

Canada's Fair Share of 1.5 °C-consistent Global Mitigation Through 2035

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Summary

Members of Climate Action Network Canada – Réseau action climat Canada (CAN-Rac), during the first calendar quarter of 2024, updated CAN-Rac's position on Canada's fair share of a 1.5 °C-consistent global mitigation effort that had been previously calculated by CAN-Rac members in 2019 (CAN-Rac Canada 2019; Holz 2019) and to extend the time horizon of that analysis to 2035.

Their work concluded that **Canada's total fair share of a 1.5 °C-consistent global mitigation effort is equivalent to a 160 % reduction in emissions below 2005 levels by 2035**, when accounting for Canada's shortfall over the post-Paris period 2016-2023 between its actual emissions and its previously calculated fair share (a total shortfall of 1,180 MtCO₂eq).

Utilizing the analysis of the International Energy Agency's Net Zero Emission scenario, implies a domestic reduction of 73 % below 2005 levels in 2035. Applying a portion of Canada's post-Paris shortfall to this figured increases it to a total **domestic reduction of 80% below 2005 levels in 2035**.

The gap between the 160 % total fair share and the 80 % domestic portion constitutes the international portion of Canada's total fair share. Expressed as climate finance contribution for mitigation, **the international portion of Canada's fair share implies, in 2025, an annual climate finance contribution for mitigation of USD \$ 19 billion (CAD \$ 25bn). This amount increases to USD \$ 64 billion (CAD \$ 86bn) per year by 2035**, for an average of USD \$ 43 billion (CAD \$ 58bn) per year during the 2025-2035 period. Table 1 below shows a summary of the mitigation climate finance implications of the international portion of Canada's mitigation fair share. This would have to be supplemented by appropriate amounts of climate finance for adaptation, loss and damage, and other purposes, which were beyond the scope of the present analysis.

Importantly, the fair shares results described in this memo can only be considered "fair" when implemented as "a package," i.e. the domestic reduction target described herein is only fair insofar as it is complemented by the international component as also calculated. Otherwise, 1.5 °C-compliant mitigation will remain out of reach, impose undue burden on the world's poorest – by forcing them to contribute much more than their fair share –, or most likely both.

¹ Climate Equity Reference Project would like to acknowledge financial support from Climate Action Network Canada – Réseau action climat Canada (CAN-Rac Canada) for this work. For transparency, the author, Ceecee Holz, is also a board member of CAN-Rac Canada – appropriate steps to manage conflicts of interest or a perception of such conflicts have been taken by the board of CAN-Rac Canada.

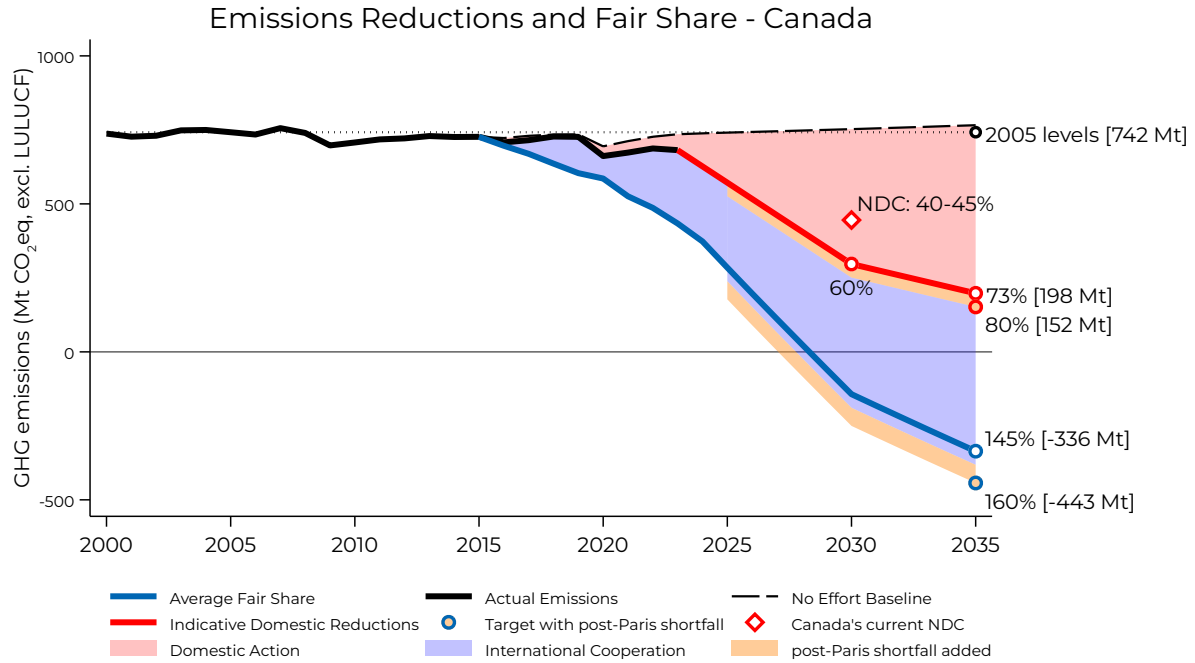


Figure 1: Canada's Fair Share of global 1.5 °C-consistent mitigation, accounting for its post-Paris shortfall. For full caption, see Figure 4.

Canada International Mitigation Obligation (median figures)		
	bn USD	bn CAD
Total 2025-2030	192.0	259.1
Total 2031-2035	283.9	383.2
Total 2025-2035	475.9	642.3
Per year in 2025	18.8	25.4
Per year average 2025-2035	43.3	58.4
Per year in 2035	63.8	86.2

Table 1: Climate Finance Implications of the international portion of Canada's mitigation fair share.

Introduction

This technical report serves to outline the methodological and normative-ethical choices taken by members of Climate Action Network Canada – Réseau action climat Canada (CAN-Rac) in deriving their current position on Canada's fair share through 2035 towards a global mitigation effort consistent with limiting warming to 1.5 °C, based on the findings of the IPCC Sixth Assessment Report (IPCC AR6) (IPCC 2022).

The choices were, in the first instance, deliberated in CAN-Rac's "Equity and Fair Shares" working group and were then further discussed among the broader CAN-Rac membership. This work is based on similar work undertaken by CAN-Rac members in 2019 to define Canada's fair share through 2030. (CAN-Rac Canada 2019; Holz 2019)

These methodological and normative-ethical choices broadly occurred in four distinct areas and in line with CAN-Rac members' values, namely:

1. Selecting a global pathway or a range of global pathways from the IPCC AR6 scenario database;
2. Determining how to fairly share the global mitigation effort among Earth's peoples and countries;
3. Determine how much of Canada's fair share should be implemented via domestic emissions reductions measures;
4. Decide whether, and if so how, Canada's shortfall up to the present moment vis-à-vis the previous fair share, as calculated by CAN-Rac in 2019, should be considered in conceptualizing and calculating its fair share through 2035; and
5. Consider the implications for international cooperation and support of the fair shares results, adjusted, as appropriate, for Canada's shortfall, and the decision of how much of it should be implemented domestically.

In the first three and the fifth of these areas, pre-existing decisions that CAN-Rac members had taken in 2019 regarding Canada's fair share of climate action through 2030 were available as starting points for the deliberations, whereas the fourth area was a new consideration.

These areas will be discussed in turn. Explicit normative decision making is required when seeking to derive national mitigation pathways from global scenarios, since the IPCC's science assessments of mitigation pathways offer, generally speaking, mostly summaries for global (or broad regional) figures, rather than national ones. Consequently, the question of how to distribute this global effort among the world's countries, cannot be answered by the physical science of climate change but is a question for social scientists – ethicists, political scientists, and potentially economists, as well as for broader societal and political discourses.

