canada's emissions ought to reduce its 1993 emissions by 10.5 percent to 19.1 percent by a pre-determined year (the authors provide the year 2010 as an example). Using the data provided in this article regarding Canada's energy-related Co2 emissions in 1993 (443 million tonnes of Co2), this range would call for Canada's emissions to reduce by 46.5 to 84.6 million tonnes of CO2, leading to emission levels of 358 to 396 million tonnes of Co2 in 2010.[444]

2. Effort sharing in ambitious, global climate change mitigation scenarios[445]

In this paper, Ekholm et al utilize a multistage approach and a triptych approach to allocate emissions in the years 2020 and 2050, using two different limits of permissible atmospheric concentration of Co2. Their findings provide Canada with the following emissions allocations in the years 2020 and 2050:

Table Seven: Canada's Emissions Allocations in 2020 and 2050 Under Two Pathways[446]

	GDP (PPP) (billion USD)	***Baseline emissions (Co2eq)***	***Emissions after allowance trading*[447] *(Co2eq)***	***Triptych allocation (Co2eq)***	***Multistage allocation (Co2eq)***
2020					
485 ppm	1200-1400	750 to 790 million tonnes	590 to 640 million tonnes	370 to 410 million tonnes	360 to 400 million tonnes
550 ppm				370 to 410 million tonnes	350 to 390 million tonnes
2050					
485 ppm	1800-2700	830 million tonnes to 1.1 billion tonnes	73 million to 250 million tonnes	65 to 73 million tonnes	42 to 60 million tonnes
550 ppm			360 to 390 million tonnes	150 to 190 million tonnes	100 to 110 million tonnes

444 See *Ibid* at 783.

445 Ekholm et al, *supra* note 250. At the time of publication, all six authors of this study were associated with the VTT Technical Research Centre of Finland, Ecofys Germany GmbH and/or TKK Helsinki University of Technology.

446 *Ibid* at 1808-9.

447 Allowance trading may be impacted by market conditions that affect transaction costs and participation in the market. Ekholm et al adjusted this study to account for these uncertainties. See *Ibid* at 1805.

B. Studies and Findings for Analysis

1. Climate Equity Reference Project[448]

To determine a country's fair share, the calculator compares a country's allocated emissions for 2030 (under the selected emissions pathway) against a projected baseline figure for 2030[449] to determine the amount of global mitigation required. The calculations below have all used the 1.5°C Low Energy Demand pathway, which has a global mitigation requirement of 36.22 billion tonnes of Co2eq below global baseline emissions in 2030. This figure is then multiplied by a country's share of the global RCI to determine its fair level of emissions reduction.

Beyond choosing the weighting of indicators, the user can also select from several variables, including the year to begin accounting for emissions (available in ten-year periods, beginning in 1850 through to 2010) and whether to include non-Co2 gases, land-use emissions, and embodied emissions. Most of the calculator's indicators were set at the default values for this paper's calculations. Non-Co2 gases were included, while land-use emissions and emissions embodied in trade were excluded. The cost indicators are not relevant for this analysis. Kyoto obligations were excluded and the mitigation-period RCI was averaged. The development and luxury threshold were excluded for the responsibility analysis. For the capability analysis, the development threshold was $7,500, the luxury threshold was $50,000, the indicator was progressive between the thresholds, a multiplier of 1 was applied on incomes above the luxury threshold, and emissions elasticity was set to 1.0.

For each approach, "Canada's mitigation fair share" as stated by the CERP was subtracted from Canada's baseline emissions to determine "Canada's Fair Share Emissions in 2030". I then converted this figure into "Canada's Fair Share Emissions Reduction Target for 2030" as a percentage level below Canada's 2005 emissions levels to compare the suggested allocation against Canada's present emissions reduction target. This calculation divided "Canada's Fair Share Emissions Allocation" by Canada's 2005 emissions levels (730 million tonnes of Co2eq) to determine a fair share percentage allocation, which was then subtracted from 1 to produce Canada's fair share percentage reduction below 2005 levels.

448 Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.
449 The CERP calculator uses 778 million tonnes of Co2eq as Canada's projected baseline emissions for 2030.

Responsibility

Table Eight: Canada's Fair Share Emissions Target (CERP, Responsibility)[450]

	Canada's Share of the Global RCI	***Canada's Mitigation Fair Share (below baseline emissions) (Co2eq)***	***Canada's Fair Share Emissions Allocation in 2030 (Co2eq)***	***Canada's Fair Share Emissions Reduction Target for 2030*****
Starting Year: 1850	1.8%	650 million tonnes	128 million tonnes	82% below 2005 levels
Starting Year: 1950	1.8%	659 million tonnes	119 million tonnes	84% below 2005 levels
Starting Year: 1990	1.7%	627 million tonnes	151 million tonnes	79% below 2005 levels

Capability

Table Nine: Canada's Fair Share Emissions Target (CERP, Capability)[451]

	Canada's Share of the Global RCI	***Canada's Mitigation Fair Share (below baseline emissions) (Co2eq)***	***Canada's Fair Share Emissions Allocation in 2030 (Co2eq)***	***Canada's Fair Share Emissions Reduction Target for 2030*****
Development Threshold; No Luxury Threshold	2.6%	931 million tonnes	-153 million tonnes	121% below 2005 levels
Development and Luxury Threshold	3.0%	1,090 million tonnes	-313 million tonnes	143% below 2005 levels

450 Climate Equity Reference Project, "Climate Equity Reference Calculator", *supra* note 149.
451 *Ibid.*

Responsibility-Capability-Need

Table Ten: Canada's Fair Share Emissions Target (CERP, Responsibility-Capability-Need)[452]

	Canada's Share of the Global RCI	***Canada's Mitigation Fair Share (below baseline emissions) (Co2eq)***	***Canada's Fair Share Emissions Allocation in 2030 (Co2eq)***	***Canada's Fair Share Emissions Reduction Target for 2030*****
Starting Year: 1850				
Development Threshold; No Luxury Threshold	2.7%	962 million tonnes	-184 million tonnes	125% below 2005 levels
Development and Luxury Threshold	3.2%	1,153 million tonnes	-375 million tonnes	151% below 2005 levels
Starting Year: 1950				
Development Threshold; No Luxury Threshold	2.7%	969 million tonnes	-191 million tonnes	126% below 2005 levels
Development and Luxury Threshold	3.2%	1,162 million tonnes	-384 million tonnes	153% below 2005 levels
Starting Year: 1990				
Development Threshold; No Luxury Threshold	2.6%	940 million tonnes	-162 million tonnes	122% below 2005 levels
Development and Luxury Threshold	3.2%	1,146 million tonnes	-368 million tonnes	150% below 2005 levels

2. Equitable Mitigation to achieve the Paris Agreement goals[453]

The information presented below is from this study's supplementary data, which used a scenario set containing two pathways in which emissions peaked by 2020 with a greater than or equal to 50 percent chance of returning to 1.5°C in 2100. As detailed earlier, this study excludes emissions resulting from international shipping and aviation.

A 30-year convergence period was applied in the capability and equality approaches to transition from present-day international emissions ratios to an equitable ratio. After this period, two formulas are used.[454] The average figures cited in each table were combined with the

452 *Ibid.*

453 du Pont et al, 2016, *supra* note 140.

