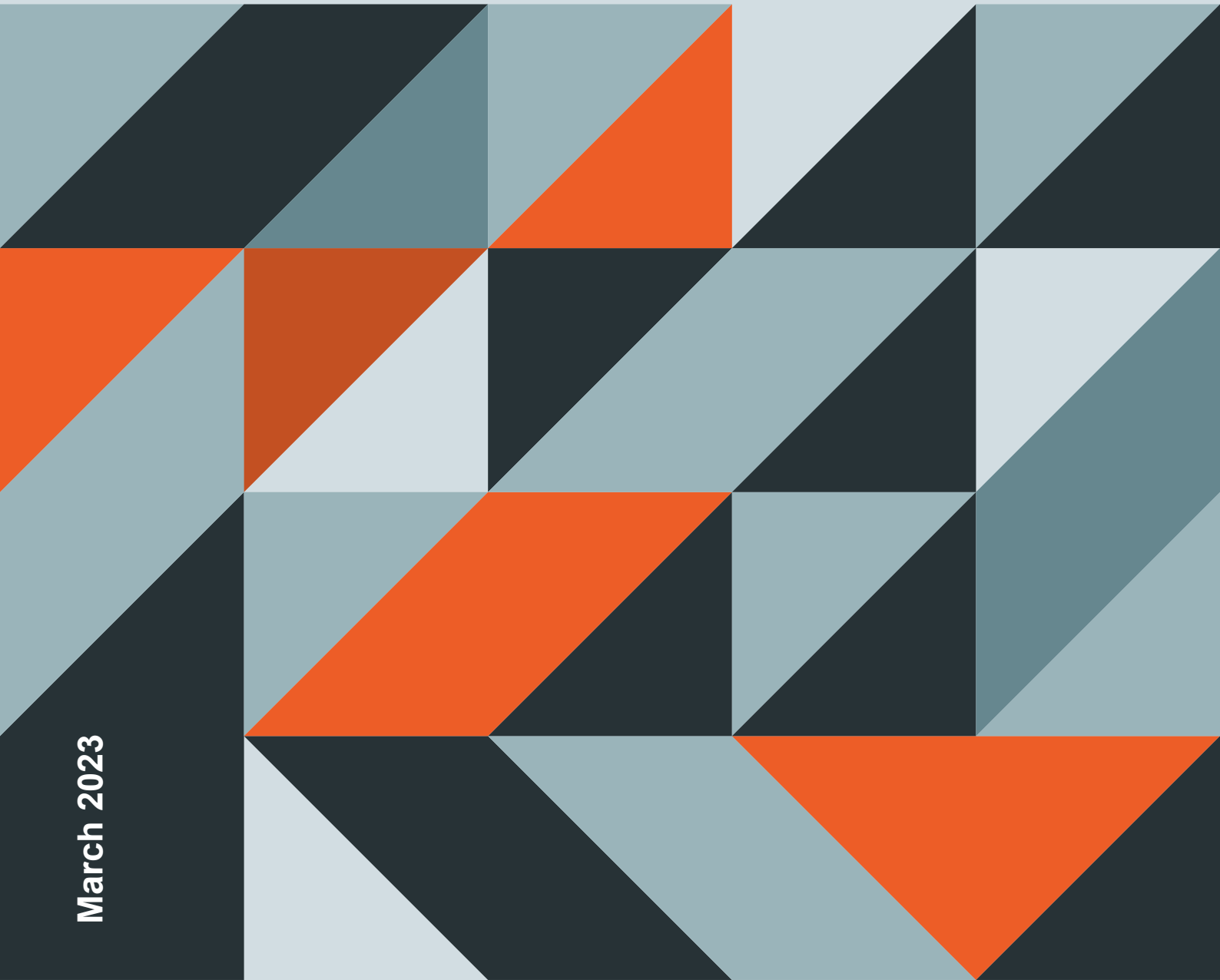
NEW CLIMATE INSTITUTE

What is a fair emissions budget for Belgium?



March 2023

What is a fair emissions budget for Belgium?