Importantly, the fair shares results described in this memo can only be considered "fair" when implemented as "a package," i.e. the domestic reduction target described herein is only fair insofar as it is complemented by the international component as also calculated, with important implications for Canada's international climate finance as described. Otherwise, 1.5 °C-compliant mitigation will remain out of reach, impose undue burden on the world's poorest – by forcing them to contribute much more than their fair share –, or most likely both.

1. Selecting a global mitigation pathway

CAN-Rac members reaffirmed the decision they had taken in 2019, that the Low Energy Demand Scenario (LED) (Grübler et al. 2018) is still the scenario from the IPCC scenario ensemble that best corresponds to their values regarding equity, environmental integrity, and the precautionary principle. Among other considerations, this is because the LED scenario does not rely on unproven-at-scale carbon dioxide removal approaches. The LED scenario classified by the IPCC AR6 as a scenario that “limits warming to 1.5 °C (>50 %) with no or limited overshoot.” Unlike the 2019 CAN-Rac fair shares calculations, which used the IPCC SR1.5 version of the LED, here, the updated version for AR6 is used. As a result of insufficient global mitigation action between the SR1.5 and AR6, the updated LED pathway results in a slightly higher and longer overshoot.

Specifically, the updated LED pathway has a 74 % probability for a temperature increase of 1.5 °C or less in 2100 and an 88 % probability of never exceeding 2 °C. The LED pathway peaks at 1.59 °C or less (with 50 % probability) or 1.71 °C, or less (with 67 % probability), and has a 38 % probability of never exceeding 1.5 °C.

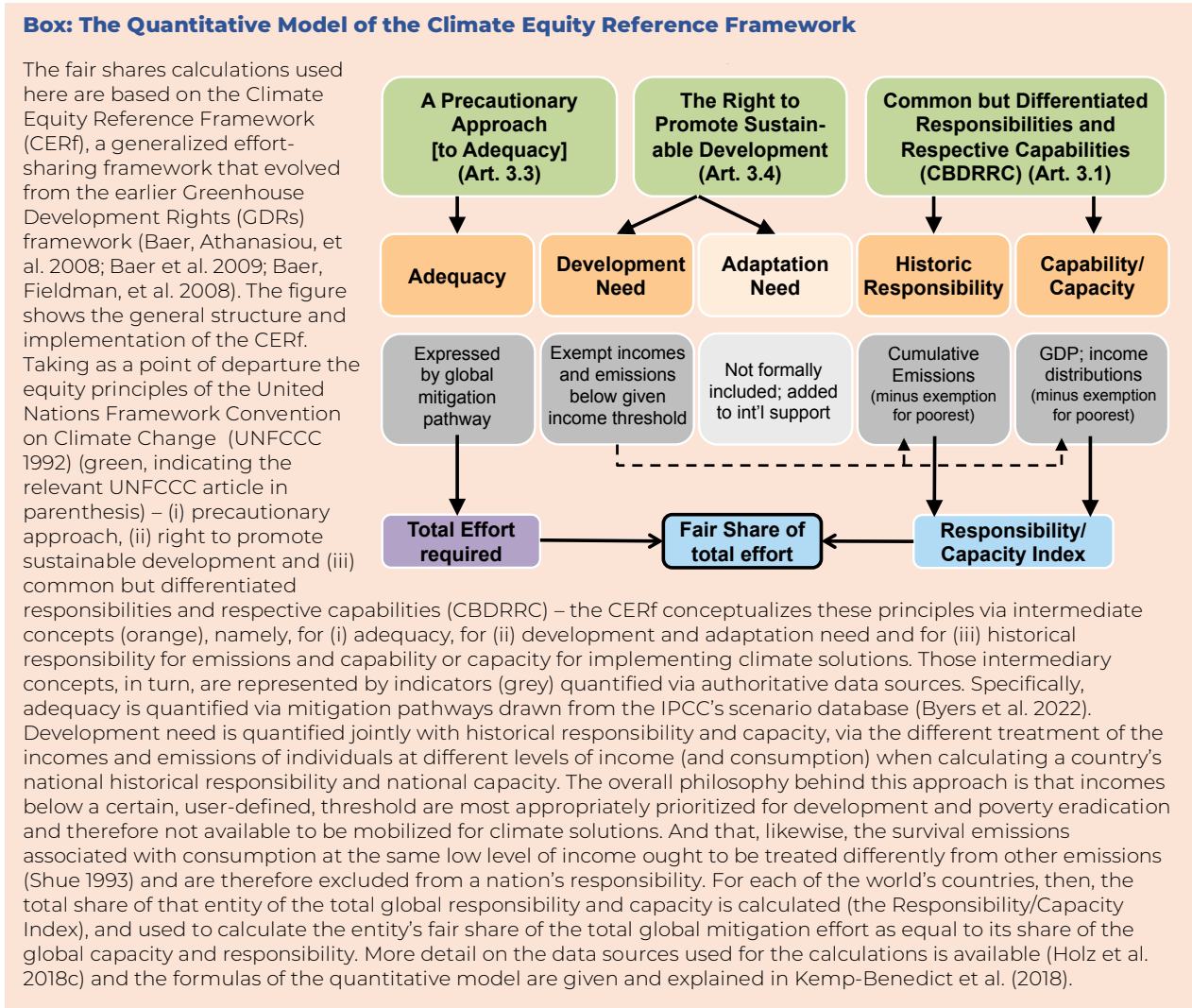
2. Determining how to fairly share the global mitigation effort among Earth’s peoples and countries

Having reaffirmed a global mitigation effort, as per the LED pathway, that aligns with CAN-Rac members’ values with regards to risks and the precautionary principle, the question emerges how to distribute this effort fairly among the world’s countries. The Paris Agreement and the United Nations Framework Convention on Climate Change (UNFCCC 1992, 2015) acknowledge the importance of equity in implementing a global response to the climate crisis. Specifically, both treaties highlight the equity principle of “Common But Differentiated Responsibilities and Respective Capabilities,” which acknowledges that addressing climate change is a shared responsibility of all countries (“common responsibilities”), while they bear different degrees of responsibility for causing the problem and thus for contributing to the solution (“differentiated responsibilities”), while also acknowledging that countries’ different levels of economic development and financial wherewithal constitute different levels of capacity to contribute to addressing the climate crisis (“respective capabilities”). Furthermore, the Paris Agreement explicitly acknowledges (in Article 4.1, UNFCCC 2015) that peaking of emissions will occur later in developing countries, which implies that developing countries’ emissions would reduce at a relative rate slower than the global figures with developed countries having to achieve deeper reductions.

The Climate Equity Reference framework (CERf) is an equity modelling framework that allows to quantitatively reflect these equity principles to derive “national fair shares” of a specified global effort (e.g. the global mitigation effort implied by the LED scenario pathway) under a variety of specific ethical-normative interpretations of the equity principles of the UNFCCC and the Paris Agreement. The CERf methodology is peer-reviewed (Holz et al. 2018a), is highlighted in the IPCC’s Fifth Assessment Report (IPCC 2014) as one of the frameworks implementing the “responsibility – capability – need” approach to equitable effort sharing, and by the IPCC’s Sixth Assessment Report as one that introduced the ethical notion of “progressivity” to effort sharing

(IPCC 2022). Since 2015, the CERf has also been utilized by the Civil Society Equity Review – a large, diverse and global coalition of organizations and movements – as a basis for a series of annual equity assessments of the climate pledges of countries (Civil Society Equity Review 2015, 2016, 2017, 2018, 2019, 2021, 2022, 2023).