454 In both formulas, *i* is the index of the sum over all countries. If the target pathway's net emissions are positive: $E_c(y) = E_{global}(y)$ x $Pop_c(y)^2\, GDP_c(y) / \sum_{i = \{countries\}} Pop_i(y)^2\, GDP_i(y)$. If the target pathway's net emissions are negative, the second formula is used: $E_c(y) = E_{global}(y)$ x $GDP_c(y) / \sum_{i = \{countries\}} GDP_i(y)$. See Yann Robiou du Pont

Canadian government's emissions data for 2010 (693 million tonnes of Co2eq), to determine Canada's emissions allocations in tonnes. The following formula was used: (0.693) x (1 +/- average emissions allocation figure). For instance, the formula used to determine Canada's 2025 emissions allocations under the capability approach would be: 693 million tonnes x (1-0.59) = 284.13 million tonnes. This number is then converted into a percentage below Canada's 2005 emissions levels by dividing the allocation figure by Canada's 2005 emissions (730 million tonnes). This equals a fair share allocation percentage, which is then subtracted from 1 to equal a fair share emissions target as a percentage below 2005 emissions levels. If the fair share allocation is a negative figure, then this number is multiplied by -1 to equal the portion of the fair share emissions target that is over 100 percent and 1 is added to the total to equal the full fair share emissions target below 2005 levels.

Capability

Table Eleven: Canada's Fair Share Emissions Reduction (du Pont et al, Capability)[455]

	2025 (% of 2010 levels; average and range)	***2030 (% of 2010 levels; average and range)***	***2040 (% of 2010 levels; average and range)***	***2050 (% of 2010 levels; average and range)***	***First Net-Zero Allocation Year***
Canada's Emissions Allocations	-59 [-48 to -67]	-75 [-68 to -81]	-98 [-97 to -99]	-99 [-97 to -100]	2058
Canada's Emissions Allocation*	284 million tonnes	173 million tonnes	14 million tonnes	7 million tonnes	/
Fair Share Emissions Target **	61% below 2005 levels	76% below 2005 levels	98% below 2005 levels	99% below 2005 levels	/

et al, "National Contributions for decarbonizing the world economy in line with the G7 agreement", Supplementary Information (2016) Envtl Research Letters 1 at 10.

[455] du Pont et al, 2016(b), *supra* note 287.

Equality

Table Twelve: Canada's Fair Share Emissions Reduction (du Pont et al, Equality)[456]

	2025 (% of 2010 levels; average and range)	***2030 (% of 2010 levels; average and range)***	***2040 (% of 2010 levels; average and range)***	***2050 (% of 2010 levels; average and range)***	***First Net-Zero Allocation Year***
Canada's Emissions Allocations	-49 [-35 to -59]	-63 [-53 to -71]	-86 [-81 to -92]	-93 [-86 to -100]	2075
Canada's Emissions Allocation*	353 million tonnes	256 million tonnes	97 million tonnes	49 million tonnes	/
Fair Share Emissions Target **	52% below 2005 levels	65% below 2005 levels	87% below 2005 levels	93% below 2005 levels	/

GDR

Table Thirteen: Canada's Fair Share Emissions Reduction (du Pont et al, GDR)[457]

	2025 (% of 2010 levels; average and range)	***2030 (% of 2010 levels; average and range)***	***2040 (% of 2010 levels; average and range)***	***2050 (% of 2010 levels; average and range)***	***First Net-Zero Allocation Year***
Canada's Emissions Allocations	-52 [-25 to -73]	-65 [-40 to -83]	-106 [-86 to -125]	-137 [-116 to -163]	2039
Canada's Emissions Allocation*	333 million tonnes	243 million tonnes	-42 million tonnes	-256 million tonnes	/
Fair Share Emissions	54% below 2005 levels	67% below 2005 levels	106% below 2005 levels	135% below 2005 levels	/

[456] *Ibid.*
[457] *Ibid.*

Target					

ECEPC

Table Fourteen: Canada's Fair Share Emissions Reduction (du Pont et al, ECEPC)[458]

	2025 (% of 2010 levels; average and range)	***2030 (% of 2010 levels; average and range)***	***2040 (% of 2010 levels; average and range)***	***2050 (% of 2010 levels; average and range)***	***First Net-Zero Allocation Year***
Canada's Emissions Allocations	-50 [-38 to -75]	-67 [-51 to -100]	-97 [-77 to -116]	-126 [-105 to -139]	2042
Canada's Emissions Allocation*	347 million tonnes	229 million tonnes	21 million tonnes	-180 million tonnes	/
Fair Share Emissions Target **	53% below 2005 levels	69% below 2005 levels	97% below 2005 levels	125% below 2005 levels	/

Average of Approaches

Table Fifteen: Canada's Fair Share Emissions Reduction (du Pont et al, average)[459]

	2025 (% of 2010 levels)	***2030 (% of 2010 levels)***	***2040 (% of 2010 levels)***	***2050 (% of 2010 levels)***	***First Net-Zero Allocation Year***
Canada's Emissions Allocations	-52.5	-67.5	-96.75	-113.75	2053.5 (July 2053)
Canada's Emissions Allocation*	329 million tonnes	225 million tonnes	23 million tonnes	-95 million tonnes	

458 *Ibid.*
459 *Ibid.*

Fair Share Emissions Target**	55% below 2005 levels	69% below 2005 levels	97% below 2005 levels	113% below 2005 levels	

3. Climate Action Tracker[460]

CAT uses results from seven effort sharing categories to inform a global effort sharing best case scenario where all countries reduce national emissions to the bottom 10 percent of their fair share range, as well as a global effort sharing worst case scenario where all countries only reduce emissions to the top 10 percent of their fair share range. CAT excludes any outlying data by utilizing the range between these two scenarios as its "fair share range". As detailed in the paper, CAT uses this range to assess a country's ambition level to reduce emissions.

Table Sixteen: Canada's Fair Share Emissions Allocations & Targets (CAT)[461]

	2020 Fair Share Emission Allocations (Median, 10th percentile, 90th percentile) (Co2eq)	***2025 Fair Share Emission Allocations (Median, 10th percentile, 90th percentile) (Co2eq)***	***2030 Fair Share Emission Allocations (Median, 10th percentile, 90th percentile) (Co2eq)***	***2050 Fair Share Emission Allocations (Median, 10th percentile, 90th percentile) (Co2eq)***
Responsibility	483 million tonnes [452 to 534]	345 million tonnes [322 to 369]	210 million tonnes [187 to 227]	-520 million tonnes [-536 to -185]
Responsibility Fair Share Target	*34% below 2005 levels*	*53% below 2005 levels*	*71% below 2005 levels*	*171% below 2005 levels*
Capability	562 million tonnes [247 to 654]	492 million tonnes [225 to 634]	311 million tonnes [134 to 613]	86 million tonnes [-32 to 460]
Capability Fair Share Target	*23% below 2005 levels*	*33% below 2005 levels*	*57% below 2005 levels*	*88% below 2005 levels*
Equality	487 million tonnes [354 to 655]	343 million tonnes [280 to 541]	240 million tonnes [177 to 431]	64 million tonnes [38 to 80]
Equality Fair Share Target	*33% below 2005 levels*	*53% below 2005 levels*	*67% below 2005 levels*	*91% below 2005 levels*

460 Climate Action Tracker, "Climate Action Tracker", *supra* note 313.
461 Climate Action Tracker, "Detailed effort sharing", *supra* note 319. The author of this paper calculated and inserted the target rows below the emissions allocations for each equity approach (using the median figures to calculate the fair share target).

