2.7 INTRODUCTION TO CLIMATE CHANGE

Remaining global carbon budget and global climate targets

Important notice
This unit is part of a package of learning materials designed to support understanding of foundational concepts relating to climate-related financial disclosures. These learning materials do not constitute application or regulatory guidance for the preparation of climate-related financial disclosures and are not intended to represent legal or professional advice. We encourage you to seek your own professional advice to find out how the Corporations Act 2001 (Corporations Act) and other relevant laws may apply to you and your circumstances, as it is your responsibility to determine your obligations and comply with them.

Key topics

- Remaining carbon budget
- The emissions gap

Relevance for climate-related disclosures

The longer it takes for annual global greenhouse gas emissions to start to decline, the steeper future reductions will need to be to limit global temperature increases. This creates higher levels of transition risk and may impact on an entity's climate-related risks and opportunities. It also increases climate-related physical risk, because temperatures will continue to rise so long as global greenhouse gas emissions continue to rise. Understanding the implications of the speed of global decarbonisation is important for understanding climate-related risks and opportunities.

In this unit, you will learn how the remaining global carbon budget is being used up too quickly, increasing the chances of dangerous levels of global warming. Every degree of warming above 1.5°C increases the risk of significant physical impacts of climate change, increasing entities' exposure to physical climate risks. In Module 2, Unit 6 you will find an explanation of the global carbon budget and how it relates to historical and current greenhouse gas emissions. Module 2, Unit 4 provides information on the Paris Agreement. This unit explores the remaining global carbon budget in more detail and how this relates to the Paris Agreement goal.

Overview

Remaining carbon budgets show the remaining volume of carbon dioxide (**CO_2**) that can be emitted from human activities, while limiting the overall temperature increase (from historical and future greenhouse gas emissions) to a specific level with a given likelihood. It refers to CO_2 emissions while accounting for the global warming effect of non-CO_2 emissions.

The remaining carbon budget reduces until we reach net zero CO_2 emissions (that is when CO_2 emissions to Earth's atmosphere from human activities are balanced by emissions removals from Earth's atmosphere from human activities over a specified period). A recent estimate is that to have a 50% chance of limiting global warming to 1.5°C, the remaining carbon budget is only 200 gigatonnes of carbon dioxide ($GtCO_2$).[1]

The **emissions gap** is the difference between how much countries have collectively *committed* to reducing their greenhouse gas emissions by, and how much they *need* to reduce to achieve the Paris Agreement temperature goal.

On some current projections, there is a 66% chance of global average temperature rise in the range of 2.6-2.8°C (best estimate) by the end of the century.[1],[2]

What is the remaining global carbon budget?

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) estimated that:

- Historical cumulative carbon dioxide (CO2) emissions from 1850 to 2019 were approximately 2390 gigatonnes of carbon dioxide (GtCO2). These cumulative emissions have contributed to global warming.
- From the pre-industrial era (around 1850) to 2019, the human-caused global surface temperature increase is approximately 1.07°C.[3]

In AR6, the IPCC also estimated remaining carbon budgets from the beginning of 2020, based on CO_2 emissions to date and the level of warming they cause. The carbon budget refers to CO_2 emissions while accounting for the global warming effect of non-CO_2 emissions.
The remaining carbon budgets show the volume of CO_2 that can still be emitted from human activities from 2020, to limit overall temperature increases (from historical and future emissions) to a specific level with a given likelihood.

Remaining carbon budgets for the Paris Agreement goal

The IPCC's AR6 provided estimated carbon budgets for 1.5°C, 1.7°C and 2°C of warming above pre-industrial levels. Figure 1 shows the carbon budgets for 1.5°C and 2°C of warming. Under the Paris Agreement, all countries must strive to limit warming to 1.5°C.