Specifically, the CERf considers the equity principle of responsibility by calculating the share of any country of the cumulative global emissions (of individuals above the



“development threshold,” see below) since a given start year. Capacity is taken into account by considering each country’s total income of individuals above a certain “development threshold,” below which incomes are not considered to be available to address climate change. This reflects the normative position that for the poorest individuals in every country the fulfilment of their immediate basic needs ought to take precedent over contributing to addressing the climate crisis. This is equivalent to

“progressive” taxation which is universal in income tax regimes around the world² – in Canada for example, reflected by the “basic amount” of tax-free income. Capacity calculations can also include a second threshold, making the calculations equivalent to “more progressive” taxation regime, with the rate at which incomes are considered available to address climate change gradually rising between the development threshold and this second threshold – this reflects income taxation regimes with multiple tax brackets with progressively higher marginal tax rates. The CERf calculates how much of the global capacity and global responsibility (each calculated as described above) can be attributed to each country and then apportions the global effort, here: the global effort to implement mitigation in line with the LED pathway, to each country.

2.1 Results of the Effort Sharing Calculations

For their calculations with the Climate Equity Reference Calculator,³ CAN-Rac members, like they did for their calculations for Canada’s 2030 mitigation fair share in 2019, elected to not select a single value for the start year of calculating historical responsibility or to choose a single approach to reflect progressivity in the calculation of capacity. Instead, they decided to **calculate Canada’s fair share under historical responsibility start dates of 1850 and 1950, each combined with one progressivity approach that applies a development threshold of \$ 7,500 annual per capita income and a second progressivity approach that additionally applies a second threshold of \$ 50,000 per capita annual income.** Unlike their previous calculations, they decided not to consider a 1990 start date for historical responsibility an equitable expression of the notion of “historical responsibility” in the sense of the UNFCCC⁴ but the results of the calculations are included in Figure 2 below to demonstrate how inclusion of this perspective would not have a material impact on the results.

The (rounded) average of these four fair shares calculations was then taken as Canada’s fair share of the global emissions reduction effort implied by the LED pathway scenario. **Specifically, this initial fair share calculation implies that Canada’s emissions in 2035 should be no higher than -366 Mt CO₂eq, or 145 % below 2005 levels.**

It is important to note that this calculation is exclusively based upon the ethical principles of the UNFCCC and the Paris agreement as explained above and given the specific views of CAN-Rac members as to how capacity and responsibility ought to be understood. It is not based upon any techno-economic or policy analysis as to how such a target could be achieved.

² There are some countries that use a “flat” income tax – the same tax rate applies to all incomes – , but since they also use tax exemptions for the lowest income (i.e. a tax rate of 0 %), those “flat taxes” are effectively progressive taxes as well.

³ For the calculations in this memo, the Climate Equity Reference Calculator (CERc) was run with the CERc core database v.7.3.3 (with 2050 extension).

⁴ The UNFCCC was negotiated during 1990-1992. In this context, emissions in the year 1990, and much less emissions thereafter, cannot be considered an appropriate meaning of “historical responsibility” in the context of the ethical principles of the UNFCCC (as those would have been “contemporary” emissions). Likewise, excluding all emissions prior to 1990 systematically undercounts emissions from wealthier countries, who industrialized earlier, more than those from less wealthy countries.

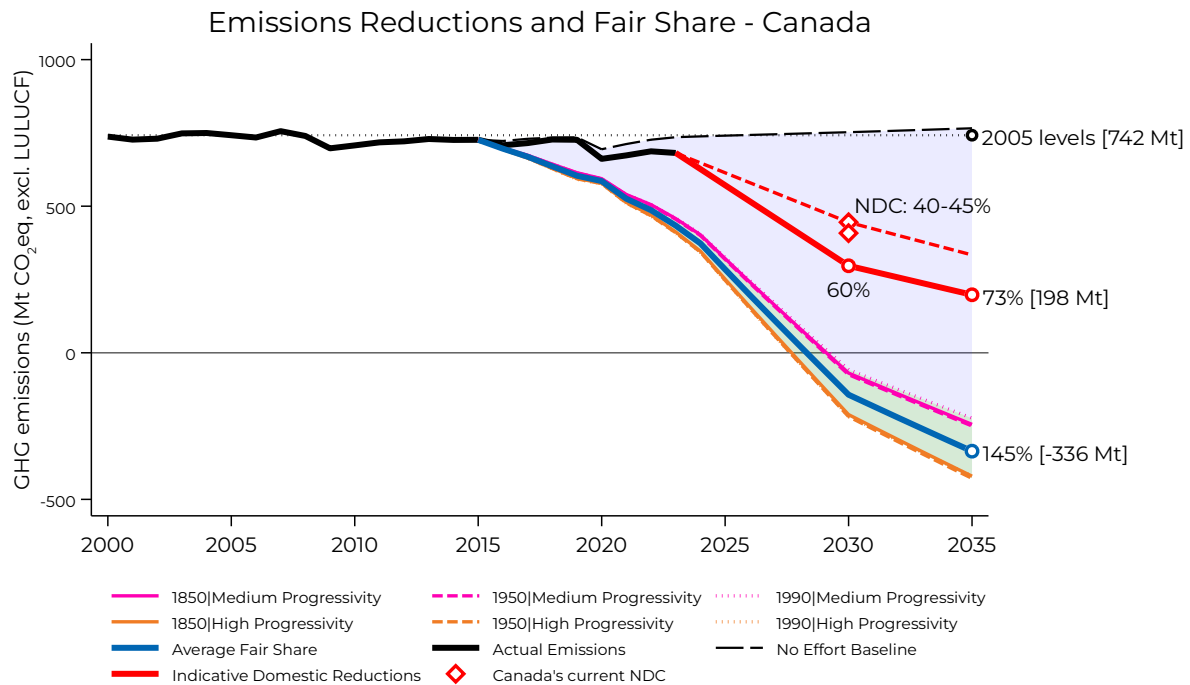


Figure 2: Canada's Fair Shares of the global mitigation effort implied by the LED global pathway. The pink lines reflect fair shares calculations using "medium progressivity" (\$7500 development threshold), the orange lines "high progressivity" (\$7500 development and \$50,000 second threshold); pink and brown lines are solid, dashed, or dotted for historical responsibility start dates of 1850, 1950, or 1990, respectively. The green shaded area shows the additional fair shares mitigation of the most stringent of these fair shares calculations relative to the least stringent ones. The solid blue line reflects the rounded average of the four of the fair shares calculations (calculations using the 1990 responsibility start date excluded from the average). The dashed red line shows a straight line from 2023 emissions levels to the lower end of Canada's 2030 NDC range (40% below 2005 levels) and from there a straight line to net zero emissions in 2050 – the legislated target for 2050. The solid red line shows a straight line from 2023 emissions levels to CAN-Rac Canada's position on domestic reductions by 2030 (60% below 2005) and then to net zero by 2045. Percentage figures express reductions relative to 2005 levels. Own calculations using the Climate Equity Reference Calculator (Holz et al. 2019; Kemp-Benedict et al. 2018).

3. Determine how much of Canada's fair share should be implemented via domestic emissions reductions measures

Recall from the previous section that the initial fair shares reduction calculation (145% below 2005 levels by 2035), as derived from ethical principles, is well in excess of 100%. This is a typical result for principle-based fair shares calculations for wealthy countries with a large share of the historical emissions like Canada (which is the 10th wealthiest countries in the world and top 9 emitter of greenhouse gases, despite being the home of only 0.5% of the world's population).