[Category]

Project number
1001

Authors
Hanna Fekete, Niklas Höhne

Disclaimer
The views and assumptions expressed in this report represent the views of the authors.
The report draws heavily from an earlier report of the same authors: (Fekete and Höhne, 2022)

Download the report
http://newclimate.org/publications/

Table of Contents

Abbreviations

EU	European Union
IPCC	Intergovernmental Panel on Climate Change
GHG	Greenhouse Gas
LULUCF	Land Use Land-Use Change and Forestry

1 Introduction

With the Paris Agreement, governments have agreed to limit temperature increase to well below 2°C and to pursue efforts to keeping it below 1.5°C, compared to preindustrial levels. With this wording, the Agreement significantly strengthens the ambition of previous global climate targets (Schleussner *et al.*, 2016). The Glasgow Climate Pact further strengthens the target, resolving to pursue efforts to limit temperature increase to 1.5°C (UNFCCC, 2021).

However, since the Paris Agreement was signed in 2015, global emissions have continued to increase up until the COVID-19 pandemic (UNEP, 2021), and already in 2021, global CO_2 emissions from the energy sector rebounded to a new record high (IEA, 2022). The Intergovernmental Panel on Climate Change (IPCC) projects that with policies implemented up to 2020, the temperature would increase to 3.2°C above pre-industrial levels by 2100 (IPCC, 2022a), illustrating the urgency for action.

The reduction pathways that the IPCC analyses today are much steeper than they were a decade ago, reflecting both the move to a lower temperature limit, and the insufficient action since then. Any further delay in action or lack of ambition will put a bigger burden particularly on vulnerable countries and future generations. The most recent assessment report of the IPCC is a clear warning signal that without any additional action, the climate impacts will risk our livelihood; the IPCC report called the current situation a “code red” (IPCC, 2022a).

In the Paris Agreement, governments also agreed to further develop their national targets and update them over time, to get on a 1.5°C compatible trajectory, given that when the agreement was signed, global average temperature was projected to increase to 2.7°C if all countries fully met their targets (Climate Action Tracker, 2015).

Since then, many countries have updated their targets, however on aggregate, the efforts so far remain insufficient and are projected to lead to 2.4°C with 2030 targets and to 2.1°C warming by 2100, assuming full target implementation also of submitted targets for years after 2030 (Climate Action Tracker, 2022b). The European Union (EU) had committed to at least 40% greenhouse gas (GHG) emissions reductions when signing the Paris Agreement and in 2020 updated its target to 55% below 1990 levels. Climate Action Tracker rates this target as “insufficient”: while the target is described by Climate Action Tracker as “almost sufficient” when compared to modelled domestic pathways, it clearly falls short of a “fair share target”, which would need to be almost at net-zero emissions in 2030 (Climate Action Tracker, 2022a).

This report describes parameters that should be considered for setting a globally fair target for Belgium, and provides a minimum threshold that could be considered fair under specific circumstances.

This report draws from the same concept and methods as (Fekete and Höhne, 2022), which are described there in detail. Annex A of this report describes all assumptions that are specific to the Belgium assessment.

2 Developing a fair 1.5°C compatible pathway for Belgium

This part of the report describes two approaches that could be considered when setting targets for Belgium:

1. Applying the global carbon budgets to Belgium.
2. Determining a fully fair level of effort based on effort sharing literature.

This report does not provide an analysis of the mitigation potential of Belgium.

2.1 Distributing the remaining carbon budget

This report uses the carbon budgets from IPCC Working Group I report published in 2021 (Arias *et al.*, 2021), with 400 $GtCO_2$ left as of Jan 2020 under scenarios limiting temperature increase to 1.5°C by the end of the century with a 67% chance. Annex B includes results under other global carbon budgets.

The scenarios behind the carbon budgets of the IPCC include a substantial share of "negative emissions", in the order of magnitude 10 $GtCO_2$ per year globally in the long run, or about 25% of current global CO_2 emissions. For Belgium, we assume a negligible potential for negative emissions that would for example come from forest sinks. As a result, a faster than average reduction of CO_2 emissions is necessary in Belgium. There should be no residual CO_2 emissions sources, given that the little CO_2 removal capacities will be needed to balance out emissions of other gases.

We calculate Belgium's share of the remaining global carbon budget based on two different indicators: First we take its current share of global GHG emissions, an approach also referred to as "grandfathering", and apply this share to the globally remaining budget. Accordingly, all countries would need to reduce their emissions at the same speed and reach zero at the same time. This approach does not reflect the concept of Common but Differentiated Responsibilities and Capabilities (CBDR) and is thus not aligned with the Paris Agreement. According to this approach and assuming a linear reduction, Belgium would need to reduce CO_2 emissions to zero by 2040 to stay within its share of the remaining budget for limiting temperature increase to 1.5°C with a 67% chance. For 2030, the reduction below 1990 level of all GHGs (incl. emissions from LULUCF) would be 61.0% (see Figure 1).