ECEPC	No information provided by CAT	344 million tonnes [344 to 344]	227 million tonnes [227 to 227]	-183 million tonnes [-183 to -183]
ECPCE Fair Share Target	/	*53% below 2005 levels*	*69% below 2005 levels*	*125% below 2005 levels*
Responsibility-Capability-Need	404 million tonnes [119 to 627]	238 million tonnes [-272 to 557]	73 million tonnes [-555 to 511]	-263 million tonnes [-830 to 265]
Responsibility-Capability-Need Fair Share Target	45% *below 2005 levels*	67% *below 2005 levels*	90% *below 2005 levels*	136% *below 2005 levels*
Staged	595 million tonnes [452 to 667]	465 million tonnes [353 to 572]	314 million tonnes [223 to 495]	45 million tonnes [-148 to 208]
Staged Fair Share Target	*18% below 2005 levels*	*36% below 2005 levels*	*57% below 2005 levels*	*94% below 2005 levels*
All (Lower Bound of Equity Range)	247 million tonnes	225 million tonnes	134 million tonnes	-536 million tonnes
All-Lower Bound Fair Share Target	*66% below 2005 levels*	*69% below 2005 levels*	*82% below 2005 levels*	*173% below 2005 levels*
All (Upper Bound of Equity Range)	655 million tonnes	572 million tonnes	511 million tonnes	265 million tonnes
All-Upper Bound Fair Share Target	*11% below 2005 levels*	*22% below 2005 levels*	*30% below 2005 levels*	*64% below 2005 levels*

BIBLIOGRAPHY

LEGISLATION: FOREIGN

Climate Change Act 2008 (UK).

Climate Change (Scotland) Act 2009 (Scot), ASP 12.

Directive (EU) 2018/410 of the European Parliament and of the Council: amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 (14 March 2018, Art 1,14(b), online: <eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0410&from=EN>.

LEGISLATION: DOMESTIC

"Output-Based Pricing System: Regulatory Impact Analysis Statement" (28 June 2019), online: *Government of Canada* <www.gazette.gc.ca/rp-pr/p2/2019/2019-07-10/html/sor-dors266-eng.html>.

INTERNATIONAL AGREEMENTS & DOCUMENTS

Boyd, David R, *Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment*, UNGA 74th Sess UN Doc A/74/161 (2019).

Committee on the Elimination of Discrimination against Women. *General Recommendation No. 37 on Gender- related dimensions of disaster risk reduction in the context of climate change*, CEDAW/C/GC/37 (2018).

Islam, S Nazrul & John Winkel, *Climate Change and Social Inequality*, UNDESA Working Paper ST/ESA/DWP/152 (2017) 1.

Kyoto Protocol to the United Nations Framework Convention on Climate Change, 11 December 1997, UN Doc FCCC/CP/1997/7/Add.1 (entered into force 16 February 2005).

Lima Call for Climate Action, UNFCCC 1/CP.20.

Preparations for the implementation of the Paris Agreement and the first session of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement, UNFCCC 24th Sess UN Doc FCCC/CP/2018/L.16 (2018).

Rio Declaration on Environment and Development, 13 June 1992, A/CONF 151/26 (vol 1).

UN Secretary-General, *Report on Intergenerational Solidarity and the Needs of Future Generations*, UNGA 68th Sess, UN Doc A/68/x (2013).

United Nations Framework Convention on Climate Change, 9 May 1992, 1771 UNTS 107 (entered into force 21 March 1994).

United Nations Framework Convention on Climate Change, *Adoption of the Paris Agreement*, 21st Sess, FCCC/CP/2015/L9/Rev 1 (2015).

UNFCCC Secretariat, *Paper No 1: Brazil - Proposed Elements of a Protocol to The United Nations Framework Convention on Climate Change, Presented By Brazil in Response to The Berlin Mandate*, 7th Sess (1997).

JURISPRUDENCE: CANADA

114957 Canada Ltée (Spraytech, Société d'arrosage) v Hudson (Town), 2001 SCC 40.

British Columbia v Canadian Forest Products Ltd, 2004 SCC 38.

Environnement Jeunesse c Procureur Général du Canada (2019), 2019 QCCS 2885 (Canlii).

Environnement Jeunesse c Procureur Général du Canada (2019), 2019 QCCS 2885 (Canlii) (Motion for Authorization to Institute a Class Action and Obtain the Statut of Representative: Unofficial Translation).

Friends of the Oldman River Society v Canada (Minister of Transport), [1992] 1 SCR 3.

La Rose et al v Canada (Attorney General) (Statement of Claim to the Defendants), online: <davidsuzuki.org/wp-content/uploads/2019/10/Statement-of-Claim-2019-10-25-FILED.pdf>.

Ontario v Canadian Pacific Ltd, [1995] 2 SCR 1031.

Reference re Greenhouse Gas Pollution Pricing Act, 2020 ABCA 74.

Reference re Greenhouse Gas Pollution Pricing Act, 2019 ONCA 544.

Reference re Greenhouse Gas Pollution Pricing Act, 2019 ONCA 544 (Factum of the Intervenor, the Attorney General of British Columbia).

Reference re Greenhouse Gas Pollution Pricing Act, 2019 ONCA 544 (Factum of the Intervenor, the David Suzuki Foundation).

Reference re Greenhouse Gas Pollution Pricing Act, 2019 ONCA 544 (Factum of the Intervenor, the Intergenerational Climate Coalition).

Reference re Greenhouse Gas Pollution Pricing Act, 2019 SKCA 40.

JURISPRUDENCE: FOREIGN

Armando Ferrão Carvalho and others v The European Parliament (2018), "Application for Annulment Pursuant to Article 263 TFEU and Application/Claim for Non-Contractual Liability Pursuant to Articles 268 and 340 TFEU and Application for Measures of Inquiry Pursuant to

Articles 88 and 91 of the Rules of Procedure of the General Court" (EU) (Case T-330/18-resubmitted).

Armando Ferrão Carvalho and others v The European Parliament (2018) (EU).

Juliana v United States "Complaint for Declaratory and Injunctive Relief" 28 U.S.C. § 1331 (US DC-Oregon, Eugene).

Juliana v United States, No 18-36082 DC No 6:15-cv-01517- AA (US CA 9th Cir 2020).

Urgenda v Government of the Netherlands (Ministry of Infrastructure and the Environment (24 June 2015) C/09/00456689 (English translation) (Netherlands).

Urgenda v Government of the Netherlands (Ministry of Infrastructure and the Environment (9 October 2018) C/09/00456689 (English translation) (Netherlands).

Urgenda v Government of the Netherlands (Ministry of Infrastructure and the Environment (20 December 2019) ECLI: NL: HR: 2019: 2006 (Netherlands).

SECONDARY MATERIAL: ACADEMIC ARTICLES

Ari, Izzet & Ramazan Sari. "Differentiation of developed and developing countries for the Paris Agreement" (2017) 18 Energy Strategy Reviews 175.

Baer, Paul et al. "Greenhouse Development Rights: A Proposal for a Fair Global Climate Treaty" (2009) 12 Ethics Place & Env 267.

Barrett, Sam. "Local level climate justice? Adaptation finance and vulnerability reduction" (2013) 23 Global Envtl Change 1819.

Bohm, Peter & Bjorn Larsen. "Fairness in a Tradable-Permit Treaty for Carbon Emissions Reductions in Europe and the former Soviet Union" (1994) 4:3 Envtl & Resource Econ 219.

Böhringer, Christoph & Carsten Helm. "On the fair division of greenhouse gas abatement cost" (2008) 30 Resource & Energy Econ 260.

Böhringer, Christoph et al. "Sharing the burden for climate change mitigation in the Canadian federation" (2015) 48:4 Cdn J Econ 1350.

Bretschger, Lucas. "Climate policy and equity principles: fair burden sharing in a dynamic world" (2013) 18 Envt and Devt Econ 517.

Brown Weiss, Edith. "In Fairness to Future Generations and Sustainable Development" (1992) 8:1 Am U Intl L Rev 19**.**

Bulkeley, Harriet et al. "Climate justice and global cities: Mapping the emerging discourses" (2013) 23 Glob Envtl Change 914.

Charpentier, Alex D, Joule A Bergerson & Heather L MacLean. “Understanding the Canadian oil sands industry’s greenhouse gas emissions” (2009) 4 Envtl Research Letters 1.

Davis, Steven J & Ken Caldeira. “Consumption-based accounting of Co2 emissions” (2010) 107:12 Proc Natl Academy Sci USA 5687.

