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

Authors:
Hanna Fekete, Niklas Höhne, Sybrig Smit

NEW CLIMATE INSTITUTE

August 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

Project number
822015

Authors
Hanna Fekete, Niklas Höhne, Sybrig Smit

Disclaimer
This analysis was financed by Greenpeace Netherlands, Milieudefensie (Friends of the Earth Netherlands) and Natuur & Milieu. The views and assumptions expressed in this report represent the views of the authors and not necessarily those of the client.

Cover picture: Flickr/ John Dalkin – Ice Portrait

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

Summary

The Paris Agreement adopted in 2015 has the goal of limiting the global warming to 1.5°C. However, the measures taken by countries to date are far from sufficient to meet these global targets and global emissions continue to increase. All countries are required to strengthen their self-imposed targets. The Dutch government recently confirmed it wants to follow the ambition of 1.5°C domestically and is revising its climate targets.

The purpose of this analysis is to assess the proposed target pathway of the Netherlands' government in the context of the required global efforts and the country's historical responsibility and capability, which are both key principles of the international efforts against climate change and the Paris Agreement.

The analysis finds that the Netherlands' proposed target pathway of a 55%/70%/80% reduction below 1990 by 2030/2035/2040 and greenhouse gas neutrality by 2050 cannot be considered fully compatible with the Paris Agreement 1.5°C limit. While the pathway roughly follows the speed of greenhouse gas (GHG) emission reductions of *global* pathways for 1.5°C, it neglects two elements: First, the global pathways implicitly assume that a large amount of emissions is removed from the atmosphere in the second half of the century (for more detail read section 2.1). The potential for emissions sinks in the Netherlands is limited, meaning it cannot rely on reducing a large amount of CO_2 in the country later on and its national carbon budget is comparably smaller. Second, the global pathways only provide the global average reduction speed but the Netherlands has a high historical responsibility for climate change, a small population in relation to the size of its emissions, and large capabilities to mitigate climate change and would therefore have to reduce emissions faster than the global average to contribute its fair share.

This report makes use of two additional concepts that could be considered for setting national targets in the Netherlands:

Distributing the remaining carbon budget: According to the IPCC, remaining global carbon budgets were at 400 $GtCO_2$ as of 2020. In the absence of the opportunities for large structural negative emissions in the Netherlands, carbon budgets for the Netherlands would be depleted earlier than on global average, assuming a linear trajectory (see Figure S1). For the Netherlands, distributing the remaining carbon budget based on the current share of population means that CO_2 emissions would need to reach 0 around 2030 to stay within the Netherlands' budget for limiting warming to 1.5°C with a 67% chance. Total GHG emissions would need to decline by 94% below 1990 by 2030. The proposed target pathway exceeds the budget by 1070 $MtCO_2e$, or by roughly six times current annual emissions of the Netherlands.

A variation of the distribution of carbon budgets is by the current share of GHG emissions rather than population, which would lead to reaching 0 CO_2 around 2037, a reduction of GHG emissions by 64% compared to 1990 by 2030 and the proposed target pathway would exceed this budget by 530 $MtCO_2e$. This however neglects the principle of common but differentiated responsibilities and capabilities of the United Nations Framework Convention on Climate Change (UNFCCC), a critical pillar of the Paris Agreement.

The Netherlands' full fair share: The distribution of the global carbon budget as above neglects to a large extent historical emissions until now and capabilities to mitigate, relative to other countries. For contributing its full fair share, the Netherlands' emissions allocations need to be below zero in 2030 already and need to remain there going forward (see Figure S1). GHG emissions should have decreased much more rapidly already by now, according to "effort sharing approaches".

Under the assumption that GHG emissions as of 2010 should have decreased linearly towards 2030, and remain at 2030 levels until 2050, the GHG emissions budget of the Netherlands going forward is already used up. The government's proposed target pathway of reducing emissions by 55%, 70% and 80% in 2030, 2035 and 2040, and achieve climate neutrality in 2050 exceeds the Netherlands' fair share budget by about 2400 $MtCO_2e$, or 14 times current annual emission levels.

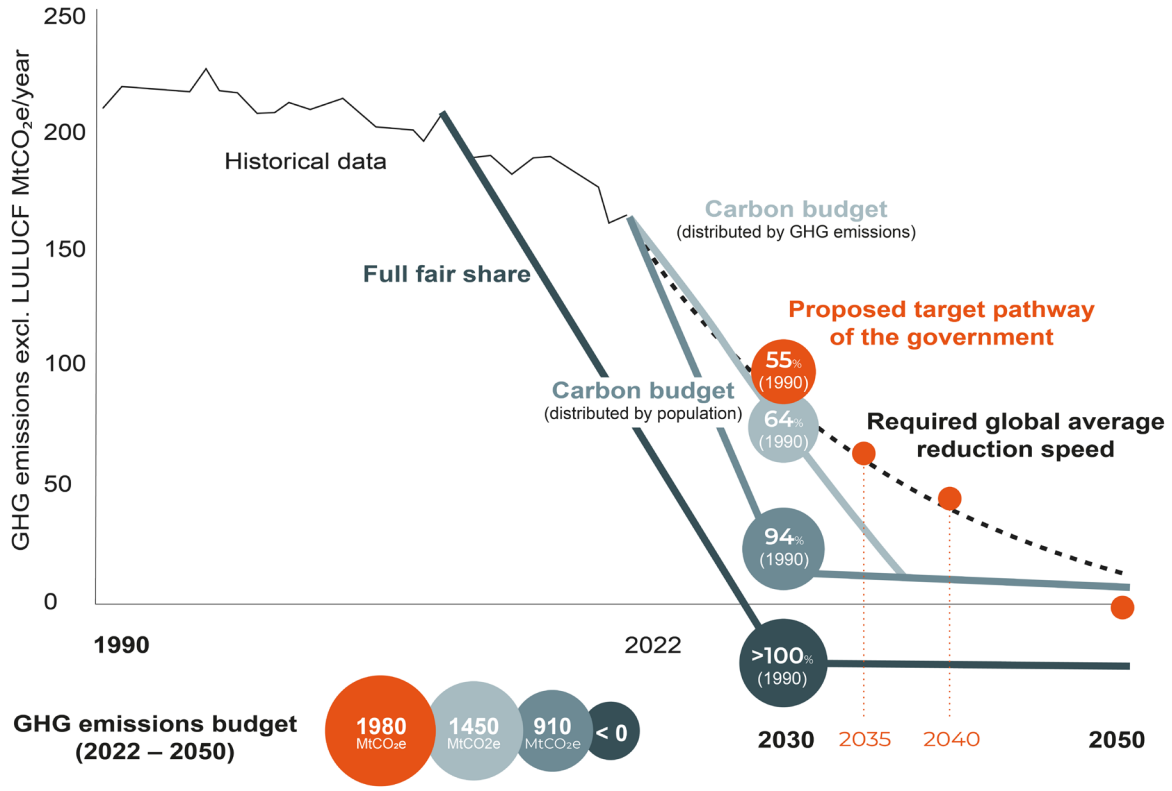


Figure S 1: Summary of proposed target pathways as in the coalition agreement and results of different ways of distributing required global efforts.

Data sources: Historical data (Statistics Netherlands (CBS), 2022a, 2022b), Targets (VVD D66 CDA en ChristenUnie, 2021), required global average speed: authors own calculations based on the average of selected 1.5°C scenarios from the IPCC special report, extracted from (IIASA, 2018), emissions trajectories based on carbon budgets own calculations with budgets from (IPCC, 2021), fair share in 2030 from (Rajamani et al., 2021)

Responsibilities and capabilities of countries are so far apart, that a fair contribution of developed countries would be to stop emissions immediately to allow developing countries to increase emissions. Mirroring this with real emissions would not make sense in both cases: developed countries will have severe difficulties to stop emitting immediately and for developing countries it is unwise to increase emissions with new infrastructure now only to reduce them again towards net-zero and make the infrastructure obsolete before the end of its life. This imbalance between the responsibilities and capabilities and the physical limitations and requirements of a transition to a 1.5°C pathway require compensation between developed and developing countries. **For the Netherlands, contributing their fair share means getting domestically as close to zero as possible and as fast as possible, and substantially supporting other countries' mitigation action.**

Table of Contents

List of Figures

List of Tables

Abbreviations

BECCS	Bioenergy with Carbon Capture and Storage
CDR	Carbon Dioxide Removal
CO_2	Carbon dioxide
CO2e	Carbon dioxide equivalent
DACCS	Direct Air CO_2 Capture and Storage
EU	European Union
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land use, land use change and forestry
NDC	Nationally Determined Contribution
PBL	Netherlands Environmental Assessment Agency
UNFCCC	United Nations Framework Convention on Climate Change

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).

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 IPCC projects that with measures implemented up to 2020, the temperature would increase to 3.2°C above pre-industrial levels by 2100 (IPCC, 2022). Current global greenhouse gas (GHG) emissions need to roughly half by 2030, and CO_2 emissions need to become net-zero by around 2050 to limit global warming to 1.5°C by the end of the century, based on cost-optimal pathways (IPCC, 2018a).

The reduction pathways that the Intergovernmental Panel on Climate Change (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 (Figure 1). 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, 2022).