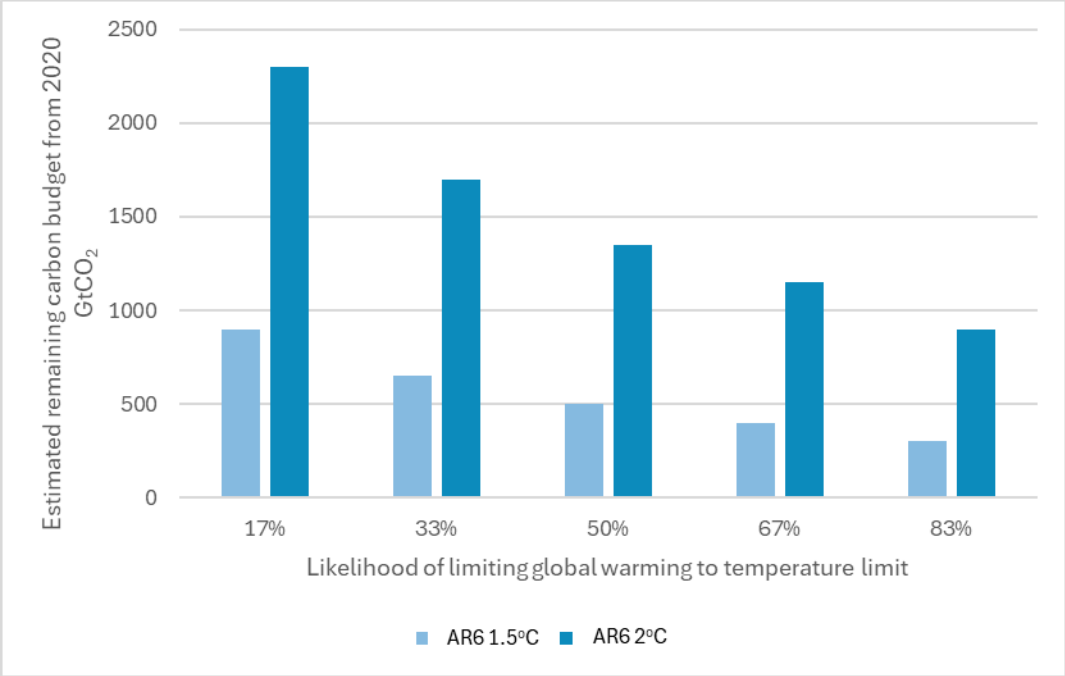

Figure 1: Estimated remaining carbon budget from 2020 to limit global warming to 1.5°C or 2°C above pre-industrial temperatures for given likelihoods[4]

What the budgets show is that, for example, to have a 50% chance of limiting global warming to 1.5°C above pre-industrial levels, the remaining net cumulative global carbon budget from 2020 is estimated to be 500 $GtCO_2$.

Put another way, if global net cumulative CO_2 emissions from human activities from 2020 exceed 500 $GtCO_2$ before net zero annual emissions are achieved, there will be a more than 50% likelihood that the global temperature increase will overshoot the 1.5°C Paris Agreement goal. To avoid overshooting the Paris Agreement temperature goal, annual global greenhouse gas emissions need to rapidly decline to net zero.

The emissions gap

Countries have committed to reduce their greenhouse gas emissions in their **Nationally Determined Contributions (NDCs).** By 2030, the emissions reductions expected from unconditional and conditional NDCs compared to 2019, are 4% and 10% respectively. For further details about NDCs, refer to Module 2, Unit 4.

According to the 2024 Emissions Gap report from the United Nations Environment Programme (**UNEP**), to limit temperature increases:

- by 2030, global greenhouse gas emissions must fall by 28% and 42% compared to 2019 for 2°C and 1.5°C respectively
- by 2035, global greenhouse gas emissions must fall by 37% and 57% compared to 2019 for 2°C and 1.5°C respectively.

The expected emissions reductions from NDCs are much less than required. This difference between the greenhouse gas emissions reductions needed to limit global warming, and the expected emissions reductions under each country's NDC is known as the emissions gap.

To be on track to achieve the Paris Agreement goal of limiting warming to 1.5°C, starting from 2024, global emissions would need to decrease annually at a rate of 7.5% until 2035. If NDCs are not strengthened until 2030, the annual rate of emissions reductions between 2030-2035 would need to double.[5]

What recent data shows

Recent data shows that annual emissions from fossil fuels like coal, oil and gas are still increasing. Between 2022-2023, total annual global greenhouse gas emissions increased by 1.3% to 57.1 $GtCO_2$-e. Emissions from fossil fuels were around 2% higher than in 2022 at 39 $GtCO_2$-e.[6]
As global emissions have continued to rise since the carbon budgets were calculated in AR6, the remaining carbon budget has reduced. Figure 2 shows the carbon budgets estimated in AR6 compared with the budgets estimated in 2024 to have a >66% chance of limiting warming to 2°C and a >50% chance of limiting warming to 1.5°C above pre-industrial levels.