Obviously, it is *physically* impossible to implement this level of reduction, for all of which Canada is *morally* responsible, within Canada. This is because this fair share obligation exceeds any plausible interpretation of the total domestic mitigation potential within Canada. However, the reverse is the case for most developing countries: those countries' mitigation potential exceeds, often very substantially, the

amount of mitigation that can be fairly expected to be implemented by those countries. Nonetheless (and this is one of the fundamental, yet unavoidable, injustices of the current moment in the climate crisis), most of the mitigation potential of those countries needs to be implemented in order to avoid exceeding the 1.5 °C warming limitation objective. Since it would not be fair to expect those countries to implement that potential with their own, limited, resources, it is appropriate for wealthy countries like Canada to engage in international mitigation cooperation and support, e.g. via financing, capacity building, or transfer of technologies, to ensure the availability of resources required to implement the fraction of the mitigation potential of developing countries that exceeds those countries' own fair share obligation. It is through this international cooperation and, crucially, through climate finance, that Canada and other wealthy countries can discharge the fraction of their total fair shares contribution that exceeds their own domestic mitigation potential.

In order to be able to determine which fraction of the total fair shares reduction target, as derived from ethical principles, should be implemented through domestic mitigation and which fraction through international cooperation and support, an estimate of the domestic mitigation potential is required. For 2030, CAN-Rac and several of its members carried out a separate analysis of potential mitigation policies and measures that should be implemented in Canada and of the potential emissions reductions impact of these measures. This analysis concluded that sufficient mitigation potential exists to reduce emissions in Canada by at least 60 % below 2005 levels by 2030 while ensuring meaningful engagement of Indigenous People, promoting just transitions for workers and communities hitherto dependent on the fossil fuel industry or other carbon-intensive activities, and enhancing transparency and accountability for the overall mitigation programme carried out (CAN-Rac Canada et al. 2019, 2021; Sawyer and Melton 2021).

Starting from this pre-existing position for a 2030 domestic reduction target, CAN-Rac Canada members considered appropriate levels for a 2035 domestic reduction target. Absent present techno-economic modelling work for an ambitious 2035 reduction target for Canada, CAN-Rac Canada members resolved to utilize the analysis of the International Energy Agency (IEA 2023), whose Net Zero Emissions scenario sees “advanced economies take the lead and reach net zero emissions by around 2045,” highlighting “that all must act much more strongly than they are today.” This is more lenient guidance than that of the United Nations General Secretary’s Accelerated Action Agenda, which stipulates that “for a livable planet,” developed countries’ net zero dates should be brought forward to 2040 (UNSG 2023). A straight line from 60 % in 2030 (CAN-Rac’s pre-existing position supported by modelling results) and zero emissions in 2045 (the IEA’s Net Zero target for advanced economies) implies an 73 % reduction in 2035 as an intermediate point.

Thus, an 73 % reduction below 2005 levels is used here as the domestic portion of the overall fair share of Canada as previously calculated.

4. Determine the scale of Canada's post-Paris shortfall vis-à-vis its fair share and the implications of this shortfall

As mentioned previously, CAN-Rac Canada members determined in 2019 the fair share of Canada of a global 1.5 °C-consistent mitigation pathway through 2030 (CAN-Rac Canada 2019; Holz 2019), which was conceptualized as Canada's minimal mitigation contribution toward the internationally agreed goals of the Paris Agreement, which had been adopted in 2015, which Canada ratified in 2016, and which entered into force in 2016 (UN 2017).

CAN-Rac Canada's calculations of Canada's fair share of global Paris-Agreement-consistent mitigation through 2030 concluded that Canada would have to implement measures that would reach an equivalent of a 140 % reduction below 2005 levels by 2030, consisting of a 60 % domestic reduction and a further mitigation impact outside Canada equivalent to 80 % of Canada's 2005 levels through international cooperation, support, and Canada's climate finance.

However, in the years since the adoption of the Paris Agreement, Canada's action – both domestically and through international cooperation, support, and climate finance – has fallen short of this fair share.

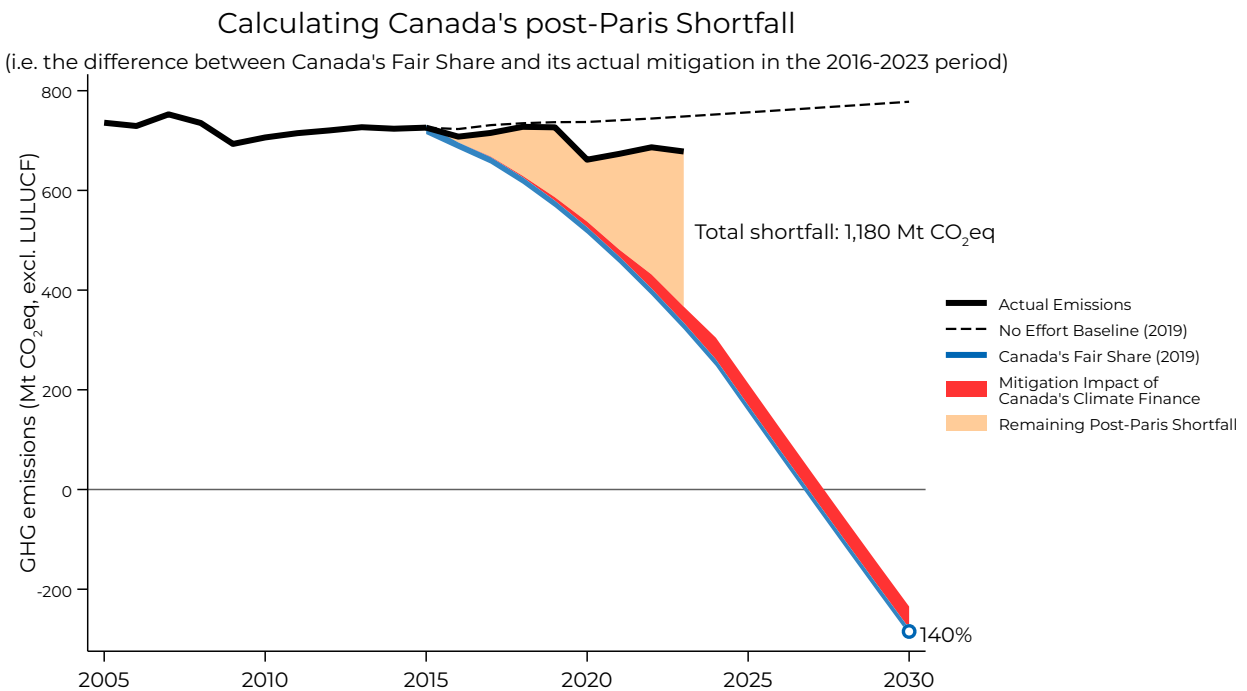


Figure 3: Canada's post-Paris climate action shortfall (orange shaded area), measured as the cumulative shortfall over the 2016-2023 period between Canada's actual GHG emissions (black line) and Canada's fair share of global 1.5 °C consistent mitigation as calculated by CAN-Rac Canada in 2019 (blue line). The shortfall calculations take into account an estimate of the mitigation impact of Canada's climate finance allocations (red shaded area, see methodology appendix for details). (AidWatch Canada 2024; Own calculations using CAN-Rac Canada 2019; ECCC 2023; GCF 2023; Gütschow et al. 2024)

Figure 3 above shows the scale of this shortfall. It utilizes Canada's National Emissions Inventory submitted to the UNFCCC for actual emissions for the period from 2016 to 2021 (via Gütschow et al. 2024) and extends this time series with Environment and Climate Change Canada projections for 2022 and 2023 (ECCC 2023). To estimate the amount of mitigation outside of Canada's border that resulted from Canada's climate finance disbursed for mitigation during the same period, data on these disbursements was obtained from Environment and Climate Change Canada's Climate Finance Announcements (via AidWatch Canada 2024).⁵ This disbursement data was then combined with information on the mitigation impact of the mitigation and cross-cutting activities funded by the Green Climate Fund between 2015 and 2023 (GCF 2023) to estimate the mitigation impact of Canada's mitigation finance. Further detail on the methodology is available in the appendix. Throughout these calculations, wherever assumptions needed to be chosen, the selected assumption err on the side of overestimating – rather than underestimating – the mitigation impact of Canada's climate finance, so the “real” mitigation impact is likely smaller, or even much smaller, than the number used here; and, therefore, Canada's remaining shortfall likely larger than shown here.