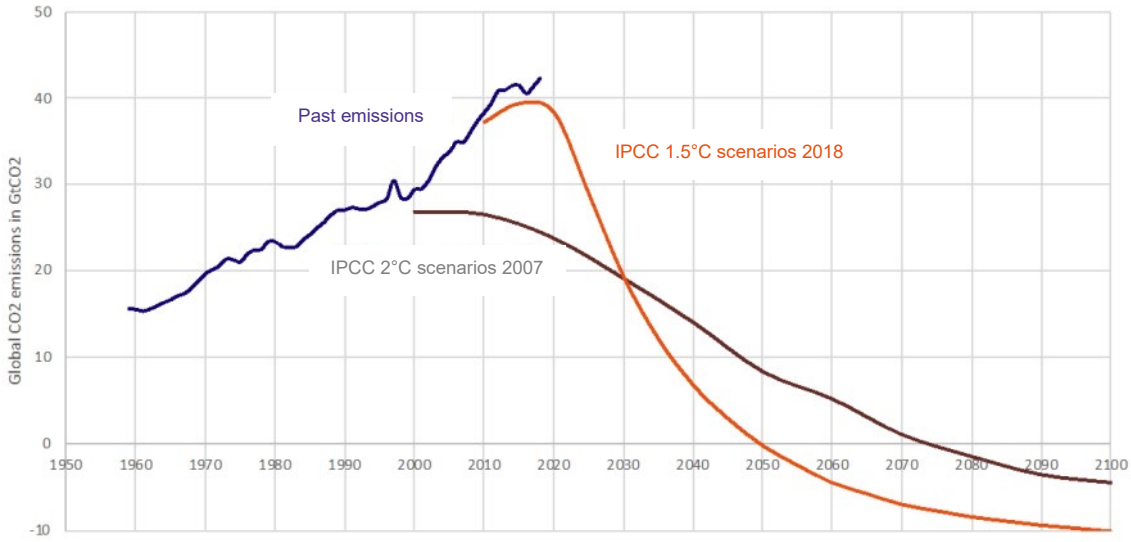


Figure 1: Pathways of global CO_2 emissions from IPCC in the Fourth Assessment Report (2007) and in the Special Report on 1.5°C in 2018

Note: Pathways from AR4 (IPCC, 2007)*: 445 to 490 ppmCO2e leading to 2°C –2.4°C. Pathways from SR1.5* (IPCC, 2018b)*: low and no overshoot scenarios leading to 1.5°C. The graphic shows only average values of the scenario range. Source:* (Höhne *et al.*, 2019)*. The scenario database from the sixth assessment report of the IPCC was not yet published when this analysis was performed, and the 1.5°C scenarios show a similar behaviour as in the 2018 report.*

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 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 2.1°C warming by 2100, assuming full target implementation (Climate Action Tracker, 2021c). The European Union (EU) had committed to at least 40% 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 compared to required domestic efforts is "almost sufficient", it clearly falls short of a "fair share target", which would need to be almost at net-zero emissions in 2030 (Climate Action Tracker, 2022). This means that if an EU member state wants to set a target that aligns with their fair share for 1.5°C, they should not use the EU target as a direct benchmark.

The Government of the Netherlands has recently confirmed its ambition to pursue a 1.5°C limit through its own targets and policies and is in the process of updating its targets to a 55% reduction by 2030, and designing policies to reach 60%, up from previously 49% below 1990 (according to the coalition agreement, VVD D66 CDA en ChristenUnie, 2021). The government argues this level of ambition is compatible with the Paris Agreement 1.5°C limit given the similarities to the globally required speed of emissions reductions (VVD D66 CDA en ChristenUnie, 2021; Ministry of Economics and Climate, 2022). However, the Paris Agreement shall "be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances" and national emissions reductions targets shall "reflect [a country's] highest possible ambition, reflecting its common but differentiated responsibilities and respective capabilities, in the light of different national circumstances" (UNFCCC, 2015b)[1]. Differentiated responsibilities also cover the historical responsibility, which can be for example expressed in terms of the share of historical emissions. Capabilities are reflected for example by the wealth of the country (Höhne, den Elzen and Escalante, 2014).

As a developed country, with a comparably high share of historical responsibility for climate change and above-average capabilities to mitigate it, the Netherlands needs to reduce its emissions faster than the globally required average needed for 1.5°C.

This report substantiates how historical responsibilities and capabilities can be considered in the discussion on national mitigation targets and provides a level of a fair contribution for the Netherlands. The report covers the concepts of a "fair share" of globally required mitigation efforts and the resulting carbon budgets for a country. It also describes how international climate finance links to national mitigation efforts and a fair contribution.

[1] Article 2.2 and Article 4.3 of the Paris Agreement

2 Background and key concepts

2.1 1.5°C compatible emissions pathways

The IPCC states that GHG emissions need to half by 2030 and CO_2 emissions need to reach net-zero around 2050 for limiting temperature increase to 1.5°C under a cost-optimal pathway (IPCC, 2018b, 2022). The urgency of the situation requires mitigation actions across the globe as of today. Global models distributing the required efforts across regions so that global costs are minimised lead to the same required speed of emissions reductions for the OECD + EU region as would be required on the global level, with more substantial differences as of the middle of the century for negative emissions (see Figure 2). The pathways do not take into account that developed countries have particular responsibilities and capabilities for climate change mitigation, according to the UN Framework Convention on Climate Change (UNFCCC) (United Nations, 1992).

The Paris Agreement requests ambitious mitigation efforts from all countries, a clear deviation from earlier agreements, where often developing countries were not expected to contribute with significant efforts to climate change mitigation. However, developing countries can only play their part with substantial support from developed countries and the Paris Agreement also stresses the importance for developed countries to lead the efforts and provide means of support to developing countries (see section 2.3 on the concept of a “fair share”).

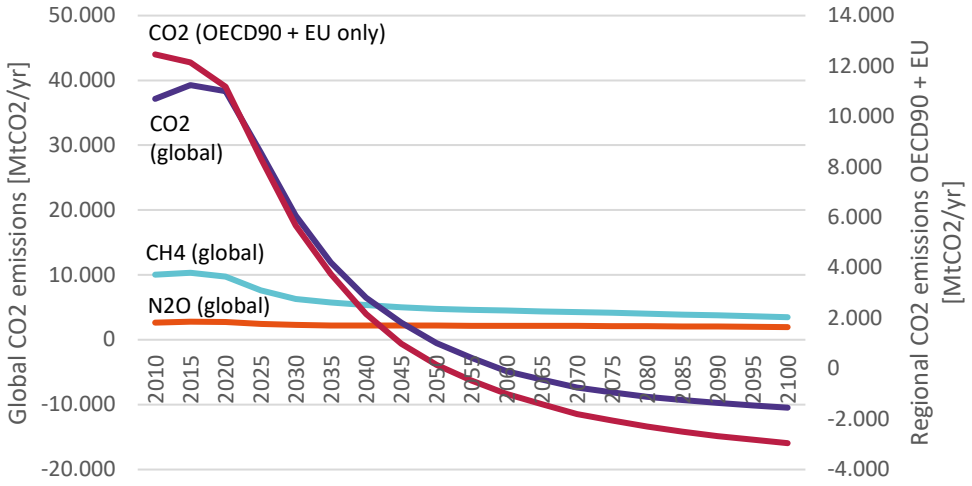


Figure 2: The required speed of global emissions reductions according to 1.5°C scenarios from the IPCC

Note: based on the average of selected 1.5°C scenarios from the IPCC special report, extracted from (IIASA, 2018). The data series CO2 (OECD90 + EU only) is depicted on the secondary y-axis, all others on the primary y-axis.

Models summarised in the IPCC’s sixth assessment report foresee a substantial amount of carbon dioxide removal (CDR) in 1.5°C scenarios, to speed up the reduction of global emissions and to decrease concentration levels through net-negative emissions (Pathak *et al.*, 2022). CDR covers three different concepts: nature-based solutions (mostly afforestation and reforestation), bioenergy with carbon capture and storage (BECCS) and direct air CO_2 capture and storage (DACCS). The IPCC report describes different options for removal and their maturity (see Table TS.7 of the Technical Summary). With the exception of nature-based approaches, CDR involves many new, rather immature technologies and/or with lack of large-scale applications, many of which are still in development, and their technical, environmental and economic feasibility in the future is to some extent uncertain. For the deployment of BECCS, biomass is required as a resource, and it needs to be ensured that its production does not create competition with food production. For all CDR options, there is the risk of non-permanence, i.e.

the risk that the CO_2 cannot be permanently stored and is released again into the atmosphere as a result of natural or anthropogenic disturbances.

The potential for negative emissions is unevenly distributed across the globe. For example, BECCS are more feasible close to large biomass sources, while DACCS require cheap and abundant electricity. Global governance and international support to countries with limited capabilities can help ensure that the potential for negative emissions is used where it is most cost-efficient while limiting negative impacts.

2.2 1.5°C compatible global carbon budgets

Since 2013, the IPCC reports also describe the remaining carbon budgets, i.e. how much CO_2 the world can still emit cumulatively over future years while staying below maximum levels of CO_2 concentration in the atmosphere and limiting temperature increase to certain levels. For policy making and target setting, this is a relevant consideration, because not only the target value and year are relevant for the concentration of CO_2 in the atmosphere, but also the pathway towards that target. For example, in 2022 the German Advisory Council on the Environment updated its estimates of remaining carbon budgets, highlighting the year 2031 by when German CO_2 emissions need to reach zero, previously corrected from 2032 due to a lack of action[2] (see Box 1).

For limiting temperature increase to 1.5°C by the end of the century with a chance of 67%, the global CO_2 budget as of 2020 was 400 Gt (IPCC 2022). In 2020 and 2021, global emissions were about 80 $GtCO_2$ in total over the two years, or 20%, of the remaining budget (Global Carbon Project, 2022). This means that the remaining budget as of 2022 stands at 320 $GtCO_2$, and if global CO_2 emissions were to remain as they are, at about 40 $GtCO_2$/yr, the global budget would be used up approximately in 2030, about 8 years from now. The previous sentences also stress the risk of delaying action (see Figure 6).