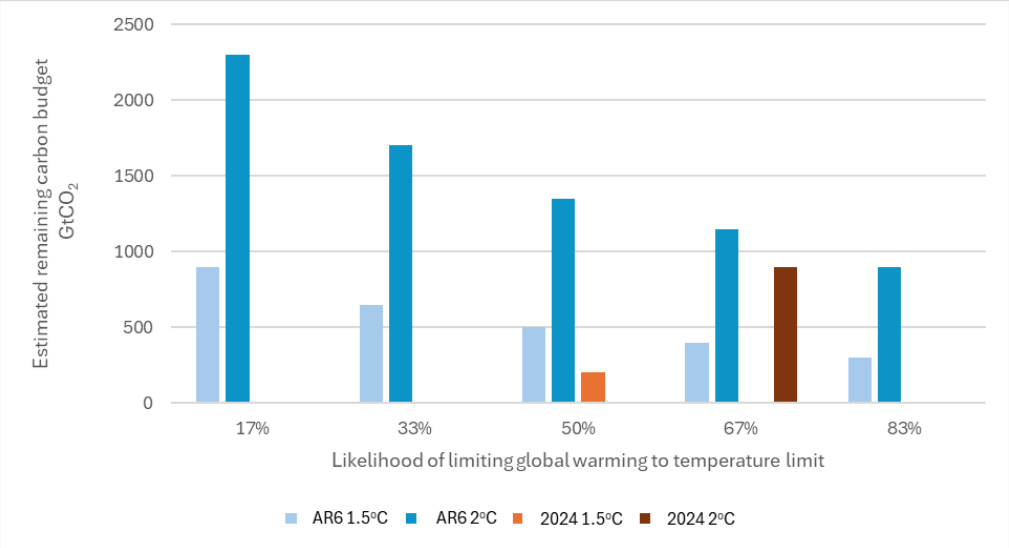

Figure 2: Estimated remaining carbon budget to limit global warming to 1.5°C or 2°C above pre-industrial temperatures for given likelihoods[7,8,9]

The implication of the emissions data is that at current levels of annual global emissions, the remaining carbon budget is being used up too quickly and there is a high probability of overshooting the 1.5°C temperature goal.
Unless NDCs are strengthened soon, the ability to limit temperature rise to even 2°C becomes increasingly difficult. **On current projections, even with full implementation of NDCs, there is a 66% chance of temperature rises in the range of 2.6-2.8°C (best estimate) over the course of the century.**[10, 11]

Key takeaways

- To avoid exceeding the remaining carbon budget, annual greenhouse gas emissions need to rapidly decline, but they are currently still increasing at a global level.
- This increases the risk that global temperature thresholds will be exceeded.
- This has implications for entity level climate-related risks and opportunities.

Sources and explanatory notes

[1] United Nations Environment Programme (2024) Emissions Gap Report 2024: No more hot air … please! With a massive gap between rhetoric and reality, countries draft new climate commitments, PXVII, Nairobi
[2] With full implementation of unconditional NDCs, there is at least a 66% chance of projected temperature rise of 2.8°C (range: 1.9-3.7). For full implementation of conditional NDCs there is at least a 66% chance of projected temperature rise of 2.6°C (range: 1.9-3.6)

[3] Intergovernmental Panel on Climate Change (2021) *Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (PDF 3,623 KB), p5
[4] Intergovernmental Panel on Climate Change (2021) *Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (PDF 3,623 KB), p29
[5] United Nations Environment Programme (2024) *Emissions Gap Report 2024: No more hot air … please! With a massive gap between rhetoric and reality, countries draft new climate commitments*, PXVII, Nairobi
[6] Global Carbon Project (2024, November 12) *Briefing on key messages Global Carbon Budget 2024*
[7] Intergovernmental Panel on Climate Change (2021) *Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, p29
[8] United Nations Environment Programme (2024) *Emissions Gap Report 2024: No more hot air … please! With a massive gap between rhetoric and reality, countries draft new climate commitments*, table 2.1, Nairobi
[9] Figure 2 data from: IPCC Sixth Assessment Report (see footnote 5) and UNEP Emissions Gap Report 2024 (see footnote 6)
[10] United Nations Environment Programme (2024) *Emissions Gap Report 2024: No more hot air … please! With a massive gap between rhetoric and reality, countries draft new climate commitments*, PXVII, Nairobi
[11] See note 2 above.