As Figure 3 shows, **Canada's post-Paris shortfall relative to its fair share amounts to a total of 1,180 Mt CO₂eq over the 2016-2023 period.** This is the amount of mitigation that Canada should have contributed toward the global effort, agreed in Paris and ratified by Canada, to limit global temperature increase to 1.5 °C, but which it has not yet contributed. In other words, this shortfall represents further excess emissions accumulation in the atmosphere that increases the amount of emissions that have to be reduced, avoided and/or removed in the future.

CAN-Rac Canada members therefore decided that the shortfall should be added to Canada's initial fair share going forward and applied it, in equal fractions, to each of the years between 2025 and 2035, splitting it between the domestic and international components of Canada's fair share in the same ratio that they had previously determined for Canada's 2030 fair share (i.e. a 60 % reduction below 2005 levels domestically, and an equivalent of an additional 80 % reduction through international cooperation, support and climate finance).

It's worth noting that this approach still ignores the substantial shortfall that Canada has accumulated vis-à-vis what would have been its fair share prior to the adoption of the Paris Agreement (see, for example, Athanasiou et al. 2009) or even merely the prior climate commitments that Canada had officially adopted, such as the target of the 1988 Toronto Climate Conference, of the UNFCCC itself, Canada's Kyoto Protocol target, and the target Canada submitted under the Copenhagen Accord/Cancun Agreement – all of which fell short of Canada's fair share and all of which Canada nevertheless missed by a wide margin.

⁵ Further detail, including estimates of annual breakdowns of disbursements, were provided by AidWatch Canada's Brian Tomlinson through private communication. The author is grateful for this assistance.

Figure 4 and Table 2 below show the results of adjusting the initially determined total fair share and domestic targets (Figure 2) by applying the post-Paris shortfall: **The shortfall-adjusted domestic emissions reduction target for 2035 is 80 % below 2005 levels, while Canada’s adjusted total fair share of a global 1.5 °C-consistent mitigation effort is equivalent to a 160 % reduction below 2005 levels by 2035.**

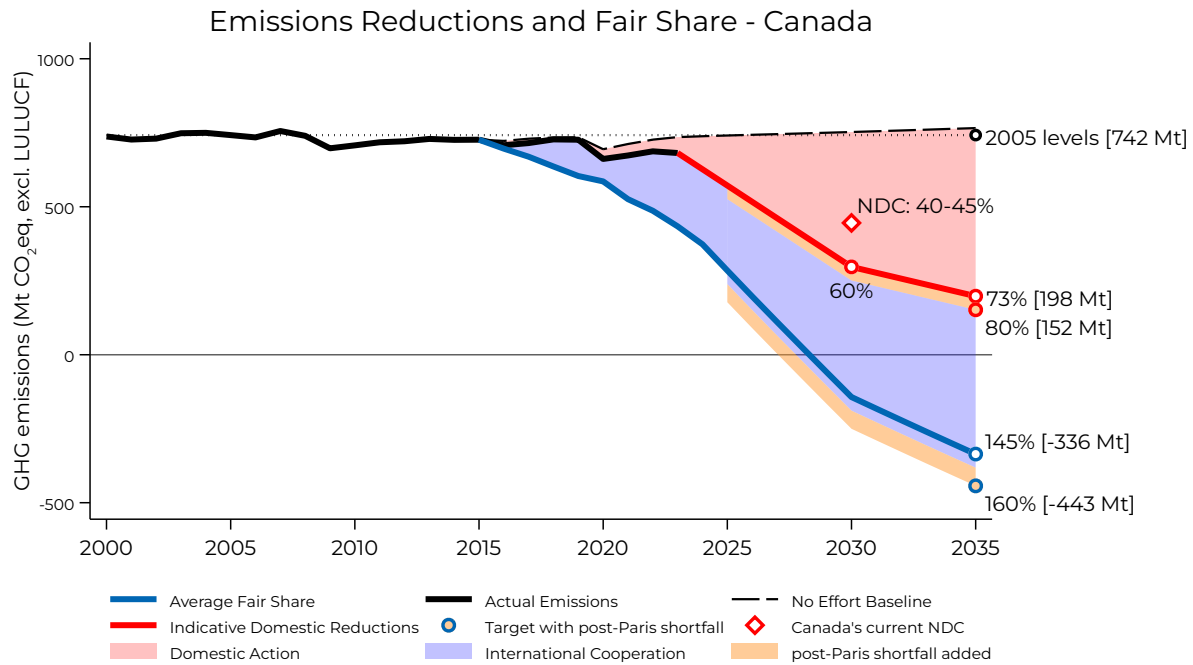


Figure 4: Canada’s Fair Share of global 1.5 °C-consistent mitigation, accounting for its post-Paris shortfall. Chart shows the initial average fair share (from Figure 2, blue line and marker) and indicative domestic portion (red line and marker), as well as the post-Paris shortfall portions as applied to both during the 2025-2035 period (orange shaded areas), with the resulting shortfall-adjusted 2035 total fair share target (blue marker with orange filling) and adjusted domestic target for 2035 (red marker with orange filling)

Canada's Fair Share and its Decomposition (MtCO₂eq)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Initial Fair Share Reduction below baseline, of which ...	456.1	545.9	634.4	721.9	808.9	895.4	937.2	978.8	1,020.0	1,060.9	1,101.5
... Domestic Mitigation (73% below 2005)	169.1	226.4	283.7	341.0	398.3	455.7	478.1	500.6	523.0	545.5	568.0
... International Obligation (remainder)	287.1	319.5	350.7	380.9	410.6	439.7	459.1	478.2	497.0	515.4	533.5
Post-Paris Shortfall applied ...	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3
... to Domestic Mitigation	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
... to International Obligation (remainder)	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Total Fair Share Reduction below baseline, of which ...	563.4	653.2	741.7	829.2	916.2	1,002.7	1,044.5	1,086.1	1,127.3	1,168.2	1,208.8
... Domestic Mitigation	215.0	272.4	329.7	387.0	444.3	501.6	524.1	546.5	569.0	591.5	614.0
... International Obligation (remainder)	348.4	380.8	412.0	442.2	471.9	501.0	520.5	539.5	558.3	576.7	594.9
Resulting Fair Share "target" levels	177.3	89.9	3.8	-81.5	-166.1	-250.2	-289.4	-328.3	-366.9	-405.1	-443.0

Table 2: Canada's total fair share and its decomposition into domestic and international components, with post-Paris shortfall applied.

5. Consider the implications for international cooperation and support of the fair shares results

Having established the total fair share for Canada of a global 1.5 °C-consistent mitigation effort through 2035, and having also established the portion of this fair share that should be implemented through domestic emissions reductions, it follows that the gap between these two metrics determines the scale of mitigation effort that Canada is responsible to enabling in other countries. Specifically, considering the percentage reduction figures for 2035, there is a gap of 80 percentage points between the domestic target (80 %, if adjusted for the post-Paris shortfall) and the total fair share (160 %) – this is the “international portion” of Canada’s total mitigation fair share.