Table 1 illustrates the remaining carbon budgets under different chances of limiting temperature increase to 1.5°C at the end of the century[3]. It shows that even small changes in the chance of limiting warming to a certain level has strong implications on the carbon budget. Demonstrating the global challenge at hand in pursuing efforts to limit temperature increase to 1.5°C.

Table 1: Remaining carbon global budgets after 2019 according to the IPCC AR6

Temperature increase by the end of the century	**50% chance**	**67% chance**
1.5°C	500 $GtCO_2$	400 $GtCO_2$

Source: (IPCC, 2021). *The carbon budgets are defined as cumulative net CO2 emissions between 2020 and 2100*

[2] For limiting temperature increase to 1.5°C with a 50% chance.

[3] The chance reflects the likelihood of limiting global warming to the temperature limit

Box 1: German Constitutional Court demands stronger targets

In 2021, Germany's Federal Constitutional Court ruled that the government needed to increase the stringency of their climate targets by setting a clear target pathway for after 2030 to ensure intergenerational injustice (BVerfG, 2021). As a result, the German government added not only interim targets post-2030 but also increased the ambition of its national emissions reduction target for 2030 from 55% to 65% below 1990.

One input to the court ruling was a report from the German Advisory Council on the Environment that illustrated remaining carbon budgets for Germany based on a distribution of the global budget by share of population (Sachverständigenrat für Umweltfragen (SRU), 2020).

It suggested 2032 as the year to get to zero CO_2 following a linear reduction pathway under a budget for limiting temperature increase to 1.5°C with a 50% chance. The same report states that this approach omits at least part of the principles of CBDR so that this budget for countries with a high historical responsibility should be seen as the "absolute ceiling, and that the aim should be to come in as far as possible below it".

The SRU updated their report in 2022, moving the point in time when CO_2 should reach 0 to one year earlier than in the original calculation (Sachverständigenrat für Umweltfragen (SRU), 2022). This illustrates the delay caused by inaction in the recent years.

If the carbon budget for the Netherlands for 1.5°C was calculated based on the share of global population, the remaining budget would be significantly smaller than if it was calculated by share of emissions as in Figure 5. The year for reaching zero CO_2 would be already 2030 (to limit temperature increase to 1.5°C with a 67% chance). In its ruling, the German Constitutional Court referenced the approach to distribute CO2 budgets based on the population, which the SRU employed in its recommendations.

2.3 The concept of a "fair share"

The previous section clearly shows that the required rapid global reductions can only be achieved by reducing emissions everywhere. However, the circumstances of each country vary. Not only geographical mitigation potentials and costs differ, but also the capabilities of countries to exploit the mitigation potentials and create the shifts that are necessary to get on a 1.5°C compatible pathway. Further, some countries have contributed more to increased atmospheric CO_2 concentrations than others so far. Therefore the Parties of the UNFCCC agreed that they should protect the climate system "on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities" (United Nations, 1992).

This concept is an integral part of the international process to combat climate change and has shaped the agreements under the UNFCCC. As part of the Kyoto Protocol, only developed countries had quantified emissions reduction targets, and the Paris Agreement clearly states that, while all countries are requested to pursue ambitious climate action, developed countries should lead mitigation efforts and provide support to others.

The Paris Agreement does not provide any guidance on the adequate level of effort of individual countries. Countries should submit their "nationally determined contributions" (NDCs) together with an explanation why they consider their own targets a fair contribution, but only a few countries have added

such an explanation (Winkler, 2020). The Netherlands' so far have not argued why their proposed target is a fair contribution or takes up a fair share of the remaining carbon budget[4].

Since the introduction of the concept of common but differentiated responsibilities, researchers and scientists have developed different models to operationalise the concept fixed in the UNFCCC treaty and calculate each country's fair contribution to global mitigation efforts. Some research covers additional principles beyond historical responsibility and capability, namely equality, need and cost-effectiveness (Höhne, den Elzen and Escalante, 2014; van den Berg *et al.*, 2020), and there are debates about which principle reflects equity best. Then, there are different ways of adopting these principles, and quantitatively distributing the required global effort to countries.

Different views of what is equitable, and the variety of calculation methods lead to a range of possible fair share contributions for each country, nevertheless the required trends are clear: Least developed countries often are allocated a comparably larger emissions allowance, while developed countries often need to go below 0 before 2030 (Rajamani *et al.*, 2021). Many emerging economies are also expected to decrease emissions soon and deeply. This reflects that their development indicators are roughly world average, and the world average needs to decrease emissions steeply, as shown in the previous section.[5]

It is important to highlight that the results of such effort sharing allowances become more and more a theoretical allocation construct because of the lack of action so far (compare Figure 1) and do not directly mirror actual physical domestic emissions limits and requirements for the countries: As global emissions need to be halved by 2030, differentiation between countries is only possible, if some reduce even faster to allow for some to reduce a bit slower. In fact, responsibilities and capabilities of countries are so far apart, that a fair contribution of developed countries would be to stop emissions immediately to allow developing countries to increase emissions for the next decade. Mirroring this with real emissions would not make sense in both cases: developed countries will have severe difficulties to stop emitting immediately and also for developing countries it is unwise to increase emissions with new infrastructure now only to reduce them again towards net-zero and make the infrastructure obsolete before the end of its life. This imbalance between the responsibilities and capabilities and the physical limitations and requirements of a transition to a 1.5°C pathway require compensation between developed and developing countries.

The difference between what is globally cost-efficient in terms of domestic emissions reductions and what is fair can be balanced with climate finance or other support means for mitigation (see Figure 3). Climate finance is financial support to a government or organisation to facilitate that country in the fight against climate change. Under the UNFCCC, governments have agreed that developed countries should mobilise 100 billion USD of climate finance to developing countries by 2020, and ramp up finance further afterwards (UNFCCC, 2015a)[6]. The number is the result of a negotiation and not a technical assessment of what is needed. Developing countries argue the target is insufficient, and the 2020 target has not yet been reached (Timperley, 2021).

Based on a calculation of a fair share, the Government of Finland recently set itself a net-zero target for 2035 domestically (see Box 2). Finland is a country with a high potential for sinks in the forestry sector, which not every country has. Countries with less potential for sinks in the forestry sector or other forms of domestic emissions sinks will need to rely more on supporting climate action abroad. In practice, the

[4] Note that the Netherlands do not submit their own NDC to the UNFCCC but are part of the EU's submission. This text refers to the Netherlands' national target, where government makes a reference to 1.5°C compatible pathways based on a cost-optimal approach, but not to the concept of historical responsibility and capability.

[5] For examples, please see the Climate Action Tracker country assessments (Climate Action Tracker, 2021b)

[6] Articles 53 and 114

requirement for developed countries can be summarised as **the need to reduce GHG emissions as much as possible at home and provide substantial support to others**.

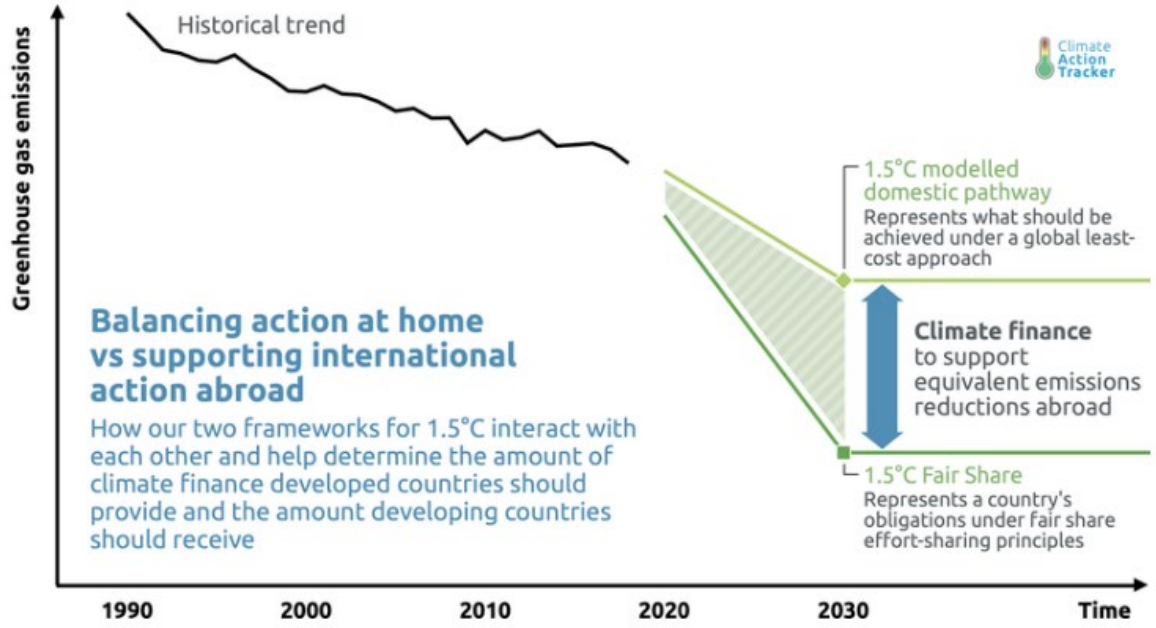


Figure 3: Climate finance as a way to balance domestic emission reductions and the full fair share (Climate Action Tracker, 2021a)

Box 2: Finland's 2035 net zero target based on a fair share approach

The Finish government recently passed its Climate Law, setting itself what has been described as "arguably the world's most ambitious climate target" (Climate Home, 2022). It aims for net-zero emissions in 2035 and net negative by 2040 domestically. This supersedes the former target of 80% reduction of greenhouse gases by 2050 below 1990.