The other approach is to share the carbon budget based on the share of current population. This is considered fairer as it considers the principle of equality and would require some countries to reduce faster and reach zero earlier than others. According to this approach and assuming a linear reduction, Belgium would need to reduce CO_2 emissions to zero already by 2032 to stay within its share of the remaining budget for limiting temperature increase to 1.5°C with a 67% chance. For 2030, the reduction below the 1990 level of all GHGs (incl. emissions from LULUCF) would be 81.5%.

This approach still distributes the efforts according to current levels of GHG emissions or population and does not take into account historical responsibilities or capabilities, meaning this is not the full fair share of global mitigation efforts for Belgium (see next section).

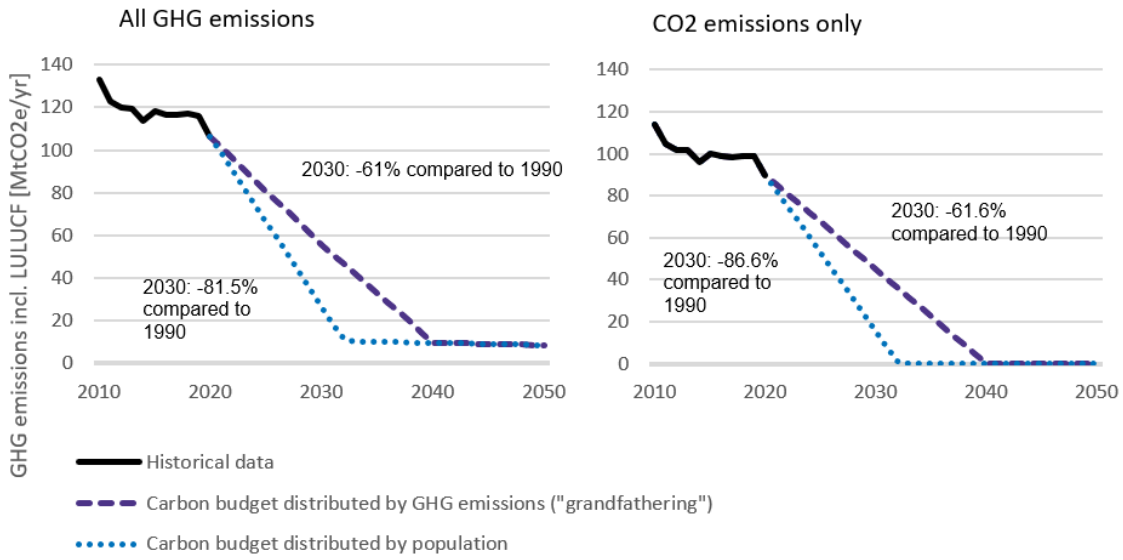


Figure 1: Historical emissions data from 2010 – 2020 and trajectories resulting from distributing the global carbon budgets based on Belgium's share of emissions (grandfathering) or population.

Source for historical data: (Belgian interregional Environment Agency (CELINE-IRCEL) et al., 2022).

This report uses 2020 as the starting year because it is the latest year for which confirmed historical data is available. Preliminary data for 2021 indicates that GHG emissions globally and in Belgium rebounded after the COVID-dip in 2021. Using the 2021 data as the starting year would imply an even faster rate of reduction than indicated in this report.

The analysis does not look into the option for negative emissions (sinks) for Belgium. To reach GHG neutrality Belgium will need remove CO_2 from the atmosphere to compensate for other GHGs that cannot be avoided (e.g. from the agricultural sector). This need for sinks is not included in the figures above.

2.2 Accounting for equity principles

The Paris Agreement requires countries to propose nationally determined contributions that reflect a fair share of the country towards the global long-term goal. Differentiation between countries is required on the basis of common but differentiated responsibilities and capabilities. Belgium has a comparably high share of historical responsibility and economic capability. We take into account the results of effort sharing approaches that take multiple views of equity into account to provide a fair contribution of Belgium.

The fair share for 2030 is taken from Rajamani et al. (2021). This journal paper synthesised all literature available on sharing the effort of mitigation and provides a range of required mitigation effort also for Belgium, based on their historical responsibility and capabilities.