It is important to note that the scale of the “international portion,” if expressed in percentages or megatons of emissions reductions, is roughly the same in size as the “domestic portion.” This is notable because, while currently still insufficient, a substantial amount of effort, by Canadian governments of all levels, by organizations, by businesses, industry, and by residents is targeting the domestic portion, while the international portion does not receive a level of attention and effort that is even close-in-scale to what is done domestically. This is a glaring disconnect.

In practice, while other channels and modes of cooperation and support are available and should be pursued and explored (for much more detail, see Civil Society Equity Review 2022), most of the international portion of Canada’s total mitigation fair share would likely have to be implemented through international climate finance. It is therefore useful to calculate the amount of international climate finance that would

be required to make an international mitigation contribution at the scale that Canada’s fair share would require.

In order to generate such an estimate, the Scenario Databases of the IPCC provide a useful source of data. Here, for convenience, the Scenario Database of the IPCC Special Report on 1.5 °C (Huppmann et al. 2018) has been used, but utilizing the more recent scenario database of the IPCC’s Sixth Assessment Report (Byers et al. 2022) would not yield substantially different results.

Table 3 below shows the mitigation costs, outside the developed countries of the OECD90 – which is where the international mitigation finance would be directed – in 2030 as extracted from the IPCC SR1.5 Scenario Database. These costs are in United States dollars per ton of mitigation and, importantly, consider mitigation ambition in line with the emissions pathways of each of the underlying scenarios, which in most cases are less ambitious, especially in the near-term, as the LED pathways utilized in the present fair shares analysis. Thus, it stands to reason that mitigation costs under the LED scenario would be higher than the values reported here; unfortunately, the LED scenario does not itself provide cost estimate data.

	minimum	first quartile	median	third quartile	maximum	N
\$/ton	46.36	69.73	92.58	109.58	243.57	19

Table 3: Average mitigation costs outside OECD90 in 2030, in USD dollars per ton. Source: IPCC Special Report on 1.5 °C scenario database (Huppmann et al. 2018); all 1.5 °C scenarios with cost information for 2030, N=19

Many of the scenarios in the IPCC Scenario Databases only report results in decadal time steps, though for this analysis, information for 2025 and 2035 is also required. This reduces the set of relevant scenarios substantially, but comparing the 2030 figures for this subset of scenarios (Table 4 below), especially the median, with the larger set in Table 3 shows very similar results.

	minimum	first quartile	median	third quartile	maximum	N
2025	46.42	51.66	53.99	55.50	56.69	8
2030	82.03	91.64	92.95	94.34	99.24	8
2035	98.23	103.98	107.32	112.46	117.04	8

Table 4: Average mitigation costs outside OECD90 in 2025, 2030, and 2035, in USD dollars per ton. Source: IPCC Special Report on 1.5 °C scenario database (Huppmann et al. 2018); all 1.5 °C scenarios where cost information is available in 5 year intervals and for which the Scenario Database has corresponding baseline scenarios, N=8

For the following calculations, the median costs shown in Table 4 above are then linearly interpolated between 2025 and 2030, as well as 2030 and 2035, respectively, to obtain annual mitigation cost values for every year of the 2025-2035 period. This time

series of annual mitigation costs outside the OECD90 can then be applied to the size of the international component of Canada’s mitigation fair share for the same year (taken from the second-to-last row of Table 2 above) to calculate the level of mitigation climate finance that Canada would need to provide to enable the level of mitigation outside its borders that these fair share calculations imply. Table 5 and Table 6 below shows the results of this calculation.

Importantly, besides its fair share of global mitigation, Canada also has a legal and moral obligation to contribute to international climate finance for adaptation, loss and damage and other purposes. The calculations here only consider the climate finance for mitigation – the scale of Canada’s climate finance for adaptation, loss and damage, etc. would have to be determined separately and would be additional to the figures calculated here.

Canada International Mitigation Obligation (median)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2025-35 total
USD billion	18.8	23.5	28.7	34.2	40.2	46.6	49.9	53.2	56.7	60.2	63.8	475.9
CAD billion	25.4	31.8	38.7	46.2	54.2	62.9	67.3	71.9	76.5	81.3	86.2	642.3

Table 5: Climate Finance Implications of the international portion of Canada’s mitigation fair share, for each year 2025-2035 and total, in billion USD and CAD per year. Bank of Canada average exchange rate for 2023 applied.

Canada International Mitigation Obligation (median figures)	billion USD	billion CAD
Total 2025-2030	192.0	259.1
Total 2031-2035	283.9	383.2
Total 2025-2035	475.9	642.3
Per year in 2025	18.8	25.4
Per year average 2025-2035	43.3	58.4
Per year in 2035	63.8	86.2

Table 6: Summary of Climate Finance Implications of the international portion of Canada’s mitigation fair share.

The results above show that the scale of the international component of Canada’s total mitigation fair share implies initially, **in 2025, an annual climate finance contribution of USD \$ 19 billion (CAD \$ 25bn). This amount increases to USD \$ 64 billion (CAD \$ 86 bn) per year by 2035, both due to the increase in per-ton mitigation costs in developing countries as well as in the size of the international component of Canada’s mitigation fair share. The total amount over the eleven years between 2025 and 2035 is USD \$ 476 billion (CAD \$ 642bn), averaging USD \$ 43 billion (CAD \$ 58 bn) per year over this period.**

Importantly, when disbursing international climate finance, donor countries like Canada typically assume co-financing of the projects, programmes and measures

they finance from other sources of financing, including the private sector, other donors, or public funds from the host countries. Such co-financing can reach ratios of 1:3, as is the case for the mitigation and cross-cutting funded activities of the Green Climate Fund's portfolio (GCF 2023, also see appendix), but is often lower or much lower – for example, OECD countries' reporting on their progress to reach their USD \$100 billion per year commitment claims to leverage private co-finance at a 5:1 ratio within all of their climate finance “provided and mobilized” (OECD 2023). Given this potential leveraging of co-finance, it would be argued that lower amounts of climate finance than those calculated above be sufficient to “provide and mobilize” the total amount. However, considering that the sources of such co-finance would presumably also want to claim an appropriate fraction of the “credit” for the mitigation impact of their financing, this would not indeed lead to a lower amount for Canada's total mitigation finance, as the (identical) factors applied to the financing (leverage ratio) and the claiming of the mitigation impact would cancel each other out.

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Appendix – Calculating Annual Mitigation Impact of the Green Climate Fund’s Project Portfolio

Information about the potential mitigation impact of Canada’s climate finance in the post-Paris period (2016-2023) is not directly available from Environment and Climate Change Canada, nor is this information consistently reported in climate finance project descriptions. However, this information is needed to accurately reflect the post-Paris shortfall between Canada’s actual mitigation impact (defined as the sum of domestic mitigation and the overseas mitigation impact of Canada’s climate finance) and what its fair share for that period would have been.

To estimate the potential mitigation impact of Canada’s climate finance, two elements are needed: 1) an estimate for mitigation impacts of climate finance more generally, and 2) data on the disbursement, or, alternatively, approval of Canada’s climate finance over time.