Den Elzen, Michel & Niklas Höhne. “Reductions of greenhouse gas emissions in Annex I and non-Annex I countries for meeting concentration stabilisation targets” (2008) 91: Climatic Change 249.

Den Elzen, Michel et al. “Are the G20 economies making enough progress to meet their NDC targets?” (2019) 126 Energy Policy 238.

Denton, Fatma. “Climate change vulnerability, impacts, and adaptation: Why does gender matter?” (2002) 10:2 Gender & Dev 10.

Dietz, Simon et al. “An assessment of climate action by high-carbon global corporations” (2018) 8 Nature Climate Change 1072.

Du Pont, Yann Robiou & Malte Meinshausen. “Warming Assessment of the bottom-up Paris Agreement emissions pledges” (2018) 9 Nature Communications 1.

Du Pont, Yann Robiou et al. “Equitable Mitigation to achieve the Paris Agreement Goals” (2016) 7 Nature Climate Change 38.

--- “Equitable mitigation to achieve the Paris Agreement Goals”, Supplementary Information (2016) Nature Climate Change 1.

Du Pont, Yann Robiou et al. “National Contributions for decarbonizing the world economy in line with the G7 agreement”, Supplementary Information (2016) Envtl Research Letters 1 at 10.

Edmonds, Jae, Marshall Wise & David W Barns. “Carbon Coalitions: The Cost and Effectiveness of Energy Agreements to Alter Trajectories of Atmospheric Carbon Dioxide Emissions” (1995) 23:4-5 Energy Pol’y 309.

Ekholm, Tommi et al. “Effort sharing in ambitious, global climate change mitigation scenarios” (2010) 38 Energy Pol’y 1797.

Galvão Ferreia, Patrícia. “‘*Common But Differentiated Responsibilities’ in the National Courts:* Lessons from Urgenda *v*. The Netherlands” (2016) 5:2 Transnational Envtl L 329.

Hof, Andries F et al. “Global and regional abatement costs of Nationally Determined Contributions (NDCs) and of enhanced action to levels well below 2°*C* and 1.5°*C”* (2017) 71 Envtl Sci & Pol’y 30.

Höhne, Niklas et al. “Evolution of Commitments under the UNFCCC: Involving Newly Industrialized Economies and Developing Countries” (February 2003), online (pdf): *ECOFYS GmbH on behalf of the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, Germany* <www.researchgate.net/publication/265670626_Evolution_of_Commitments_under_the_UNFCCC_Involving_Newly_Industrialized_Economies_and_Developing_Countries>.

--- “Assessing the ambition of post-2020 climate targets: a comprehensive framework” (2018) 18:4 Climate Pol’y 425.

Höhne, Niklas, Michel den Elzen & Donovan Escalante. “Regional GHG reduction targets based on effort sharing: a comparison of studies” (2014) 14:1 Climate Pol’y 122.

Höhne, Niklas, Michel den Elzen & Martin Weiss. “Common but differentiated convergence (CDC): a new conceptual approach to long term climate policy” (2006) 6:2 Climate Pol’y 181.

Holz, Christian, Sivan Kartha & Tom Athanasiou. “Fairly sharing 1.5: national fair shares of a 1.5 °C-compliant global mitigation effort” (2018) 18: Intl Envtl Agreements 117.

Kaijser, Anna & Annica Kronsell. “Climate change through the lens of intersectionality” (2014) 23:3 Envtl Pol 417.

Klinsky, Sonja & Hadi Dowlatabadi. “Conceptualizations of justice in climate policy” (2009) 9:1 Clim Pol’y 88.

Klinsky, Sonja & Harald Winkler. “Building equity in: strategies for integrating equity into modelling for a 1.5°C world” (2018) 376 Phil Trans Royal Soc 1.

Knutti, Reto & Joeri Rogelj. “The legacy of our Co2 emissions: a clash of scientific facts, politics and ethics” (2015) 133: Climatic Change 361.

Krabbe, Oskar et al. “Aligning corporate greenhouse-gas emissions targets with climate goals” (2015) 5 Nature Climate Change 1057.

Kuramochi, Takeshi et al. “Comparative assessment of Japan’s long term carbon budget under different effort sharing principles” (2016) 16:8 Climate Pol’y 1029.

Lahn, Bård. “In the light of equity and science: scientific expertise and climate justice after Paris” (2018) 18: Intl Envtl Agreements 29.

Lahn, Bård & Göran Sundqvist. “Science as a “fixed point”? Quantification and boundary objects in international climate politics” (2017) 67 Envtl Sci & Pol’y 8.

McGlade, Christophe & Paul Ekins. “The geographical distribution of fossil fuels unused when limiting global warming to 2°C” (2015) 517 Nature 187.

McLeod, Christie, Barr, Heather & Katharina Rall. "Does Climate Change Increase the Risk of Child Marriage: A Look at What We Know - And What We Don't - With Lessons from Bangladesh and Mozambique" (2019) 38:1 Colum J Gender & L 96.

Meyer, Lukas H & Dominic Roser. “Climate justice and historical emissions” (2010) 13:1 Crit Rev Intl Soc & Pol Phil 229.

Moore, Aoife. “Court rules for Irish government in historic climate case” (19 September 2019), online: *Independent.Ie* <www.independent.ie/breaking-news/irish-news/court-rules-for-irish-government-in-historic-climate-case-38514770.html>.

Müller, Benito, Niklas Höhne & Christian Ellermann. “Differentiating historic responsibilities for climate change” (2009) 9:6 Climate Pol’y 593.

Okereke, Chukwumerije & Philip Coventry. “Climate justice and the international regime: before, during, and after Paris” (2016) 7 WIREs Clim Change 834.

Pan, Xunzhang et al. “Equitable Access to Sustainable Development: Based on the comparative study of carbon emission rights allocation schemes” (2014) 130 Applied Energy 632.

--- “Exploring fair and ambitious mitigation contributions under the Paris Agreement goals” (2017) 74 Envtl Sci & Pol’y 49.

Pan, Xunzhang, Fei Teng & Gehua Wang. “Sharing emission space at an equitable basis: Allocation scheme based on the equal cumulative emission per capita principle” (2014) 113 Applied Energy 1810.

Phylipsen, G J M et al. “A Triptych sectoral approach to burden differentiation; GHG emissions in the European bubble” (1998) 26:12 Energy Pol’y 929.

Rao, Narasimha D. “International and intranational equity in sharing climate change mitigation burdens” (2014) 14 Intl Envtl Agreements 129.

Riahi, Keywan et al. “Locked into Copenhagen pledges — Implications of short-term emission targets for the cost and feasibility of long-term climate goals” (2015) 90 Techno Forecasting & Soc Change 8.

Richels, Richard et al. “The Berlin Mandate: The Design of Cost-Effective Mitigation Strategies” in John Weyant, ed, *Energy and Environmental Policy Modeling* (New York: Springer US, 1999) 67.

Ringius, Lasse, Asbjørn Torvanger & Bjart Holtsmark. “Can multi-criteria rules fairly distribute climate burdens?” (1998) 26:10 En Pol’y 777.

Rogelj, Joeri et al. “Paris Agreement climate proposals need a boost to keep warming well below 2 °C” (2016) 534 Nature 631.

Rose, Adam. “Reducing conflict in global warming policy: The potential of equity as a unifying principle” (1990) 18:10 Energy Pol’y 927.

Rose, Adam & Brandt Stevens. “The Efficiency and Equity of Marketable Permits for Co2 Emissions” (1993) 15:1 Resource & Energy Econ 117.

Rose, Adam et al. “International Equity and Differentiation in Global Warming Policy: An Application to Tradeable Emission Permits” (1998) 12 Envtl & Resource Econ 25.

Savaresi, Annalisa & Juan Auz. “Climate Change Litigation and Human Rights: Pushing the Boundaries” (2019) Climate L 1.