To meet the target, Finland needs to deviate from the trends of the past decades, requiring a much steeper decrease of emissions going forward. It also requires reversing the recent problematic trend in the forestry sector and become a net-sink again to compensate for residual emissions in other sectors. In 2021, for the first time, forestry had turned into a source of emissions.

Interesting about the target is not only its overall level of ambition, but the origin of the numbers. The target is based on analysis of a "fair distribution of remaining carbon budgets" (Ollikainen, Weaver and Seppälä, 2019), a report of the advisory board 'The Finnish Climate Change Panel', commissioned by the Finnish government. This makes Finland one of the examples of a developed country taking these arguments into account.

Note that Ollikainen et al. select a few approaches to the calculation of a fair share, which does not reflect all viewpoints of what is fair. For example, it uses 1990 as the start year of historical emissions, where other approaches go further back to reflect the impact of developed countries earlier on. According to the meta-analysis for the fair share used in this study for the Netherlands, the Finnish target needs to go negative already in 2030 to be fully compatible with 1.5°C (Rajamani et al., 2021).

3 A fair 1.5°C compatible pathway for the Netherlands

This part of the report describes the Netherlands' currently anticipated target pathway and two approaches that could be considered when setting targets:

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

Van den Berg et al describe these approaches as "carbon budget approach" and as "emissions pathway approach" (van den Berg *et al.*, 2020).

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

3.1 The Netherlands' current national targets

The Netherlands' current national targets are at 49% GHG emissions below 1990, and the government is currently in the process of increasing it to at least 55% and designing policies to reach 60%, by 2030. The coalition agreement and responses to recent parliamentary questions emphasise the government's commitment to limit temperature increase to 1.5°C and also formulate a net-zero target by 2050 and interim steps of 70% below 1990 by 2035 and 80% by 2040 (VVD D66 CDA en ChristenUnie, 2021; Ministry of Economics and Climate, 2022).

Box 3: Evolvement of the Netherlands' emission reduction targets and responses from the PBL Netherlands Environmental Assessment Agency

In December 2021, an updated emission reduction target was presented in the Dutch coalition agreement. This is an emission reduction target of 55% by 2030, but the government aims to design policies to reach a reduction of 60%, to ensure 55% is reached if the policy roll-out faces setbacks. The target of 55% is an update from the previous emission reduction target of 49%, that is currently described in the Dutch climate agreement and the climate law (*Klimaatakkoord* and *Klimaatwet,* respectively). The 49% reduction target is based on a well-below 2°C scenario, that uses a carbon budget from 2015 and a global average per capita reduction pathway (Kuiper, 2022; van Vuuren et al., 2017).

The emission reduction target of 55% is a direct copy of the EU's emission reduction target of 55%. PBL provided reflections on the proposed target of the coalition (Hamers et al., 2021). The agency says that, based on global analyses to achieve 1.5°C, cost efficiency, capacity and historical responsibility, a stronger emission reduction target would be more suitable for the Netherlands but recognises substantial efforts are required to meet this target. Moreover, the Netherlands' per capita emissions are a lot higher than the EU's average and absolute GHG emissions reductions have been slower in the Netherlands: Compared to 1990 levels, Dutch emissions had only decreased by 18% in 2019, while the emissions of the entire EU wide had decreased 24%. PBL furthermore says that, considering the global climate agreements, more international contributions may be expected from the Netherlands to meet efforts in line with 1.5°C to go beyond a 55% reduction.

Figure 4 illustrates the target pathway next to historical emissions, the previous target and the required global average reduction speed reflected to the Netherlands. This is a strong simplification, given that countries have different per capita emissions currently and GHG emissions trends have different

dynamics. For example in some countries, GHG emissions have yet to peak, while in others they are already sinking.

The target pathway roughly relates to the average globally required efforts. This is only 1.5°C compatible, if emissions in all other countries declined at similar rates.

Countries will however deviate from the global average of required efforts described in chapter 2.1, according to their geographical, societal and political circumstances.

The Netherlands is among the richest countries in the world and has a high historical responsibility for GHG emissions, which according to the Paris Agreement should "take the lead". A global average pathway can therefore not be considered a fair contribution that fully reflects the Netherlands' responsibilities and capabilities.

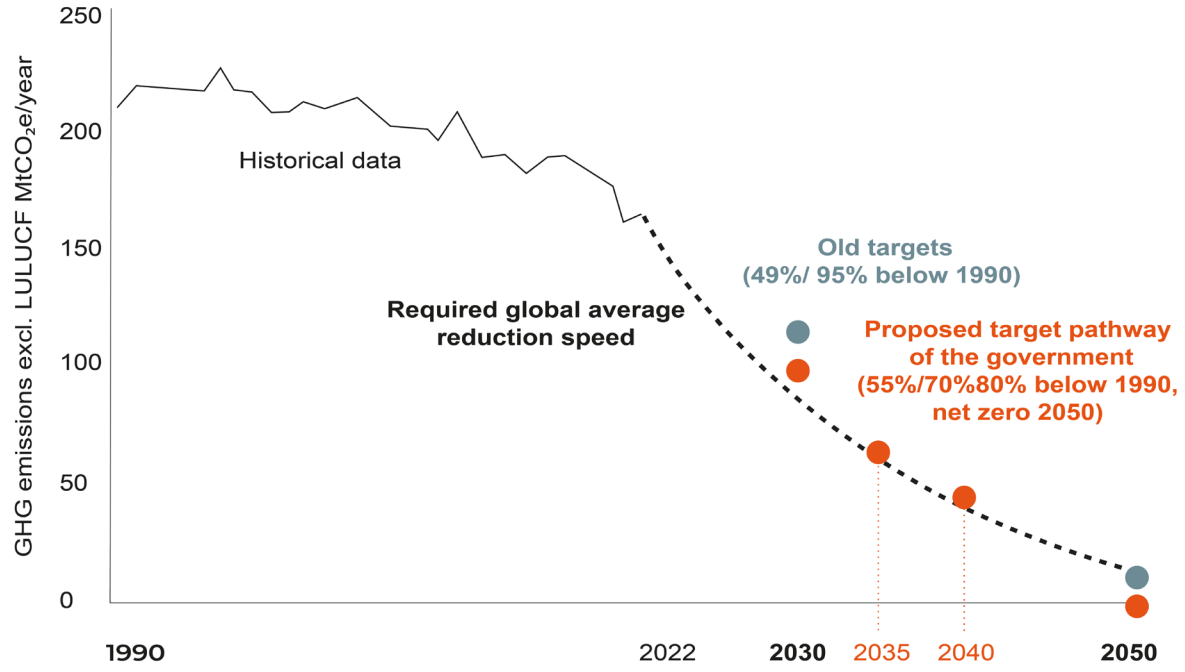


Figure 4: National targets compared to the required global speed of emissions reduction for 1.5°C.

Sources: Historical data (Statistics Netherlands (CBS), 2022a, 2022b), Targets (VVD D66 CDA en ChristenUnie, 2021)*, required global average speed: authors own calculations based on the average of selected 1.5°C scenarios from the IPCC special report, extracted from (IIASA, 2018)*

Note: The old 49% reduction target did not cover emissions from LULUCF, while the new target will. This report assumes a 55% reduction across all sectors, because some information about the contribution of LULUCF to the target became available only after finalisation of the data analysis behind this report. This leads to a small deviation for the 2030 target as compared to draft policy documents of the Netherlands' government: Those suggest a LULUCF net-emissions target of 4.1 MtCO2 in 2030 (Ministry of Economic Affairs and Climate Change, 2022)*, while a 55% reduction across all sectors would lead to net-emissions of the sector of 2.7 MtCO2 in 2030. The difference for the 2030 target excl. LULUCF is thus 1.8 MtCO2e or less than 2%. Data for other years is insufficient to recalculate the target pathway.*

GHG emissions not covered by the NDC

The text above describes the Netherlands' targets for national emissions, as they are covered in GHG inventories for the international processes. Another element is international transport, where the Netherlands' government coalition intends to set a ceiling for the CO_2 emissions of departing international aircrafts. The proposed goal is zero emissions by 2070. According to Climate Action Tracker, global emissions from aviation should decrease by about 90% already by 2050, compared to

today (CAT, 2022). Another element that could be interesting to consider for the Netherlands is consumption-based emissions, i.e. GHG emissions that occur in other countries due to the consumption of products in the Netherlands. Sweden currently is the only country to pursue the setting up of such a target (Morgan, 2022), where important details are still open, for example how to account for exports in turn.

3.2 Distributing the remaining carbon budget

Most global scenarios for 1.5°C show net-negative CO_2 emissions as of around 2050 from nature-based solutions and/or technological carbon dioxide removal, in the order of magnitude 10 $GtCO_2$ in the long run, or about 25% of current global CO_2 emissions (see Figure 2). Anthropogenic GHG emissions and sources overall reach a balance within the second half of the century as well and become negative afterwards in 1.5°C scenarios.

Given the geographical conditions, the Netherlands have limited potential for structural negative emissions that would come for example from forest sinks. The sinks from BECCS required to reach net-zero emissions in 2050 is estimated at 1.2 to 5.5 $MtCO_2e$/yr in 2050 (Ouden *et al.*, 2020), or about 4% of current CO_2 emissions at maximum. A PBL report estimates a potential for various CDR options that do not require bio-feedstocks of up to 7.2 $MtCO_2$ in 2050, but also mentions high costs as potential barriers to achieving such a level (Strengers *et al.*, 2022)[7]. A cautionary interpretation of this means that the Netherlands may balance out some residual emissions (mostly non-CO2), but cannot rely on substantial removal.