Approval Year	GCF Board Meetings	Projects (Mitigation or xcutting)	GCF Financing (USD million)	Co-Financing (USD million)	Total Financing (USD million)	Mitigation (MtCO ₂ eq)
2015	B.11	2	31.2	87.9	119.1	4.1
2016	B.12-B.15	13	812.4	1,880.0	2,690.0	112.9
2017	B.16-B.18	8	450.2	1,840.0	2,290.0	81.4
2018	B.19-B.21	25	1,580.0	4,170.0	5,740.0	379.5
2019	B.22-B.24	17	800.0	3,030.0	3,830.0	195.9
2020	B.25-B.27	26	1,740.0	2,470.0	4,210.0	385.3
2021	B.28-B.30	17	2,180.0	10,490.0	12,670.0	1,050.0
2022	B.31-B.34	16	1,380.0	4,340.0	5,720.0	170.2
2023	B.35-B.37	15	1,060.0	4,300.0	5,350.0	567.0
TOTAL			10,033.8	32,607.9	42,619.1	2,946.3

Table 7: Extracted from Green Climate Fund Open Data Library. Funded Activities Database. Accessed 2024-03-08. (GCF 2023). Approach: Filtered "Funded Activities" database by theme ("mitigation" or "cross-cutting") and board meeting, then copied summary dashboard details of filtered activities.

For the first element, we can turn to the Green Climate Fund’s (GCF) Project Portfolio (GCFPP). Currently (March 2024), the GCFPP reports a climate impact of 2.9 GtCO₂eq with a total portfolio value of USD \$13.9 billion (of which, upon further investigation, USD \$10 billion is for mitigation and “cross-cutting” projects, see Table 7). The mitigation impact of the GCFPP is cumulative over a long time horizon, so to estimate annual impacts, this cumulative figure has to be broken down in annual amounts. Unfortunately, no default project duration for the calculation of mitigation impact applies to all GCFPP project and, indeed, not all project summary descriptions include information about the duration. Among the project summary descriptions consulted, durations of 5, 7, 10, 15 and 21 years were reported, with longer time scales usually

applying for larger, infrastructure-type projects. For the purpose of this analysis, a weighted average value of 15 years has been assumed for the entire project portfolio. Further it is assumed that the mitigation impact is equally distributed over the project period, even though other “shapes” of the mitigation-impact-over-time curve are imaginable.⁶

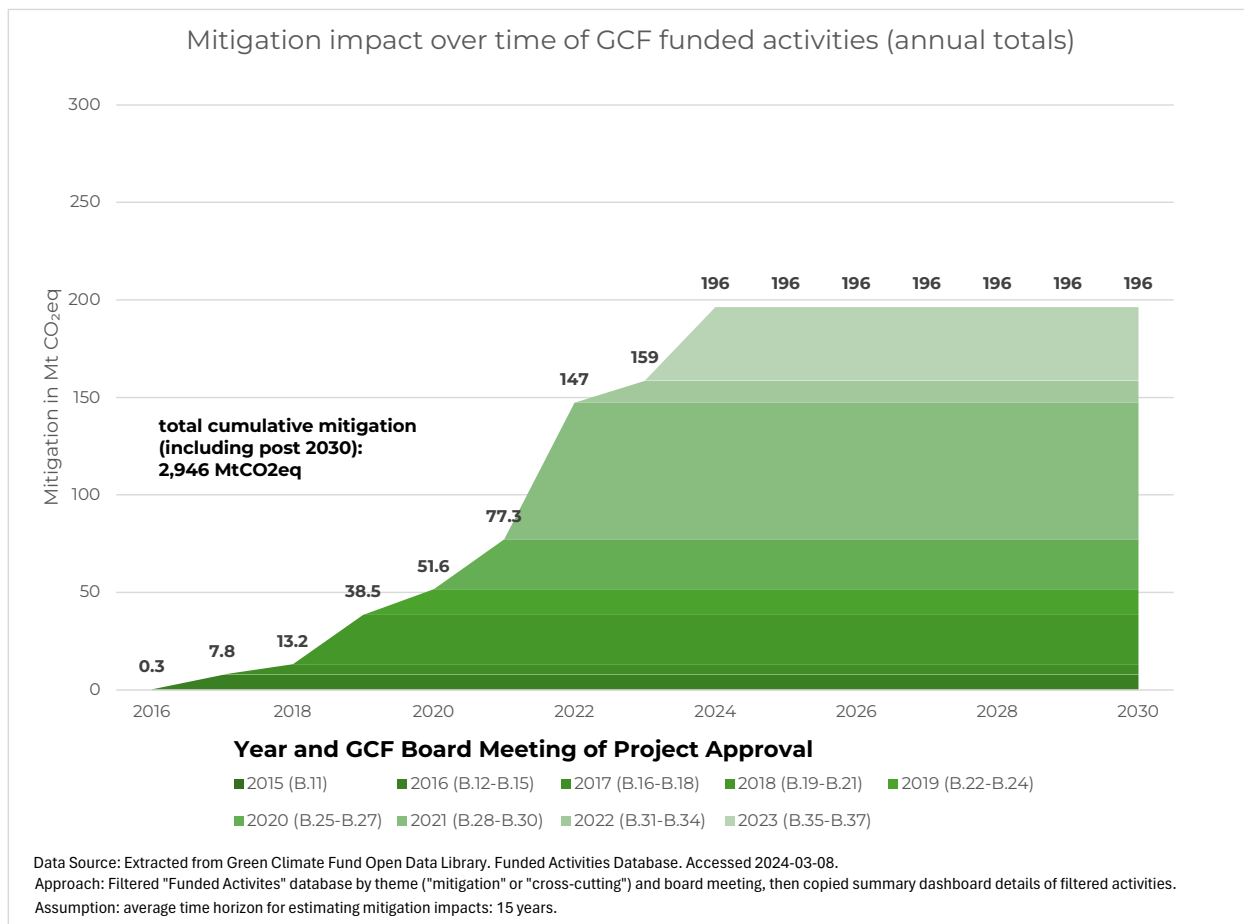


Figure 5: Estimating the Mitigation impact over time of GCF projects approved in a given year. Extracted from Green Climate Fund Open Data Library. Funded Activities Database. Accessed 2024-03-08. (GCF 2023). Approach: Filtered "Funded Activities" database by theme ("mitigation" or "cross-cutting") and board meeting, then copied summary dashboard details of filtered activities. Assumption: weighted average time horizon for estimating mitigation impact for the activities in the portfolio dashboard is 15 years.

From the GCF Open Data Library (ODL), the Funded Activities Database was consulted. The database was filtered for projects with mitigation or cross-cutting

⁶ E.g. for a PV solar project, panel efficiency, and this output, will decrease over time, leading to a curve with a negative slope. On the other hand, a project adopting LED for energy efficiency in lighting would be expected to have roughly constant impact over the lifetime of the lights. Finally, a Bus Rapid Transit or other local transit project to encourage mode switching, could have a growth-platau-decline curve, as individuals gradually change habits and take up transit ridership, plateau at a maximum level of conversion, and then decline as the GHG efficiency of the private motor vehicle fleet in the baseline scenario improves over time, resulting in less emission to be replaced.

main theme, and further filtered by GCF board meeting, as proxy for the year in which a project was approved by the GCF board. The ODL interface outputs a list of projects and summary statistics for funding amounts and mitigation impact for the filtered activities, which allows a time series of cumulative mitigation impact by year of GCF approval to be generated. Table 7 shows this time series.

Based on this time series, and the assumptions introduced earlier (constant distribution of mitigation impact over 15 years), the mitigation impact of each approval-year slice of the GCFPP can be calculated.⁷ Figure 5 shows the results of this calculation with each approval-year slice being represented by a different colour and the total amount of mitigation impact of for each year across all slices reported in the bold numbers on top of the top slice. The resulting annual time series of the GCFPP's mitigation impact is what is used in the following as an estimate for the mitigation impact of international climate finance more generally.