Schlosberg, David. “Capacity and Capabilities: A Response to the Greenhouse Development Rights Framework” (2009) 12:3 Ethics Place & Env 287.

Shockley, Kenneth E. “A gentle critique of the Greenhouse Development Rights framework” (2013) 4 WIREs Clim Change 225.

Van Ruijven, Bas J et al. “Emission allowances and mitigation costs of China and India resulting from different effort-sharing approaches” (2012) 46 Energy Pol’y 116.

Winkler, Harald et al. “Countries start to explain how their climate contributions are fair: more rigour needed” (2018) 18 Intl Envtl Agreements 99.

Yu, Shengmin et al. “Study on the Concept of per Capita Cumulative Emissions and Allocation Options” (2011) 2:2 Advances in Climate Change Research 79.

Zhou, P & M Wang. “Carbon dioxide emissions allocation: A review” (2016) 125 Ecological Econ 47.

OTHER MATERIALS: NEWS ARTICLES & PRESS RELEASES

Bate, Felix. “France sets 2050 carbon-neutral target with new law” (27 June 2019), online: *Reuters* <www.reuters.com/article/us-france-energy/france-sets-2050-carbon-neutral-target-with-new-law-idUSKCN1TS30B>.

BBCNews. “Climate change: MSPs approve beefed up emissions target” (25 September 2019), online: *BBCNews* <www.bbc.com/news/uk-scotland-49819905>.

Burger, Michael & Jessica Wentz. “A Preview of How Climate Science Could Play Out in ‘Juliana v. United States’ Courtroom” (11 January 2019), online: *Sabin Center for Climate Change Law* <blogs.ei.columbia.edu/2019/01/11/climate-courtroom-juliana-v-us/>.

Cheadle, Bruce. “Catherine McKenna says Canada won’t set emissions target, Tory targets will be ‘floor’” (9 November 2015), online: *CBCNews* <www.cbc.ca/news/politics/catherine-mckenna-paris-talks-tory-target-1.3311482>.

Climate Action Tracker. “Pledged action leads to 2.9°C – time to boost national climate action” (19 Sept 2019), online: *Climate Action Tracker* <climateactiontracker.org/publications/time-to-boost-national-climate-action/>.

Climate Central. “The 10 Hottest Global Years on Record” (6 Feb 2019), online: *Climate Central* <www.climatecentral.org/gallery/graphics/the-10-hottest-global-years-on-record>.

Copenhagen Capacity. “New climate plan to make Denmark carbon neutral by 2050” (9 October 2018), online: *Copenhagen Capacity* <www.copcap.com/newslist/2018/new-ambitious-climate-plan-will-make-denmark-carbon-neutral-by-2050>.

David Suzuki Foundation. “15 Canadian youth launch Canada’s first federal youth climate lawsuit to protect their charter and public trust rights” (25 October 2019), online: *David Suzuki Foundation* <davidsuzuki.org/press/15-canadian-youth-launch-canadas-first-federal-youth-climate-lawsuit-to-protect-their-charter-and-public-trust-rights/>.

Davidson, Gail & Rohan Shah. “Canada’s failure to reduce emissions: Unlawful or above the law” (1 November 2015), online: *Canadian Centre for Policy Alternatives* <www.policyalternatives.ca/publications/monitor/canadas-failure-reduce-emissions-unlawful-or-above-law>.

Drugmand, Dana. “EU Families Appeal ‘People’s Climate Case’ Dismissal” (11 July 2019), online: *Climate Liability News* <www.climateliabilitynews.org/2019/07/11/eu-climate-case-emissions/>.

DutchNews.Nl. “Supreme court upholds Urgenda ruling, Dutch state must cut pollution” (20 December 2019), online: *DutchNews.Nl* <www.dutchnews.nl/news/2019/12/supreme-court-upholds-urgenda-ruling-dutch-state-must-cut-pollution/?fbclid=IwAR0Sn5rishT18rxyxMSSIjdiFXakKOnQwoQ4eXfFfC8gWLKIXzt1ayZsJJs>.

Gibillini, Nicole. “Encana sheds Canadian identity with name change, U.S. domicile” (31 October 2019), online: *BNN Bloomberg* <www.bnnbloomberg.ca/encana-sheds-canadian-roots-with-name-change-and-u-s-domicile-1.1340681>.

Gibson, Victoria. “Liberals promise net-zero emissions by 2050, offer sparse detail on path ahead” (24 September 2019), online: <ipolitics.ca/2019/09/24/liberals-promise-net-zero-emissions-by-2050/>.

Hood, Marlowe. “Earth warming more quickly than thought, new climate models show” (17 September 2019), online: *Phys.org* <phys.org/news/2019-09-earth-quickly-climate.html>.

Jackson, Hannah. “National climate emergency declared by House of Commons” (17 June 2019), online: *Global News* <globalnews.ca/news/5401586/canada-national-climate-emergency/>.

Mason, Gary. “Meaningful climate action in Canada is doomed” (28 September 2019), online: *The Globe & Mail* <www.theglobeandmail.com/opinion/article-meaningful-climate-action-in-canada-is-doomed/>.

NOAA Headquarters. “Earth still absorbing about half carbon dioxide emissions produced by people: study” (1 August 2012), online: *Phys.org* <phys.org/news/2012-08-earth-absorbing-carbon-dioxide-emissions.html>.

Rapier, Robert. “China Emits More Carbon Dioxide Than the U.S. and EU Combined” (1 July 2018), online: *Forbes* <www.forbes.com/sites/rrapier/2018/07/01/china-emits-more-carbon-dioxide-than-the-u-s-and-eu-combined/#17a994d628c2>.

Romm, Joseph. “What is the safe upper limit for atmospheric CO2?” (1 January 2008), online: *Grist* <grist.org/article/parting-company-with-mckibben-and-maybe-hansen/>.

Saxifrage, Barry. “Canada’s climate gap widens yet again” (30 January 2019), online: *National Observer* <www.nationalobserver.com/2019/01/30/analysis/canadas-climate-gap-widens-yet-again>.

Saxifrage, Barry. “Surprise! Most of Canada is on track to hit our 2020 climate target” (27 May 2019), online: *National Observer* <www.nationalobserver.com/2019/05/27/analysis/surprise-most-canada-track-hit-our-2020-climate-target>.

Skidmore, Chris. “UK becomes first major economy to pass net zero emissions law” (27 June 2019), online: *Department for Business, Energy & Industrial Strategy* <www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law>.

Statista. “Largest producers of territorial fossil fuel CO2 emissions worldwide in 2017, based on their share of global CO2 emissions” (2019), online: *Statista* <www.statista.com/statistics/271748/the-largest-emitters-of-co2-in-the-world/>.

Timperley, Jocelyn. “Denmark adopts climate law to cut emissions 70% by 2030” (6 December 2019), online: *Climate Change News* <www.climatechangenews.com/2019/12/06/denmark-adopts-climate-law-cut-emissions-70-2030/>.

UN Sustainable Development Goals. “In the face of worsening climate crisis, UN Summit delivers new pathways and practical actions to shift global response into higher gear” (23 September 2019), online: *UN Sustainable Development Goals* <www.un.org/sustainabledevelopment/blog/2019/09/in-the-face-of-worsening-climate-crisis-un-summit-delivers-new-pathways-and-practical-actions-to-shift-global-response-into-higher-gear/>.

Woods, Melanie. “All the Places in Canada that have Declared States of Climate Emergency” (28 August 2019), online: *Huffington Post* <www.huffingtonpost.ca/entry/climate-emergency-edmonton-declare_ca_5d671036e4b022fbceb5caff>.

World Meteorological Organization. “2019 concludes a decade of exceptional global heat and high-impact weather” (3 December 2019), online: *World Meteorological Organization* <public.wmo.int/en/media/press-release/2019-concludes-decade-of-exceptional-global-heat-and-high-impact-weather>.