To contribute according to the global average across all sinks and sources, a faster than average required reduction of CO_2 emissions is thus necessary in the Netherlands, compared to global emissions. 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 (Ouden *et al.*, 2020).

We calculate the Netherlands' share of the remaining carbon budget, assuming a limited amount of negative emissions, 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, the Netherlands would need to reduce CO_2 emissions to zero by 2037 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 (excl. emissions from LULUCF) would be 64%. The government's anticipated target pathway would exceed its budget by 530 $MtCO_2e$ between today and 2050, three times current annual GHG emissions of the Netherlands.

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. The German Constitutional Court made a reference to this approach in its ruling that the German government should revise its climate targets (see Box 1). According to this approach, the Netherlands would need to reduce CO_2 emissions to zero already by 2030 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 (excl. emissions from LULUCF)

[7] The PBL discusses limitations of biomass import and therefore calculates a realistic import based on expected availability and share of world population results in 230-430 PJ. The Netherlands can provide 230 PJ - which comes to a total of 460-660 PJ. This is in the same order of magnitude required according to Ouden et al.

would be 94%. The government's anticipated target pathway would exceed its budget by 1070 $MtCO_2e$ between today and 2050, six times current annual GHG emissions of the Netherlands.

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 the Netherlands (see next section).

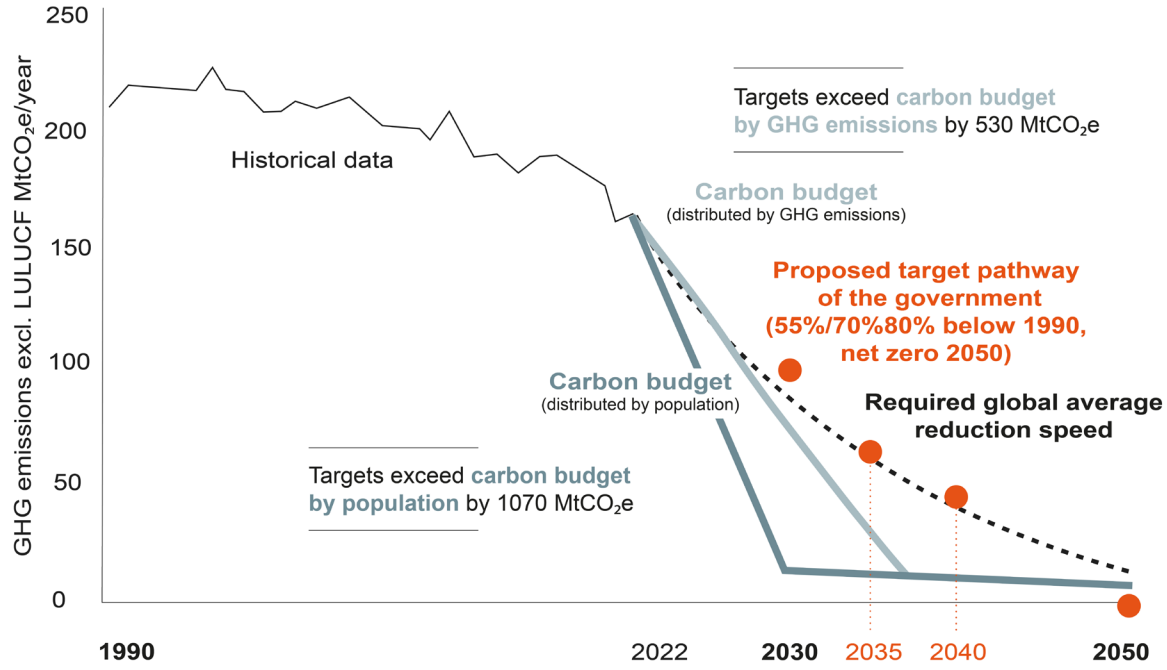


Figure 5: Mirroring global carbon budgets while considering the limited potential for negative emissions in the Netherlands

Sources: Historical emissions (Statistics Netherlands (CBS), 2022a, 2022b)*, Targets* (VVD D66 CDA en ChristenUnie, 2021)*, emissions for future scenarios developed by the authors with carbon budgets from* (IPCC, 2021)

The illustrated pathway in Figure 5 assumes an immediate deviation from current trends towards 0 in 2037. If action is delayed and the Netherlands' CO2 emissions remained at current levels, these emissions would need to be compensated, making the trajectory even steeper and reaching zero emissions earlier (see Figure 6).

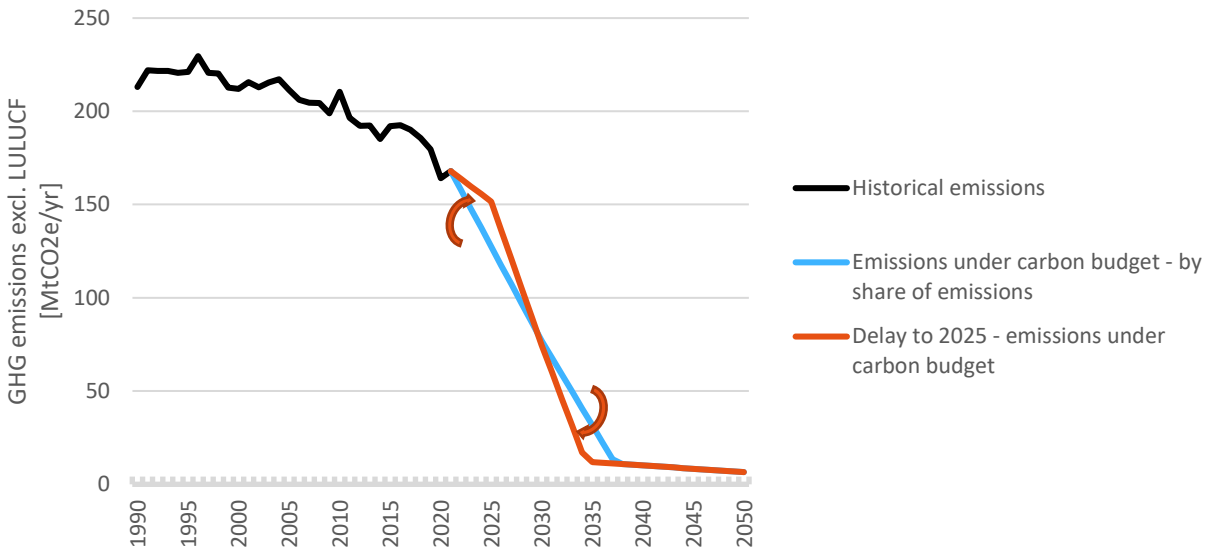


Figure 6: Illustration of the implications of a delay in additional action on the carbon budgets of the Netherlands.

Sources: Historical emissions (Statistics Netherlands (CBS), 2022a, 2022b)*, future scenarios developed by the authors with carbon budgets from* (IPCC, 2021)

Increasing the Netherlands' CO_2 removal to the maximum potential would make only a small difference. The maximum CO_2 sink capacity is estimated at -5.5 $MtCO_2e$ in 2050 (Ouden *et al.*, 2020), which is equivalent to only a small percentage of current emissions. If these sinks were fully intensified, the reduction rate earlier on could in theory be slightly slower. However, given the limited size of possible sinks, the effect on the earlier growth rate and the year when the Netherlands should reach zero CO_2 is minor and therefore not reflected in the data illustrated above[8].

3.3 Accounting for equity principles

The IPCC pathways taken as the basis for the data in the previous section look at the global level and do not consider a fair distribution of efforts across countries. The Netherlands has a comparably high share of historical responsibility and capability. We take into account the results of effort sharing approaches to provide a fair contribution of the Netherlands (see Figure 7).

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 the Netherlands, based on their historical responsibility and capabilities.

For the Netherlands, the paper names a fair share range of -95 $MtCO_2e$ to 130 $MtCO_2e$ in 2030. This range includes a wide range of effort sharing approaches[9], 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 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

[8] For example, if sinks were to gradually increase to 5.5 MtCO2/yr in 2050 starting in 2030, the cumulative sink would be about 50 MtCO2e, compared to a remaining budget of 1150 MtCO2e, or about one third of current annual CO2 emissions.

[9] 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.

by this factor for all countries. For the Netherlands, this means that the fair share emissions level compatible with 1.5°C is below zero, at -27.3 $MtCO_2e$ 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.

The fair share trajectory starts in 2010 as this is the base year used in the paper. 2010 can be understood as the year when the efforts should have started and then move to the levels depicted for 2030[10], for a fair contribution. 2010 is the commonly used starting year in research on effort sharing approaches (van den Berg *et al.*, 2020).

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).