For Belgium, the supplementary information of the paper provides a fair share range of -87.5 $MtCO_2e$ to 82.6 $MtCO_2e$ in 2030. This range includes a wide range of effort sharing approaches[1], and within this range, one approach that is not ambitious for one country, will require much more ambition from others. If every country chose the approach that is most beneficial for itself, i.e. at the upper of the range, the

[1] Rajamani et al include effort sharing approaches that cover the principles of equality, historical responsibility and capability, and exclude approaches that use grandfathering or cost-efficiency as a basis for distributing the efforts because those do not reflect equity but other allocation frameworks.

countries would choose conflicting approaches and the aggregate effort would be insufficient for 1.5°C. Therefore, the paper then calculates the factor by which the global limit is exceeded in sum, and reduces the fair share range by this factor for all countries. For Belgium, this means that the fair share emissions level compatible with 1.5°C is below zero, at -36.3 $MtCO_2e$ in 2030. This approach is similar to that of the Climate Action Tracker, which uses the emission budget up to 2100 and not only the emission level in 2030.

Rajamani at al. do not provide data beyond 2030. This report assumes that the fair share emissions level needs to remain at this level, which is rather conservative, seeing that for most developed countries, the fair share emissions level decreases further in other analysis (compare Climate Action Tracker).

3 Conclusions

This report describes and quantifies different approaches on how the remaining global carbon budget could be distributed to individual countries and the implications for Belgium. It also illustrates the share that according to literature would reflect an unambiguously fair share for Belgium.

Under an approach that distributes the remaining global budget as of 2020 to countries based on their emissions at that point and assumes a linear pathway towards zero CO_2, Belgium would need to reduce total GHG emissions by 61.0% below 1990 by 2030. This approach is referred to as “grandfathering” and research widely acknowledges that this is **not** an approach that distributes global efforts in a fair manner, according to the principle of common but differentiated responsibilities and capabilities, but that this approach benefits countries with a comparably high share of emissions today and puts developing countries at disadvantage.

The grandfathering approach can thus be seen as the absolute minimum for emissions reductions for a developed country like Belgium. Also, the assumptions of this report are relatively generous to Belgium in terms of the selected carbon budget: This report uses the budgets from IPCC AR6 working group 1. Working group 3 suggests more ambitious budgets already. A smaller global budget would require Belgium to decrease emissions even faster.

If the global carbon budget would be distributed to countries based on their population, Belgium would need to reduce total GHG emissions by 81.5% by 2030. This could be considered fair by some, but this calculation still does not include the relatively high capability and high historical responsibility of Belgium.

To fully unambiguously provide a fair share taking into account all characteristics of Belgium, it would need to reduce GHG emissions to below zero already by 2030. In essence, Belgium has used its fair share of the carbon space already.

Under the carbon budget approaches and a linear reduction of CO_2 emissions, Belgium would reach zero CO_2 emissions by 2040 (based on the grandfathering approach) or 2032 (based on a distribution by share of population). This means that the reduction pathways that the approaches imply likely reach GHG neutrality well before the year 2050, which Belgium currently targets for climate neutrality.

The carbon budget approaches can be understood as the absolute minimum that Belgium should contribute to global climate change mitigation based on considerations of fairness. For an unambiguously fair contribution, Belgium would need to go much further. Where this is not possible through domestic action, support to other countries for ambitious, transformative mitigation action is essential.

References

Arias, P.A. *et al.* (2021) 'Technical summary', in *Technical Summary on Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, pp. 33–144. Available at: https://doi.org/10.1017/9781009157896.002.

Belgian interregional Environment Agency (CELINE-IRCEL) *et al.* (2022) *Belgium' s greenhouse gas inventory 1990 - 2020*. Available at: https://unfccc.int/documents/461915.

Climate Action Tracker (2015) *INDCs lower projected warming to 2.7˚C: significant progress but still above 2°C. Climate Action Tracker Update 1st October 2015.* Climate Action Tracker (PIK Potsdam, Climate Analytics, NewClimate Institute, Ecofys). Available at: http://climateactiontracker.org/assets/publications/CAT_global_temperature_update_October_2015.pdf.

Climate Action Tracker (2022a) *EU country assessment - June 2022*. Available at: https://climateactiontracker.org/countries/eu/2022-06-03/ (Accessed: 20 June 2022).

Climate Action Tracker (2022b) *Warming Projections Global Update November 2022: Massive gas expansion risks overtaking positive climate policies*. Climate Action Tracker (Climate Analytics, NewClimate Institute).