OTHER MATERIALS: REPORTS

ActionAid et al. “Fair Shares- A Civil Society Equity Review of INDCs”, online (pdf): *Civil Society Review* <civilsocietyreview.org/wp-content/uploads/2015/11/CSO_FullReport.pdf>.

Bodansky, Daniel. “International Climate Efforts Beyond 2012: A Survey of Approaches” (December 2004), online (pdf): *Pew Centre on Global Climate Change* <www.c2es.org/site/assets/uploads/2004/11/international-climate-efforts-beyond-2012-survey-approaches.pdf>.

Boothe, Paul & Félix-A Boudreault. “By the Numbers: Canadian GHG Emissions” (2016), online: *Lawrence National Centre for Policy and Management* <www.ivey.uwo.ca/cmsmedia/2112500/4462-ghg-emissions-report-v03f.pdf>.

Boothe, Paul & Félix-A Boudreault. “Sharing the Burden: Canadian GHG Emissions” (2016), online: *Lawrence National Centre for Policy and Management* <www.ivey.uwo.ca/cmsmedia/2169603/ghg-emissions-report-sharing-the-burden.pdf>.

Burck, Jan et al. “Climate Change Performance Index: Results 2019”, online (pdf): *German Watch* <germanwatch.org/sites/germanwatch.org/files/CCPI-2019-Results-190614-WEB%20A3.pdf>.

Chen, C et al. “University of Notre Dame Global Adaptation Index Country Index Technical Report” (November 2015), online (pdf): *ND-GAIN* <gain.nd.edu/assets/254377/nd_gain_technical_document_2015.pdf>.

Clarke, Leon et al. “Assessing Transformation Pathways”, in O Edenhofer et al, eds, *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom: Cambridge University Press, 2014) 413.

Climate Action Tracker. “Climate crisis demands more government action as emissions rise” (June 2019), online (pdf): *Climate Action Tracker* <climateactiontracker.org/documents/537/CAT_2019-06-19_SB50_CAT_Update.pdf>.

Climate Change Performance Index. “Climate Change Performance Index 2018”, online: *Climate Change Performance Index* <www.climate-change-performance-index.org/climate-change-performance-index-2018>.

Climate Transparency. “Brown to Green: The G20 Transition to a Low-Carbon Economy-Canada” (2018), online (pdf): *Climate Transparency* <www.climate-transparency.org/wp-content/uploads/2019/01/BROWN-TO-GREEN_2018_Canada_FINAL.pdf>.

Commissioner of the Environment and Sustainable Development to the Parliament of Canada. “Report 1-Progress on Reducing Greenhouse Gases-Environment and Climate Change Canada” (2017), online: *Office of the Auditor General of Canada* <www.oag-bvg.gc.ca/internet/English/parl_cesd_201710_01_e_42489.html>.

Committee on Climate Change. “Net Zero: The UK’s Contribution to stopping global warming” (May 2019), online: *Committee on Climate Change* <www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf>.

--- “Report 2-Adapting to the Impacts of Climate Change” (2017), online: *Office of the Auditor General of Canada* <www.oag-bvg.gc.ca/internet/English/parl_cesd_201710_02_e_42490.html>.

Den Elzen, Michel & MM Berk. “Bottom-Up Approaches for Defining Future Climate Mitigation Commitments”, (26 April 2004), online (pdf): *National Institute for Public Health and the Environment* <pdfs.semanticscholar.org/36b5/0391560b8e39ffcd098fc484a1ef3ac1b12c.pdf?_ga=2.4896565.70959157.1566493553-1164268795.1566493553>.

Dietz, Simon et al. “Carbon Performance Assessment in Oil and Gas: Discussion Paper” (November 2018), online (pdf): *Transition Pathway Initiative* <www.lse.ac.uk/GranthamInstitute/tpi/wp-content/uploads/2018/11/Oil_and_gas_discussion_paper_061118.pdf>.

Environment and Climate Change Canada. “2018 Canada's Greenhouse Gas and Air Pollutant Emissions Projections” (2018), online (pdf): *Environment and Climate Change Canada* <publications.gc.ca/collections/collection_2018/eccc/En1-78-2018-eng.pdf>.

--- “Canada’s 7th National Communication and 3rd Biennial Report: Actions to Meet Commitments Under the United Nations Framework Convention on Climate Change” (2017), online (pdf): *Environment and Climate Change Canada* <unfccc.int/files/national_reports/national_communications_and_biennial_reports/application/pdf/82051493_canada-nc7-br3-1-5108_eccc_can7thncomm3rdbi-report_en_04_web.pdf>.

--- “Canada’s Mid-Century Long-Term Low-Greenhouse Gas Development Strategy” (2016), online (pdf): *Environment and Climate Change Canada* <unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf>.

--- *Canadian Environmental Sustainability Indicators: Progress towards Canada's greenhouse gas emissions reduction target* (Gatineau: Environment and Climate Change Canada, 2020) at 5, online: *Government of Canada* <www.canada.ca/content/dam/eccc/documents/pdf/cesindicators/progress-towards-canada-greenhouse-gas-reduction-target/2020/progress-ghg-emissions-reduction-target.pdf>.

--- "Government of Canada: Submission to the Talanoa Dialogue" (2018), online (pdf): *Environment and Climate Change Canada* <publications.gc.ca/collections/collection_2019/eccc/En4-351-2018-eng.pdf>.

--- "National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada-Part 1" (2019), online (pdf): *Environment and Climate Change Canada* <publications.gc.ca/collections/collection_2019/eccc/En81-4-2017-1-eng.pdf>.

Environmental Defence & Stand.Earth. "Canada's Oil & Gas Challenge: A Summary Analysis of Rising Oil and Gas Industry Emissions in Canada and Progress Towards Meeting Climate Targets" (2018), online (pdf): *Stand.Earth* <www.stand.earth/sites/stand/files/Canadas_Oil%2BGas_Challenge_0.pdf>.

European Commission. "In-Depth Analysis in Support of the Commission Communication COM (2018) 773: A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy" (28 November 2018), online (pdf): *European Commission* <ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf> .

Expert Group on Global Climate Obligations. "Oslo Principles on Global Climate Obligations" (2015), online (pdf): *Expert Group on Global Climate Obligations* <climateprinciplesforenterprises.files.wordpress.com/2017/12/osloprincipleswebpdf.pdf>.

Gaffney, Owen et al. "Meeting the 1.5°C Climate Ambition: Moving from Incremental to Exponential Action" (2019), online (pdf): *Exponential Roadmap* <exponentialroadmap.org/wp-content/uploads/2019/09/Meeting-the-1.5%C2%B0C-Climate-Ambition-September-19-2019.pdf>.

Gage, Andrew. "A Carbon Budget for Canada: A Collaborative Framework for Federal and Provincial Climate Leadership" (December 2015), online (pdf): *West Coast Environmental Law* <www.wcel.org/sites/default/files/publications/CarbonBudget%20(Web)_0.pdf>.

Gibson, Robert B et al. "From Paris to Projects: Clarifying the implications of Canada's climate change mitigation commitments for the planning and assessment of projects and strategic undertakings" (January 2019), online (pdf): *Metcalf Foundation* <uwaterloo.ca/paris-to-projects/sites/ca.paris-to-projects/files/uploads/files/p2p_full_report_23jan19.pdf>.

Global Commission on Adaptation. "Adapt Now: A Global Call for Leadership on Climate Resilience" (September 2019), online (pdf): *Global Commission on Adaptation* <cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf>.

Government of British Columbia. "CleanBC: Our Nature. Our Power. Our Future." (last updated March 2019), online (pdf): *Government of British Columbia* <blog.gov.bc.ca/app/uploads/sites/436/2019/02/CleanBC_Full_Report_Updated_Mar2019.pdf>.