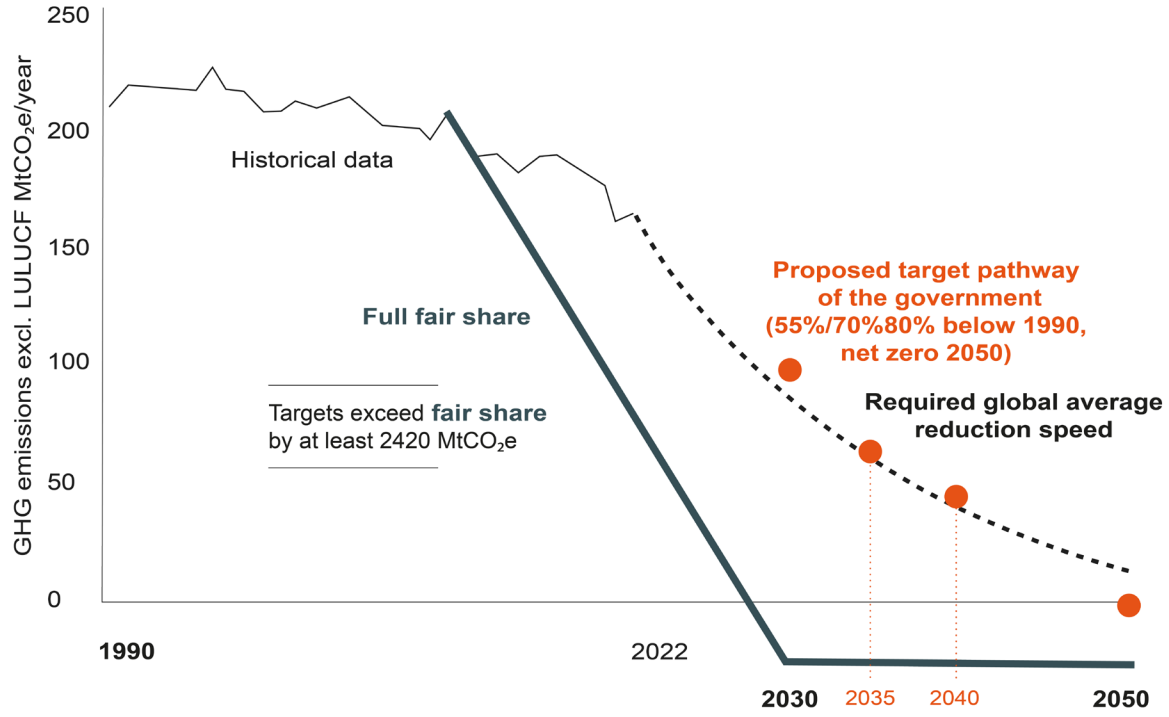


Figure 7: A fair share for the Netherlands.

Sources: Historical emissions (Statistics Netherlands (CBS), 2022a, 2022b)*, Targets* (VVD D66 CDA en ChristenUnie, 2021)*, Fair share in 2030: (Rajamani et al., 2021).*

According to the fair share, the Netherlands has already used up its budget in the last decade and now needs to make up for this. The Netherlands should reach net-zero GHGs already before 2030, in 2027 assuming a linear trajectory from 2010 (see Figure 7). Since 2010, GHG emissions in the Netherlands has not decreased as fast as the fair share trajectory would have required, and in fact the remaining budget has already been used up since then, i.e. the budget under the fair share trajectory depicted in Figure 7 as of today is already negative and the Netherlands need to make up for the past lack of action.

[10] The paper does not provide numbers for other years. When comparing for example the Climate Action Tracker results of similar countries as the Netherlands, we see that the fair share decreases further as global pathways approach 0. For this study we illustrate the 2030 value continuing up to 2050. This is a simplification that means that the fair share budget depicted here is on the less ambitious end.

The government's target trajectory exceeds what is required from the fair share by about 2400 $MtCO_2e$, about 14 times the current (2021) annual emissions.

The role of international support

Reaching this level domestically is required from a perspective of common but differentiated responsibilities and capabilities, but will likely run into physical limits: Decarbonising all sectors within a few years is very difficult and the Netherlands do not have enough potential for sinks that would be big enough to compensate for the remaining CO_2 emissions and other gases, for example from agricultural production.

This means, that to uphold its fair share contribution, the Netherlands need to provide a substantial amount of support to other countries, to enable those to implement mitigation efforts that go beyond their responsibilities and capabilities, and transition to a Paris-compatible pathway.

As described earlier, international support is an integral element of the Paris Agreement and it needs to be ramped up urgently. There is no robust method to directly translate fair share allowances as illustrated here to monetary support units, given that climate finance is not always equally effective. Some support may not even lead to direct emission reductions but could have a long-term transformative effect.

Some countries are planning to rely on international offsets to fulfil part of their mitigation targets. Article 6 under the Paris Agreement is supposed to facilitate such trading, however, it is an ambition raising mechanism rather than a flexibility mechanism, thus fulfilling a very different purpose than the Clean Development Mechanism under the Kyoto Protocol. In practice, this leads to limited applications, and there is a severe threat that an unambitious application of the Article undermines ambition of host and donor countries (Warnecke *et al.*, 2018; Warnecke, Day and Fearnehough, 2021).

4 Conclusions

The Netherlands' anticipated target pathway is not Paris-compatible with the equity aspects of the Paris Agreement. The Netherlands' proposed target pathway of a 55%/70%/80% reduction below 1990 in 2030/2035/2040 and GHG neutrality by 2050 roughly follows the *globally* required average speed of reductions of GHGs. This pathway implicitly assumes that a large share of emissions is removed from the atmosphere in the second half of the century, neglecting that the Netherlands has limited potential to do so. Adopting this target pathway would also require the rest of the world to reduce at the same speed, neglecting that the Netherlands has higher responsibility and capacity than the global average. That is contradictory to the principle of the UNFCCC for Common But Differentiated Responsibilities and Capabilities.

The Netherlands can consider the following concepts in setting its national targets, to live up to its common but differentiated responsibilities and capabilities as agreed in the Paris Agreement:

Distributing the remaining carbon budget: In the absence of the opportunities for large structural negative emissions in the Netherlands, carbon budgets for the Netherlands would be comparably smaller and depleted earlier than on global average, assuming a linear trajectory. For the Netherlands, distributing the remaining carbon budget based on the current share of population means that CO_2 emissions need to reach 0 around 2030 to stay within the Netherlands' budget for limiting warming to 1.5°C with a 67% chance. Total greenhouse gas emissions would need to decline by 94% below 1990 by 2030. The proposed target pathway exceeds the budget under this pathway by 1070 $MtCO_2e$, or by six times current annual emissions of the Netherlands (see Figure 8).

A variation of the distribution of carbon budgets is by the current share of GHG emissions rather than population, which would lead to reaching 0 CO_2 around 2037, a reduction of GHG emissions by 64% compared to 1990 by 2030 and the proposed target pathway would exceed this budget by 530 $MtCO_2e$. This is not in line with the principle of common but differentiated responsibilities and capabilities of the United Nations Framework Convention on Climate Change (UNFCCC).

The Netherlands' full fair share: The distribution of the global carbon budget as above neglects to a large extent historical emissions until now and capabilities to mitigate, relative to other countries. For contributing its full fair share in 2030 and beyond, the Netherlands' emission allocations need to be below zero already in 2030, and need to remain there going forward. In fact, the emissions budget under this approach is already used up today, and the Netherlands need to make up for the lack of action in the last decade.

Under the assumption that GHG emissions as of 2010 should have decreased linearly towards 2030, and remain at 2030 levels going forward, the GHG emissions budgets of the Netherlands are already used up. The coalition's target pathway of reducing emissions by 55%, 70% and 80% in 2030, 2035 and 2040, and to achieve net-zero in 2050 exceeds the Netherlands fair share by about 2400 $MtCO_2e$, or 14 times current emission levels (see Figure 8).

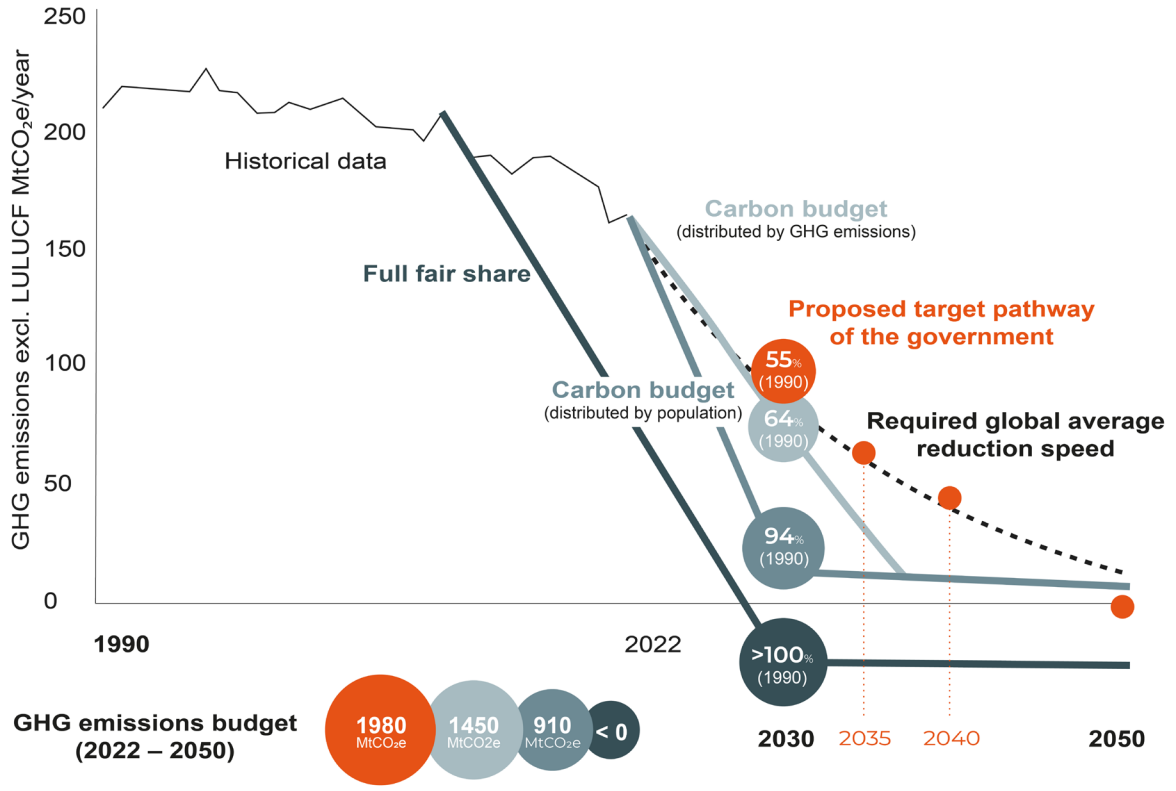


Figure 8: Summary of target pathways as in the coalition agreement and results of different ways of distributing required global efforts.