In a second step, the results from the analysis of the GCFPP are then applied to Canada's climate finance disbursements. Unfortunately, data on Canada's climate finance disbursements is not directly available and is highly variable depending on the nature of the finance activities and the channel of disbursement – e.g. bilateral funding arrangements can have much faster disbursement than funding disbursed via multilateral development banks, the latter being the preferred distribution mechanism for Canadian climate finance (AidWatch Canada 2024).⁸ In the absence of such information, for simplicity, climate finance is assumed to be disbursed in the year it was approved. This assumption is also made to err on the side of over-estimating, rather than under-estimating the mitigation impact of Canada's climate finance in the post-Paris (2016-2023) period, which consequently means erring on the side of under- rather than over-estimating Canada's post-Paris shortfall. In other words, with more robust availability of data, the estimate of the mitigation impact of Canada's climate finance during this period would most likely be smaller and, thus, the shortfall larger.

Table 8 shows the approval, and thus assumed disbursement, of Canada's climate finance since 2015 for the principal purpose "mitigation." This assumed disbursement schedule is then applied to the mitigation impact of the GCFPP for the same period, to obtain the time series of the mitigation impact, over time, of Canada's climate finance, as shown in Figure 6.

⁷ Obviously, the year in which an activity is approved for funding by the GCF board is almost never the year in which mitigation impacts start to occur due to the time it takes to actually disburse approved finance, get project implementation underway and, finally, for project implementation to be advanced enough to have mitigation impacts. However, since this delay is very project-specific and no information about its length available, for this analysis, this aspect was ignored in the interest of simplicity. Overall, this does not impact the total scale of the mitigation impact estimate, only its timing as this approach overestimates the impact at the beginning of the project period and underestimates it later by the same amount.

⁸ This section relies heavily on information and analysis provided by AidWatch Canada, including private communication with AidWatch's Brian Tomlinson, whose generous assistance is gratefully acknowledged.

(\$ million)	CAD	FX Rate*	USD
2015/2016	163.4	1.2986	125.8
2016/2017	172.5	1.2986	132.8
2017/2018	331.3	1.2957	255.7
2018/2019	351.1	1.3269	264.6
2019/2020	250.2	1.3415	186.5
2020/2021	557.9	1.2535	445.1
2021/2022	634.3	1.3013	487.4
2022/2023	431.2	1.3497	319.5

Table 8: Canada Climate Finance Disbursed for Principal Purpose "Mitigation," in million dollars. FX Rate applied is Bank of Canada average USD-CAD exchange rate for the year, which was unavailable for 2016; the 2017 rate was used for 2016. Source: Environment and Climate Change Canada's Climate Finance Announcements (via AidWatch Canada 2024, and private communication Brian Tomlinson).

As described in the main text, this amount is likely an overestimation of the mitigation impact of Canada's climate finance for several reasons. First, the leverage ratio of co-finance (roughly 1:3 – see columns "GCF Financing" and "Co-Financing" in Table 7) for the GCFPP is higher than what OCED countries report for the climate finance they "provided and mobilized" under their annual \$100 billion commitment under the UNFCCC (OECD 2023), thus, assuming that Canada's climate finance matches the GCFPP's performance in terms of mitigation impact, is likely an overestimation. Second, as described in the main text, to the degree that activities attract co-finance, to avoid double counting, arguably, the "credit" for the total mitigation impact of the activity would be distributed among all sources of finance, for example, proportional to the amount of finance provided by each source. In this estimate of the GCFPP's impact, all the mitigation impact is "credited" to the GCF contribution. In applying this figure to the Canadian mitigation finance disbursements, the same assumption is implicitly applied to Canada's climate finance. In all these cases, simplified assumptions have been made to err on the side of overestimating the mitigation impact of Canada's climate finance, in order to derive the most conservative estimate of Canada's post-Paris shortfall.

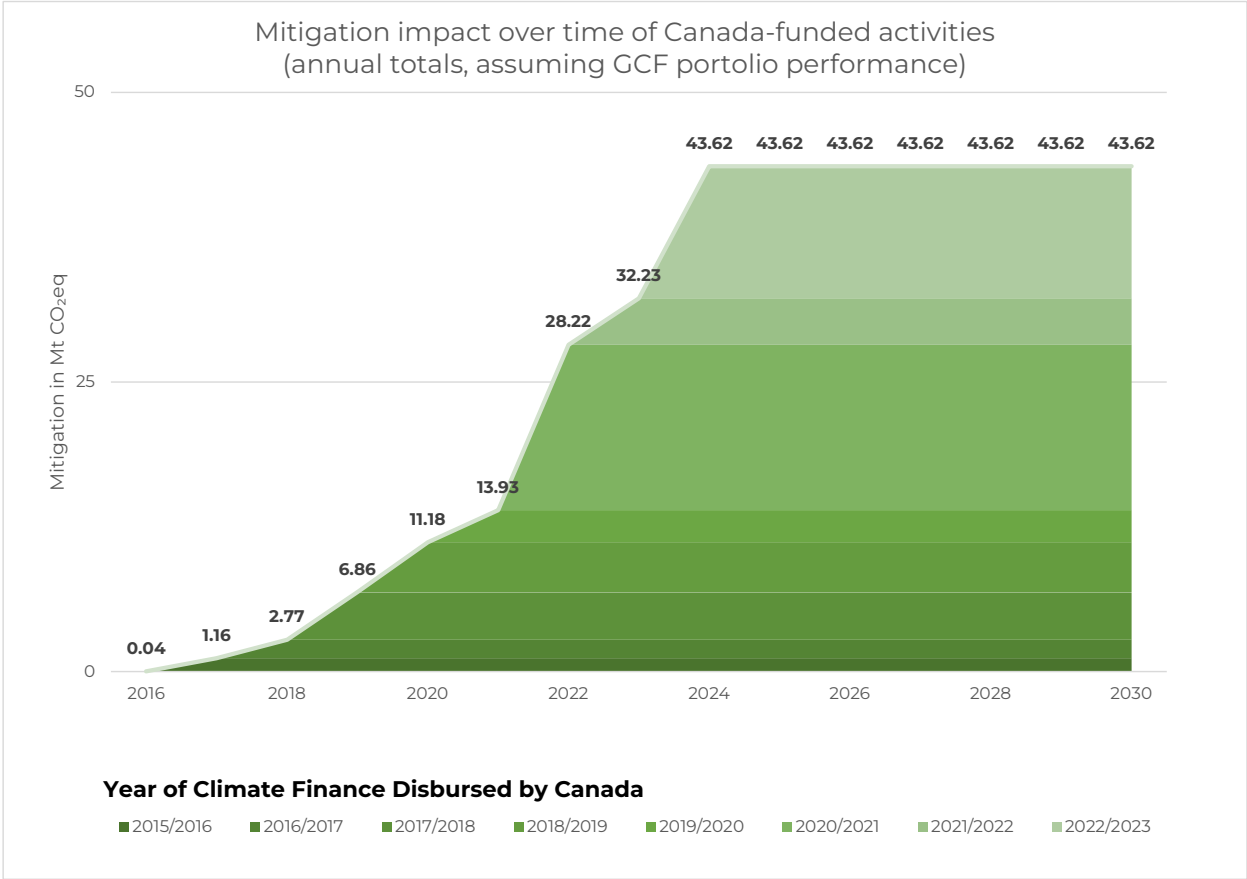


Figure 6: Estimating the Mitigation impact over time of Canada's climate finance for mitigation, assuming mitigation impact performance equal to the GCF activities portfolio as estimated.