Fekete, H. and Höhne, N. (2022) *What is a fair emissions budget for the Netherlands? How the Netherlands can integrate the principle of common but differentiated responsibilities and capabilities in their climate target*. Cologne. Available at: https://newclimate.org/resources/publications/what-is-a-fair-emissions-budget-for-the-netherlands.

Forster, P. *et al.* (2022) *Guest post: What the tiny remaining 1.5C carbon budget means for climate policy*. Available at: https://www.carbonbrief.org/guest-post-what-the-tiny-remaining-1-5c-carbon-budget-means-for-climate-policy/?utm_campaign=Carbon Brief Daily Briefing&utm_content=20221114&utm_medium=email&utm_source=Revue Daily (Accessed: 8 March 2023).

Friedlingstein, P. *et al.* (2021) 'Global Carbon Budget 2021', *Earth Syst. Sci. Data Discuss.*, 2021, pp. 1–191. Available at: https://doi.org/10.5194/essd-2021-386.

IEA (2022) *Global Energy Review: CO2 Emissions in 2021 Global emissions rebound sharply to highest ever level*. Available at: https://iea.blob.core.windows.net/assets/c3086240-732b-4f6a-89d7-db01be018f5e/GlobalEnergyReviewCO2Emissionsin2021.pdf.

IPCC (2022a) *Mitigation of Climate Change – Summary for Policymakers (SPM)*, *Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: Intergovernmental Panel on Climate Change (IPCC). Available at: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf (Accessed: 6 December 2022).

IPCC (2022b) 'Summary for Policymakers', in P.R. Shukla et al. (eds) *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, NY, USA: Cambridge University Press. Available at: https://doi.org/10.1017/9781009157926.002.

Rajamani, L. *et al.* (2021) 'National "fair shares" in reducing greenhouse gas emissions within the principled framework of international environmental law', *Climate Policy*, 21(8), pp. 983–1004. Available at: https://doi.org/10.1080/14693062.2021.1970504.

Schleussner, C.-F. *et al.* (2016) 'Science and policy characteristics of the Paris Agreement temperature goal', *Nature Climate Change*, Online Pub. Available at: https://doi.org/10.1038/NCLIMATE3096.

UNEP (2021) *Emissions Gap Report 2021: The Heat Is On – A World of Climate Promises Not Yet Delivered*. Nairobi, Kenya: United Nations Environment Programme (UNEP).

UNFCCC (2021) *Glasgow Climate Pact. FCCC/PA/CMA/2021/L.16*. Bonn, Germany: United Nations Framework Convention on Climate Change. Available at: https://unfccc.int/sites/default/files/resource/cma2021_L16_adv.pdf.

World Bank (2023) *World Bank data, population total, updated on 1 March 2023*. Available at: https://data.worldbank.org/indicator/SP.POP.TOTL (Accessed: 24 March 2023).

Annex A Detailed approach to calculating the carbon budget for Belgium

For CO_2 emissions:

- Take **total global remaining CO_2 budget** from IPCC 6th Assessment Report Working Group 1 as of 2020 (Arias *et al.*, 2021).
- Calculate the **share of Belgium** of current global budgets according to the share of emissions (0.24%) and of population (0.15%) in the year 2020.[2]
- Apply this share to the globally remaining budget
- Deduct already "missed years" until the starting year of reductions (2020).
- Calculate the year when CO_2 is zero.
- Assume a linear reduction trajectory to 0 (base year 2020)

Note that this study does not quantitatively include the potential of sinks, given the uncertainty in available estimates. LULUCF has consistently been a small sink of emissions in Belgium of below 1 $MtCO_2e/yr$ in most years of the last decade. To calculate the reductions below 1990 including LULUCF, we assume that as of 2021, net emissions from LULUCF remain constant at the average of the five most recent inventory years (2016 – 2020).

This study uses the budget for limiting warming to 1.5°C with a high chance (67%) by the end of the century of 400 $GtCO_2$ as of 2020. This is in line with the Climate Action Tracker's interpretation of the Paris Agreement temperature goal, and with the scenarios underlying the calculations in the study used for the "fair share" in section 2.3.

AR6 working group III provides alternative scenario groups with updated carbon budget numbers. The scenario group that is closest to the budget used here is the C2 category that reaches 1.5°C after overshooting and relies on a high amount of negative emissions, illustrating that even 400 $GtCO_2$ could be interpreted as a generous remaining budget.