Government of Canada. “Canada’s INDC Submission to the UNFCCC” (last visited 3 November 2019), online: *UNFCCC* <www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Canada%20First/INDC%20-%20Canada%20-%20English.pdf>.

--- “Pan-Canadian Approach to Pricing Carbon Pollution” (last modified 3 October 2016), online: *Government of Canada* <www.canada.ca/en/environment-climate-change/news/2016/10/canadian-approach-pricing-carbon-pollution.html≥.

--- “Pan-Canadian Framework on Clean Growth and Climate Change: Canada’s Plan to Address Climate Change and Grow the Economy” (2016), online: *Government of Canada* <www.canada.ca/content/dam/themes/environment/documents/weather1/20161209-1-en.pdf>.

Gupta, S et al. “Policies, Instruments and Co-operative Arrangements” in Bert Metz et al, eds, *Climate Change 2007 Mitigation: Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom: Cambridge University Press, 2007) 745.

Heede, Richard. “Carbon Majors: Accounting for carbon and methane emissions 1854-2010-Methods & Results Report” (7 April 2014), online (pdf): *Climate Accountability* <climateaccountability.org/pdf/MRR%209.1%20Apr14R.pdf>.

Holz, Christian. “Deriving a Canadian Greenhouse Gas Reduction Target in Line with the Paris Agreement’s 1.5°C goal and the Findings of the IPCC Special Report on 1.5°C” (December 2019), online: *Climate Action Network* <climateactionnetwork.ca/wp-content/uploads/2019/12/CAN-Rac-Fair-Share-%E2%80%94-Methodology-Backgrounder.pdf>.

Human Rights Watch. “Submission to the Committee on the Elimination of Discrimination against Women on “Gender-Related Dimensions of Disaster Risk Reduction and Climate Change”” (2016), online (available for download): *United Nations Human Rights Office of the High Commissioner* <www.ohchr.org/EN/HRBodies/CEDAW/Pages/ContributionsClimageChange.aspx>.

Hussey, Ian et al. “Boom, Bust, and Consolidation: Corporate Restructuring in the Alberta Oil Sands” (November 2018), online: *Parkland Institute* <d3n8a8pro7vhmx.cloudfront.net/parklandinstitute/pages/1664/attachments/original/1542129868/boombustconsolidation.pdf?1542129868>.

International Bar Association. “Achieving Justice and Human Rights in an Era of Climate Disruption: International Bar Association Climate Change Justice and Human Rights Task Force Report” (July 2014), online (pdf): *International Bar Association* <www.ibanet.org/PresidentialTaskForceClimateChangeJustice2014Report.aspx>.

International Energy Agency & International Renewable Energy Agency. “Executive Summary: Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System” (2017), online (pdf): *International Renewable Energy Agency* <www.irena.org/-

/media/Files/IRENA/Agency/Publication/2017/Mar/Perspectives_for_the_Energy_Transition_2017_Executive_Summary.pdf?la=en&hash=7FCE69C6C62EA63EBC400A85F1E0BEEBBC7A63E7>.

IPCC. "Climate Change 2014 Synthesis Report Summary for Policymakers" (2014), online (pdf): *IPCC* <www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf>.

--- "Impacts of 1.5°C global warming on natural and human systems" in V Masson-Delmotte et al, eds, *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-industrial Levels & Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, & Efforts to Eradicate Poverty* (Geneva, Switzerland: World Meteorological Organization, 2018) 177.

--- "Mitigation Pathways Compatible with 1.5°*C* in the Context of Sustainable Development" in V Masson-Delmotte et al, eds, *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-industrial Levels & Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, & Efforts to Eradicate Poverty* (Geneva, Switzerland: World Meteorological Organization, 2018) 93.

--- "Summary for Policymakers" in V Masson-Delmotte et al, eds, *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (Geneva, Switzerland: World Meteorological Organization, 2018).

--- "Sustainable Development and Equity" in Edenhofer et al, eds, *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom: Cambridge University Press, 2014) 283.

--- "Sustainable Development, Poverty Eradication and Reducing Inequalities*"* in V Masson-Delmotte et al, eds, *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-industrial Levels & Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, & Efforts to Eradicate Poverty* (Geneva, Switzerland: World Meteorological Organization, 2018).

Lee, Marc. "Extracted Carbon: Re-examining Canada's Contribution to Climate Change through Fossil Fuel Exports" (January 2017), online (pdf): *Canadian Centre for Policy Alternatives* <www.policyalternatives.ca/sites/default/files/uploads/publications/National%20Office%2C%20BC%20Office/2017/01/ccpa_extracted_carbon_web.pdf>.

Macdonald, Douglas et al. "Allocating Canadian Greenhouse Gas Emission Reductions Amongst Sources and Provinces: Learning from the European Union, Australia and Germany" (April

2013), online (pdf): *University of Toronto* <tspace.library.utoronto.ca/bitstream/1807/77153/1/AllocatingGHGReductions2013.pdf>.

Merzian, Richie & Rod Campbell. "Advance Australia's fair share: Assessing the fairness of emissions targets" (12 June 2018), online (pdf): *Australia Institute* <www.tai.org.au/sites/default/files/P507%20Advance%20Australias%20Fair%20Share%20FINAL_1.PDF>.

Oil Change International. "Climate on the line: Why new tar sands pipelines are incompatible with the Paris goals" (January 2017), online (pdf): *Oil Change International* <priceofoil.org/content/uploads/2017/01/climate_on_the_line_FINAL-OCI.pdf>.

Prime Minister of Canada. "Government of Canada fighting climate change with price on pollution" (23 October 2018), online: *Justin Trudeau, Prime Minister of Canada* <pm.gc.ca/en/news/news-releases/2018/10/23/government-canada-fighting-climate-change-price-pollution>.

Somanathan, Eswaran et al. "National and Sub-national Policies and Institutions" in O Edenhofer et al, eds, *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom: Cambridge University Press, 2014) 1141.

Suncor. "Annual Information Form", (1 March 2018), online: *Suncor* <www.suncor.com/-/media/Files/PDF/Investor-Centre/Annual-Reports/2017-AR/English/2017_Annual_AIF_EN.pdf?la=en-CA&modified=20180517215507&hash=99432E472051442B73F248A21ADEADD0DBC0BE11>.

--- "2018 Climate Risk and Resilience Report" (2018), online: *Suncor* <sustainability.suncor.com/-/media/project/ros/2018/documents/2018-climate-risk-and-resilience-report-en.pdf?modified=20180810193032>

--- "2018 Suncor CDP Climate Response" (2018), online: *Suncor* <sustainability-prd-cdn.suncor.com/-/media/project/ros/2018/documents/2018-suncor-cdp-climate-response-en.pdf?modified=20190129211405&la=en&hash=D5CE678437702024E4ABA37139B2B3CB35500134>.

The Mary Robinson Foundation for Climate Justice. "Zero Carbon Zero Poverty The Climate Justice Way: Achieving an Equitable phase-out of carbon emissions by 2050 while protecting human rights" (2015), online (pdf): *The Mary Robinson Foundation for Climate Justice* <www.mrfcj.org/media/pdf/2014/ZeroCarbontheClimateJusticeWay.pdf>.

Turcotte, Isabelle, Gorski, Jan & Brianne Riehl. "Carbon Emissions: Who makes big polluters pay" (November 2019), online (pdf): *Pembina Institute* <www.pembina.org/reports/obps-comparative-analysis-final2.pdf>.

Union of Concerned Scientists. “The 2018 Climate Accountability Scorecard: Insufficient Progress from Major Fossil Fuel Companies” (October 2018), online: *Union of Concerned Scientists* <www.ucsusa.org/sites/default/files/attach/2018/10/gw-accountability-scorecard18-report.pdf>.