Responsibilities and capabilities of countries are very far apart. This imbalance between the responsibilities and capabilities and the physical limitations and requirements of a transition to a 1.5°C pathway require compensation between developed and developing countries. **For the Netherlands, contributing their fair share means getting domestically as close to zero as possible and as fast as possible, and substantially supporting other countries' mitigation action.**

The risk of delaying action –Every year of delayed action means either faster decrease of domestic emissions to catch up or more support to others. Compensating for this difference later is difficult, first because of the lack of potential sinks in the required order of magnitude, and also because while the calculations mathematically work, the climate system physically cannot be limitlessly filled and later be compensated for. Delaying action increases the risks for tipping points and even more severe climate change impacts.

References

van den Berg, N.J. *et al.* (2020) 'Implications of various effort-sharing approaches for national carbon budgets and emission pathways', *Climatic Change*, 162(4), pp. 1805–1822. Available at: https://doi.org/10.1007/s10584-019-02368-y.

BVerfG (2021) *Bundesverfassungsgericht, Beschluss des Ersten Senats vom 24. März 2021 - 1 BvR 2656/18 -, Rn. 1-270,*. Available at: http://www.bverfg.de/e/rs20210324_1bvr265618.html.

CAT (2022) *Sector Assessment: International Aviation (update of 9 May 2022)*. Climate Action Tracker. Available at: https://climateactiontracker.org/sectors/aviation/ (Accessed: 19 May 2022).

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 (2021a) *CAT rating methodology - Detailed description of the Climate Action Tracker rating methods*. Available at: https://climateactiontracker.org/documents/874/CAT_2021-09_RatingMethodology_FullDescriptionNewSystem.pdf.

Climate Action Tracker (2021b) *Country Assessments (updated September 2020 - August 2021)*. Climate Action Tracker (Climate Analytics, NewClimate Institute). Available at: https://climateactiontracker.org/countries (Accessed: 31 August 2021).

Climate Action Tracker (2021c) *Glasgow's 2030 credibility gap: net zero's lip service to climate action. Warming Projections Global Update. November 2021*. Climate Analytics, NewClimate Institute. Available at: https://climateactiontracker.org/publications/glasgows-2030-credibility-gap-net-zeros-lip-service-to-climate-action/.

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

Climate Home (2022) *Finland sets world's most ambitious climate target in law*. Available at: https://www.climatechangenews.com/2022/05/31/finland-sets-worlds-most-ambitious-climate-target-in-law/ (Accessed: 5 June 2022).

Global Carbon Project (2022) *Global Carbon Budget - Summary Highlights*. Available at: https://www.globalcarbonproject.org/carbonbudget/21/highlights.htm (Accessed: 26 June 2022).

Greenpeace (2020) *EU climate diet: 71% less meat by 2030*.

Hamers, D. *et al.* (2021) *Reflections on environmental topics in the coalition agreement 2021 - 2025 (Reflectie op de leefomgevingsthema's in het coalitieakkoord 2021-2025)*. Available at: https://www.pbl.nl/sites/default/files/downloads/pbl-2021-reflectie-leefomgevingsthemas-coalitieakkoord-4884-2.pdf.

Höhne, N. *et al.* (2019) 'A possible 2050 climate target for the EU'. Cologne. Available at: https://newclimate.org/wp-content/uploads/2019/09/EU2050_Target_Adequacy.pdf (Accessed: 25 September 2019).

Höhne, N., den Elzen, M. and Escalante, D. (2014) 'Regional GHG reduction targets based on effort sharing: a comparison of studies', *Climate Policy*, 14(1), pp. 122–147. Available at: https://doi.org/10.1080/14693062.2014.849452.

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.

IIASA (2018) *IAMC 1.5°C Scenario Explorer*. International Institute for Applied System Analysis (IIASA). Available at: https://data.ene.iiasa.ac.at/iamc-1.5c-explorer/#/login (Accessed: 29 January 2019).

IPCC (2007) *Summary for Policymakers of the Synthesis Report of the IPCC Fourth Assessment Report*. Geneva; Switzerland.

IPCC (2018a) *IPCC special report on the impacts of global warming of 1.5°C - Summary for policy makers*. Intergovernmental Panel on Climate Change (IPCC). Available at: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf.

IPCC (2018b) 'Summary for Policymakers', in V. Masson-Delmotte et al. (eds) *Global Warming of 1.5°C Summary for policy makers*. Cambridge, UK; New York, NY, USA: Cambridge University Press, pp. 3–24. Available at: https://doi.org/10.1017/9781009157940.001.

IPCC (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*. Cambridge University Press. Available at: https://www.ipcc.ch/report/ar6/wg1/.

IPCC (2022) 'Mitigation of Climate Change - Summary for Policymakers (SPM)', *Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Preprint]. Intergovernmental Panel on Climate Change (IPCC). Available at: https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf.

Kuiper, E.-J. (2022) *Are the Dutch climate targets in line with the 1.5°C of Paris? (Zijn de Nederlandse klimaatdoelen in lijn met de 1.5°C van Parijs?)*.

Ministry of Economic Affairs and Climate Change (2022) *Draft Climate Policy Program (Ontwerp Beleids-programma Klimaat)*. Available at: https://www.klimaatakkoord.nl/binaries/klimaatakkoord/documenten/publicaties/2022/06/02/ontwerp-beleidsprogramma-klimaat/Ontwerp_Beleidsprogramma_Klimaat.pdf.

Ministry of Economics and Climate (2022) 'Answers to parliamentary questions about the most recent IPCC report in relation to Bonaire, Sint Eustatius and Saba'. Available at: https://www.rijksoverheid.nl/documenten/kamerstukken/2020/07/01/kamerbrief-uitvoering-motie-gebruik-vaste-houtige-biomassa-voor-energietoepassingen.

Ministry of the Environment (2022) *Finland's national climate change policy*. Available at: https://ym.fi/en/finland-s-national-climate-change-policy (Accessed: 26 June 2022).

Morgan, S. (2022) 'Sweden set to be world's first country to target consumption-based emission cuts', *Climate Home*, April.

Natuur & Milieu (2017) *Towards a healthy and sustainable food system by 2030 (Naar een gezond en duurzaam voedselsysteem in 2030)*.

Ollikainen, M., Weaver, S. and Seppälä, J. (2019) *An approach to nationally determined contributions consistent with the Paris climate agreement and climate science: Application to Finland and the EU*. Available at: https://www.ilmastopaneeli.fi/wp-content/uploads/2019/10/Finlands-globally-responsible-contribution_final.pdf (Accessed: 5 June 2022).

Ouden, B. den *et al.* (2020) *Climate neutral energy scenarios 2050 (Klimaatneutrale energiescenario's 2050)*. Available at: https://www.berenschot.nl/actueel/2020/april/nederland-klimaatneutraal-2050/.

Pathak, M. *et al.* (2022) 'Technical summary', 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*. Cambrigde, 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.

Ruyssenaars, P.G. *et al.* (2021) *Greenhouse gas emissions in the Netherlands 1990-2019*, *National Inventory Report 2021*. Available at: https://www.rivm.nl/bibliotheek/rapporten/2021-0007.pdf.

Sachverständigenrat für Umweltfragen (SRU) (2020) *Für eine entschlossene Umweltpolitik in Deutschland und Europa (For determined environmental politics in Germany and Europe)*, *Sachverständigenrat für Umweltfragen*. Available at: https://www.umweltrat.de/SharedDocs/Downloads/DE/01_Umweltgutachten/2016_2020/2020_Umweltgutachten_Entschlossene_Umweltpolitik.pdf?__blob=publicationFile&v=2.

Sachverständigenrat für Umweltfragen (SRU) (2022) *How much CO2 can Germany still emit? Questions and Answers on the CO2 budget (Wie viel CO_2 darf Deutschland maximal noch ausstoßen ? Fragen und Antworten zum CO_2-Budget)*. Available at: https://www.umweltrat.de/SharedDocs/Downloads/DE/04_Stellungnahmen/2020_2024/2022_06_fragen_und_antworten_zum_co2_budget.pdf?__blob=publicationFile&v=15.

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.

Statistics Netherlands (CBS) (2022a) *Emissions of greenhouse gases according to IPCC guide-lines*. Available at: https://opendata.cbs.nl/#/CBS/en/dataset/70946eng/table?searchKeywords=greenhouse gas emissions (Accessed: 28 July 2022).

Statistics Netherlands (CBS) (2022b) *Greenhouse gas emissions 2.1 percent higher in 2021*. Available at: https://www.cbs.nl/en-gb/news/2022/11/greenhouse-gas-emissions-2-1-percent-higher-in-2021#:~:text=Compared to 2019%2C CO2,partly on account of aviation (Accessed: 28 July 2022).

Strengers, B. *et al.* (2022) *NEGATIEVE EMISSIES. Technisch potentieel, realistisch potentieel en kosten voor Nederland*. Available at: https://www.pbl.nl/sites/default/files/downloads/pbl-2017-negatieve-emissies-technisch-potentieel-realistisch-potentieel-en-kosten-voor-nederland_2606.pdf.