For non-CO_2 emissions:

Budgets consistent with 1.5°C pathways are not available for non-CO_2 emissions. Instead, this report follows the global average of the IPCC 6th Assessment Report Working Group 3 scenario database to provide reductions below 2020 for CH_4 and N_2O (SPM Figure 5).

We choose scenario category C1, as the definition of that category is closest to that of the carbon budget selected for CO_2 from the working group 1, that we base the approach for CO_2 emissions on.

AR6 does not provide the same level of detail for f-gases, so we use the average of CH_4 and N_2O as a proxy for the required reduction of f-gases. This leads to the following rates by 2030 of reduction below 2020:

Table 1: Assumed reductions below 2020 for non-CO_2 emissions

	CH_4	N_2O	F-gases
By 2030	34%	33%	34%
By 2050	58%	33%	46%

[2] Data sources:
Global historical CO2 emissions in 2020: (Friedlingstein *et al.*, 2021)
Belgian CO2 emissions in 2020: (Belgian interregional Environment Agency (CELINE-IRCEL) *et al.*, 2022)
Population data: (World Bank, 2023)

The report assumes a linear reduction for non-CO_2 emissions for Belgium between 2020 and 2030, and 2030 and 2050.

The sum of all gases is the trajectory shown in Figure 1. Given that non-CO_2 emissions never decrease completely to 0, and the trajectory for CO_2 is assumed to use up the budget but not compensate, this path does not lead to net-negative emissions.

Annex B – Results of the different approaches under different carbon budget approaches

The report uses the budget of 400 GtCO2 between 2020 and 2100 as the central estimate. There are various uncertainties and definitions around the budgets, and different scenario categories, models and starting years make a direct comparison difficult (see for example (Forster *et al.*, 2022)).

The table below illustrates the impact of the budget choice on the results of the carbon budget approach described in chapter 2.1 of this report, with three example budgets that could be considered compatible with 1.5°C:

- 320 $GtCO_2$ from AR6, Working Group 3. This budget reflects scenarios that limit warming to 1.5°C with a chance of at least 50%, with no or limited overshoot (i.e. warming over the course of this century does not exceed 1.5°C much) (IPCC, 2022b, p. 18)
- 400 $GtCO_2$ from AR6, Working Group 1. This budget reflects scenarios that limit warming to 1.5°C by the end of the century with a chance of 67% (Arias *et al.*, 2021, p. 98)
- 500 $GtCO_2$ from AR6, Working Group 1. This budget reflects scenarios that limit warming to 1.5°C by the end of the century with a chance of 50% (ibid)

Working group 1 does not describe whether or not the budgets imply an overshoot or substantial negative emissions.

Table 2: Implication of different global carbon budgets on the results

Distribution of global budget	**Budget [cumulative $GtCO_2$ 2020 – 2100]**	**Year of zero CO_2**	**Reduction of GHGs below 1990 by 2030, incl. LULUCF**
By emissions	320	2036	69.4%
	400	**2040**	**61.0%**
	500	2045	54.5%
By population	320	2030	92.6%
	400	**2032**	**81.5%**
	500	2035	70.4%

Annex C – implications of the pathway choice under carbon budget approaches

The approach in this report assumes a linear trajectory of CO_2 emissions from the base year 2020 until the year when CO_2 emissions reach zero. This implies that the CO_2 trajectories under the approaches lead to zero CO_2 emissions well before 2050, Belgium's target year for GHG neutrality. Even if we assume that Belgium would need to reduce CO_2 to zero a few years earlier than total GHG emissions, the trajectories reach zero clearly before the timing required for the GHG neutrality target.

An alternative approach could be to use the GHG neutrality target year as guidance for the trajectory:

- Assume CO_2 emissions need to by zero by 2045, which leaves 5 years for reducing further to compensate for emissions of other gases.
- Fix the budget for the time period until 2045 according to the different distributional approaches.
- Assume that the trajectory between 2020 and 2030 as well as between 2050 and the zero CO_2 year is linear.
- Set the level for 2030 as the variable to be determined.

Extending the time period until 2045 requires even steeper reductions earlier on. This means that the 2030 emissions level would need to be even lower if the GHG neutrality target is not achieved before 2050.

NewClimate – Institute for Climate Policy and Global Sustainability gGmbH

Cologne Office
Waidmarkt 11a
50676 Cologne, Germany

Berlin Office
Schönhauser Allee 10-11
10119 Berlin, Germany

Phone: +49 221 999 83 300 (19)
Email: info@newclimate.org
Website: www.newclimate.org