United Nations Environment Programme. “Emissions Gap Report 2019” (November 2019), online (pdf): *United Nations Environment Programme* <wedocs.unep.org/bitstream/handle/20.500.11822/30797/EGR2019.pdf?sequence=1&isAllowed=y >.

von Lucke, Franziskus. “O Justice, Where Art Thou? Developing a New Take on Climate Justice” (April 2017), online (pdf): *GLOBUS Research Papers* <poseidon01.ssrn.com/delivery.php?ID=984094084082031122101006121122084068102080021061010049073012104118078005022117105098016059027059030017044100099115000093119029043027046041038064116105117112090065070075051121115104093065085020020102113024095079064026122124127028074071103125108084120&EXT=pdf>.

Zhang, Xuebin et al. “Temperature and Precipitation Across Canada” in E Bush & D S Lemmen, eds, “Canada’s Changing Climate Report” (Ottawa: Government of Canada, 2019), online (pdf): *Government of Canada* <changingclimate.ca/site/assets/uploads/sites/2/2018/12/CCCR-Chapter4-TemperatureAndPrecipitationAcross Canada.pdf>.

OTHER MATERIALS: WEBSITES

Carbon Tracker Initiative. “Balancing the Budget: Why deflating the carbon bubble requires oil & gas companies to shrink” (1 November 2019), online: *Carbon Tracker Initiative* <www.carbontracker.org/reports/balancing-the-budget/>.

Chachula, Andrew T R, Sarah E Gilbert & Thomas W McInerney. “New Details on Application of Federal Carbon-Pricing Backstop” (6 November 2018), online: *Bennett Jones* <www.bennettjones.com/Blogs-Section/New-Details-on-Application-of-Federal-Carbon-Pricing-Backstop>.

Climate Action Network Canada. “Canada’s Fair Share Towards Limiting Global Warming to 1.5°C” (2 December 2019), online: *Climate Action Network Canada* <climateactionnetwork.ca/2019/12/02/canadas-fair-share-towards-limiting-global-warming-to-1-5c/>.

Climate Action Tracker. “Climate Action Tracker” (last visited 29 October 2019), online: *Climate Action Tracker* <climateactiontracker.org/>.

--- “Comparability of effort” (last visited 24 October 2019), online: *Climate Action Tracker* <climateactiontracker.org/methodology/comparability-of-effort/>.

--- “Detailed effort sharing data” (last modified 28 November 2018), online: *Climate Action Tracker* <climateactiontracker.org>.

--- "Global Pathways" (last visited 12 October 2019), online: *Climate Action Tracker* <climateactiontracker.org/methodology/global-pathways/>.

--- "NDC Ratings and LULUCF" (last visiting 11 December 2019), online: *Climate Action Tracker* <climateactiontracker.org/methodology/indc-ratings-and-lulucf/>.

---"Norway" (last modified 19 September 2019), online: *Climate Action Tracker* <climateactiontracker.org/countries/norway/pledges-and-targets/>.

--- "Rating System" (last visited 24 October 2019), online: *Climate Action Tracker* <climateactiontracker.org/countries/rating-system/>.

Climate Equity Reference Project. "The Climate Equity Reference Calculator database" (last visited 12 October 2019), online: *Climate Equity Reference Project* <climateequityreference.org/calculator-information/the-climate-equity-reference-calculator-database/>.

Climate Policy Info Hub. "The EU Emissions Trading System: an Introduction" (last visited 14 October 2019), online: *Climate Policy Info Hub* <climatepolicyinfohub.eu/eu-emissions-trading-system-introduction>.

Climate Principles for Enterprises. "About" (last visited December 11 2019), online: *Climate Principles for Enterprises* < climateprinciplesforenterprises.org/about/>.

Corporate Europe. "EU emissions trading: 5 reasons to scrap the ETS" (26 October 2015), online: *Corporate Europe* <corporateeurope.org/en/environment/2015/10/eu-emissions-trading-5-reasons-scrap-ets>.

Elizabeth May MP. "Backgrounder: Canada & Climate Change" (14 December 2012), online: *Elizabeth May MP* <elizabethmaymp.ca/publications/backgrounder/2012/12/14/backgrounder-canada-climate-change/>.

Government of Canada. "Global greenhouse gas emissions" (30 May 2019), online: *Government of Canada* <www.canada.ca/en/environment-climate-change/services/environmental-indicators/global-greenhouse-gas-emissions.html>.

--- "Greenhouse gas emissions" (last modified 17 April 2019), online: *Government of Canada* <www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>.

InforMEA. "Intragenerational equity" (last visited 14 October 2019), online: *InforMEA* <www.informea.org/en/terms/intragenerational-equity>.

Kemp-Benedict, Eric et al. "The Climate Equity Reference Calculator" (2019), online: *Climate Equity Reference Project* <calculator.climateequityreference.org>.

Notre Dame Global Adaptation Initiative. “Rankings” (last visited 3 November 2019), online: *Notre Dame Global Adaptation Initiative* <gain.nd.edu/our-work/country-index/rankings/>.

Sabin Center for Climate Change Law. “Friends of the Irish Environment v Ireland” (last visited December 21 2019), online: *Climate Case Chart* <climatecasechart.com/non-us-case/friends-of-the-irish-environment-v-ireland/>.

Science Based Targets. “About the Science Based Targets Initiative” (last visited 25 October 2019), online: *Science Based Targets* <sciencebasedtargets.org/about-the-science-based-targets-initiative/>.

--- “Methods” (last visited 25 October 2019), online: *Science Based Targets* <sciencebasedtargets.org/methods/>.

Swedish Environmental Protection Agency. “Sweden’s Climate Act and Climate Policy Framework” (last modified 24 September 2019), online: *Swedish Environmental Protection Agency* <www.swedishepa.se/Environmental-objectives-and-cooperation/Swedish-environmental-work/Work-areas/Climate/Climate-Act-and-Climate-policy-framework-/>.

The World Bank. “CO2 emissions (metric tons per capita)” (last visited 3 November 2019), online: *The World Bank* <data.worldbank.org/indicator/EN.ATM.CO2E.PC?most_recent_value_desc=true>.

Theroux, Michael P, Laura M Gill & Stephanie Gagne. “Quebec’s Superior Court Leaves the Door Open to Canadian Climate Change Litigation” (1 August 2019), online: *Bennett Jones* <www.bennettjones.com/Blogs-Section/Quebecs-Superior-Court-Leaves-the-Door-Open-to-Canadian-Climate-Change-Litigation?utm_source=Mondaq&utm_medium=syndication&utm_campaign=View-Original>.

United Nations. “Climate Change” (last visited November 3 2019), online: *United Nations* <www.un.org/en/sections/issues-depth/climate-change/>.

United Nations Development Programme. “Human Development Index” (last visited 2 November 2019), online: *United Nations Development Programme* <hdr.undp.org/en/content/human-development-index-hdi>.

United Nations Framework Convention on Climate Change. “Land Use, Land-Use Change and Forestry (LULUCF)” (last visited 11 December 2019), online: *United Nations Framework Convention on Climate Change* <unfccc.int/topics/land-use/workstreams/land-use--land-use-change-and-forestry-lulucf>.

World Population Review. “Canada Population 2019” (last modified 10 October 2019), online: *World Population Review* <worldpopulationreview.com/countries/canada-population/>.

--- “Co2 Emissions By Country 2019” (2019), online: *World Population Review* <worldpopulationreview.com/countries/co2-emissions-by-country/>.

OTHER MATERIALS: OTHER

House of Commons Debates, 42-1, No 086 (3 October 2016) (Right Hon Justin Trudeau).

Letter from West Coast Environmental Law et al to Prime Minister Justin Trudeau (25 February 2019) on "CleanBC: An Accountability Model for the Pan-Canadian Framework", online (pdf): *West Coast Environmental Law* <www.wcel.org/sites/default/files/publications/pcf-cleanbc-letter-2019.pdf>.