

Montreal's emissions targets for 1.5°C and 2°C global warming

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The Paris climate agreement has left the world with a significant challenge: to limit global temperature increases to not more than 2°C above pre-industrial levels, and to pursue efforts to limit global temperature increases to 1.5°C. This is an extremely ambitious global target that will require rapid and sustained emissions cuts from all countries and economic sectors over the coming decades, and will ultimately require a complete decarbonization of the world economy by within about the next half century^{1,2}.

Against the backdrop of this global challenge, it is critical that Montreal's efforts to mitigate greenhouse gas emissions over the coming decades are consistent with the global effort to meet the agreed international climate target. In this memorandum, I will outline the allowable global emissions that are consistent with climate targets of 1.5 – 2 °C, and show how this global carbon budget can inform Montreal's own emissions targets. I will focus in particular on emissions of carbon dioxide (CO₂), as the single most important greenhouse gas, and also the greenhouse gas for which there is the clearest scientific understanding of allowable global emissions.

Allowable global emissions for 2 °C and 1.5°C

It is now well established in the scientific literature that it is possible to define a global carbon budget, which represents the total amount of CO₂ emissions that are compatible with a given temperature target^{3,4}. The idea of a finite amount of allowable emissions over time requires that global CO₂ emissions must at some point reach zero; in other words, stabilizing global temperatures at 1.5°C, 2°C or any other level is only consistent with the eventual elimination of CO₂ emissions from fossil fuel combustion¹.

The global carbon budget consistent with a likely (67%) chance of staying below the 2°C temperature target is 3200 billion tonnes of CO₂ (Gt CO₂) in total allowable emissions from 1870 onwards⁵. If we adopt a lower likelihood threshold (50% chance of staying below 2°C), the global carbon budget increases to 3500 billion tonnes. While there have not been many published estimates of the global carbon budget for a 1.5°C climate target, the first-order expectation is that the carbon budget for 1.5°C would be 3/4 of the 2°C budget. This suggests a 1.5°C budget in the range of 2400 (67% likelihood) to 2625 (50% likelihood) Gt CO₂.

Of this total budget, we have already emitted 2050 Gt CO₂ between 1870 and 2015, a total which is currently increasing at a rate of 36 billion tonnes per year^{5,6}. The remaining global

carbon budget is therefore 1150 – 1450 Gt CO₂ from 2016 onwards for 2°C, and 350 – 575 Gt CO₂ for a 1.5°C climate target.

Montreal's share of the global carbon budget.

How to share the global carbon budget among countries is one of the most intractable challenges of current international negotiations. Several methods have been proposed in the scientific literature, which usually represent some compromise between the distribution of current emissions among countries (which favours high-emitting countries), and national shares of world population (which favours countries with large current populations)^{2,4}. Using an equal weighting of current emissions and current population, Raupach et al (2014) estimated Canada's share as 1.1% the global carbon budget. Based on a global budget of 1150 – 1450 Gt CO₂ for the 2°C target, Raupach et al.'s allocation method would mean that Canada's total allowable emissions are 12.65 – 15.95 billion tonnes of CO₂. For the 1.5°C target, Canada's allowable emissions are only 3.85 – 6.3 billion tonnes of CO₂.

This national budget could similarly be allocated to individual cities based on either current shares of national emissions, or on an equal per-capita basis. Current emissions from the island of Montreal are on the order of 2% of Canada's annual greenhouse gas emissions, whereas Montreal is home to 5% of Canada's population. This implies a potential share of Canada's overall carbon budget of 2 to 5%; as with the national allocation used above, an equal weighting of these two criteria would imply a 3.5% share of Canada's carbon budget allocated to Montreal. Montreal's allowable carbon budget for the 2°C climate target is therefore 3.5% Canada's budget: 440 – 560 million tonnes of CO₂ emissions for the 2°C target, and 135 – 220 million tonnes for 1.5°C.

Ambitious climate goals require ambitious emission targets

Canada has fully supported the Paris climate agreement, though has yet to announce specific emission targets. A clear outcome of the Paris climate talks was that the current suite of national emissions pledges will not be sufficient to meet the 2°C, let alone the 1.5°C climate target; most estimates suggest that this level of ambition would instead lead to warming of about 2.7 °C before end of the century (climateactiontracker.org). As a leading voice supporting an ambitious climate target in the Paris talks, and the 1.5 °C climate target in particular, the onus is now on Canadians to come forth with emission pledges that are consistent with the level of ambition of the Paris agreement.

The Montreal Climate Coalition has proposed that Montreal set a target of net-zero CO₂ emissions by our 400th anniversary in 2042. If Montreal were to meet this target (assuming a linear decrease from current emissions of 14 million tonnes CO₂ per year to net-zero at 2042), this would result in total emissions from Montreal of 190 million tonnes CO₂ between 2016 and 2042. This emission target would therefore be consistent with a global

effort to limit temperature increases to 1.5 °C above pre-industrial temperatures. As stated by the Paris climate agreement, the 1.5 °C climate target would “significantly reduce the risks and impacts of climate change,” many of which would be very severe at 2°C of global warming. Montreal therefore has an opportunity in adopting this emissions target, to lend our support to a growing global movement to adopt high-ambition climate targets so as to ensure that global climate changes do not exceed dangerous climate thresholds over the coming century.

References

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