Timperley, J. (2021) 'The broken $100-billion promise of climate finance - and how to fix it', *Nature*, 598(7881), pp. 400–402. Available at: https://doi.org/10.1038/d41586-021-02846-3.

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 (2015a) 'Decision 1/CP.21: Adoption of the Paris Agreement (FCCC/CP/2015/10/Add.1).' Available at: https://unfccc.int/documents/9097.

UNFCCC (2015b) *Paris Agreement*. Paris: United Nations Framework Convention on Climate Change (UNFCCC). Available at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (Accessed: 25 January 2019).

United Nations (1992) *United Nations Framework Convention on Climate Change. Entered into force 1994.* Available at: http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf.

van Vuuren, D.P. *et al.* (2017) *The Implications of the Paris Climate Agreement for the Dutch Climate Policy Objectives*.

VVD D66 CDA en ChristenUnie (2021) 'Coalition agreement 2021 - 2025'. Available at: https://open.overheid.nl/repository/ronl-f3cb0d9c-878b-4608-9f6a-8a2f6e24a410/1/pdf/coalitieakkoord-2021-2025.pdf.

Warnecke, C. *et al.* (2018) *Opportunities and safeguards for ambition raising through Article 6: The perspective of countries transferring mitigation outcomes*. Berlin: NewClimate Institute. Available at: https://newclimate.org/resources/publications/opportunities-and-safeguards-for-ambition-raising-through-article-6.

Warnecke, C., Day, T. and Fearnehough, H. (2021) *Switerland's bilateral agreement to offset their emissions set a poor precedent for ambition ahead of COP26*. Available at: https://newclimate.org/news/switzerlands-bilateral-agreements-to-offset-their-emissions-set-a-poor-precedent-for-ambition (Accessed: 26 June 2022).

Winkler, H. (2020) 'Putting equity into practice in the global stocktake under the Paris Agreement', *Climate Policy*, 20(1), pp. 124–132. Available at: https://doi.org/https://doi.org/10.1080/14693062.2019.1680337.

Annex: Detailed approach to calculating the carbon budget for the Netherlands

For CO_2 emissions:

- Take **total global remaining CO_2 budget** from IPCC report as of 2020.
- Calculate the **share of the Netherlands** of current global budgets according to the current share of emissions (0.36%) and of population (0.22%).
- Apply this share to the globally remaining budget
- Deduct already "missed years" until today (2018 – 2021).
- Assuming a linear reduction trajectory to 0 (base year 2021), calculate the year when CO_2 is zero.

Note that this study does not quantitatively include the potential of sinks, given the uncertainty in available estimates. This study also excludes LULUCF, which has consistently been a source of emissions in the Netherlands of around 5 $MtCO_2e/yr$ in the last decades. The negative effects of the LULUCF sector on the budget is likely larger than the potential of sinks.

This study uses the budget for limiting warming to 1.5°C with a high chance (67%) by the end of the century. 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.

Overview table of calculation of the national carbon budget.

	1,5		**1.7**		**2**	
	0,67	0,5	0,67	0,5	0,67	0,5
Global CO2-budget as of 1.1.2020, incl. LULUCF	400	500	700	850	1150	1350
Global timing for net zero CO_2 emissions	2039	2044	2055	2062	2078	2088
Budget of the Netherlands according to share of emissions in 2021 after 2019	1,44	1,80	2,52	3,06	4,14	4,86
Budget of the Netherlands according to share of emissions in 2021 after 2021	1,15	1,51	2,23	2,77	3,85	4,57
Timing for the Netherlands for net zero CO_2 according to share of emissions	2037	2042	2053	2060	2075	2086
Budget of the Netherlands according to share of population in 2021 after 2019	0,90	1,12	1,57	1,91	2,58	3,03
Budget of the Netherlands according to share of population in 2021 after 2021	0,61	0,83	1,28	1,62	2,30	2,74
Timing for the Netherlands for net zero CO_2 according to share of population	2030	2033	2039	2044	2053	2060

For non-CO_2 emissions:

Budgets consistent with 1.5°C pathways are not available for non-CO_2 emissions. Instead, this report follows different suggestions for reducing the production and consumption of livestock as a proxy for the required reduction of non-CO_2 emissions (methane and nitrous oxide)[11]):

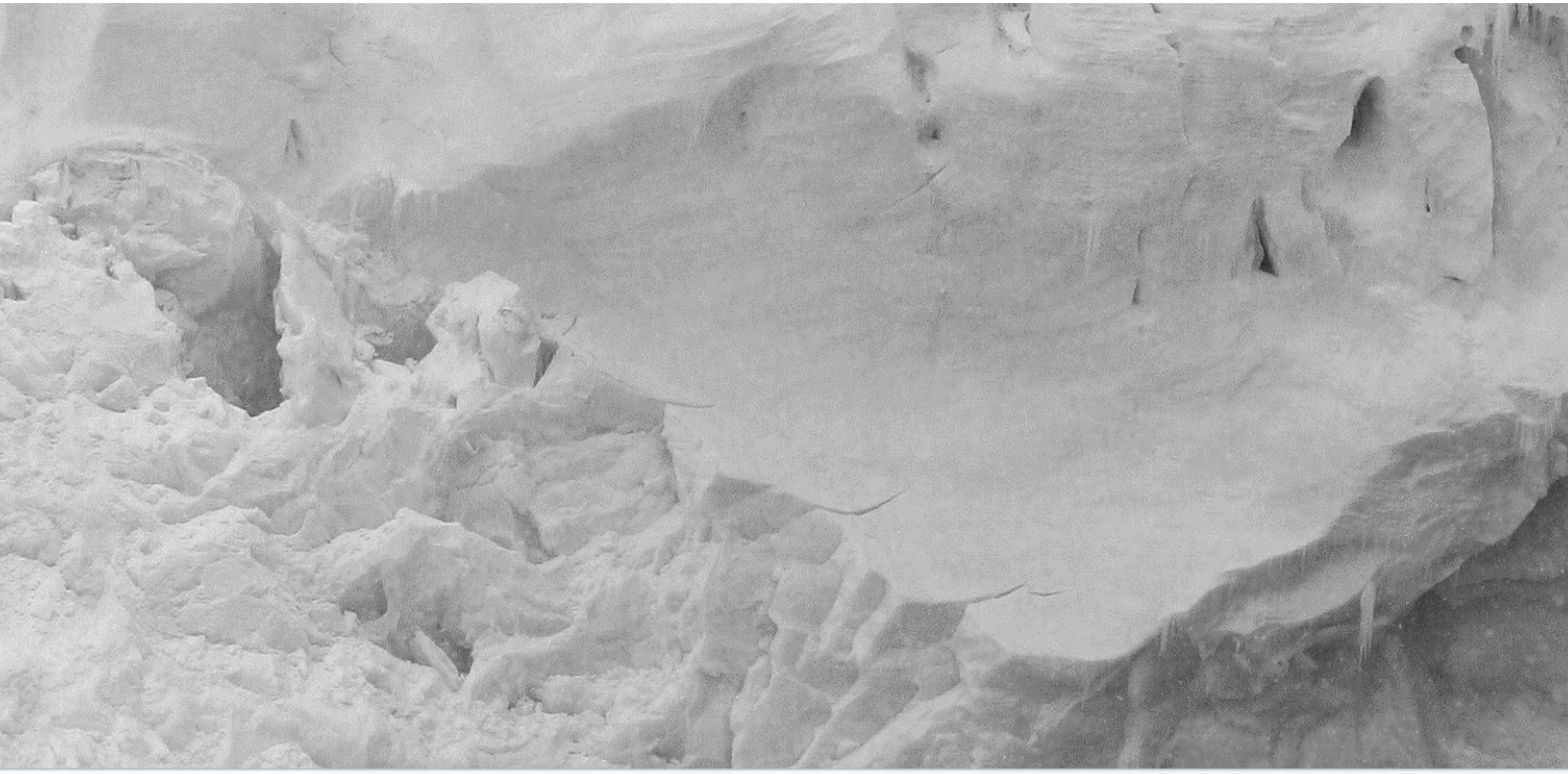
- 50% below current levels by 2030 based on Natuur & Milieu 2017 (Natuur & Milieu, 2017).
- 70-80% below current levels by 2050 based on Greenpeace (Greenpeace, 2020).

Applying the same rates as suggested for the reduction of livestock and animal product is a simplification and potentially ignores international trade of animal products and a partially non-linear correlation between the production of animal products and parts of the emissions. This means that this approach illustrates a broad sense of direction, but does not provide a detailed technical analysis of what a possible or necessary reduction of methane and nitrous oxide emissions.

The global average required speed of reduction for the individual gases is slower than for the Netherlands. For methane, this means roughly reducing by 50%, for nitrogen reducing by 20%, by 2050 compared to 2020, with further reductions after 2050. However, the global numbers include strongly growing agricultural production and consumption in developing countries, which still required some growth to satisfy dietary needs of the population.

The **sum of all gases** is the trajectory shown in the graphic. 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.

[11] F-gases are irrelevant in the Netherlands according to the GHG inventory (Ruyssenaars *et al.*, 2021).



NewClimate – Institute for Climate Policy and Global Sustainability gGmbH

Cologne Office
Waidmarkt 11a
50676 Cologne
Germany

T +49 (0) 221 999833-00
F +49 (0) 221 999833-19

Berlin Office
Schönhauser Allee 10-11
10119 Berlin
Germany

E info@newclimate.org
www.newclimate.org