# Policy implications of Europe's dwindling carbon budget

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## Defining 1.5°C compatible $CO_2$ targets and climate finance responsibilities for a range of European countries

Since the first publication of global carbon budget estimates by the Intergovernmental Panel on Climate Change (IPCC) in 2013, a lot of progress has been made to deal with some of the uncertainties related to the use of carbon budgets in climate policy development. The latest numbers as contained in the IPCC's Sixth Assessment Report (AR6) are considered more robust than ever, but a number of challenges remain when using the carbon budget concept to set emission reduction targets. This briefing aims to contribute to the discussion on the potential application of carbon budgets in the policy debate by identifying both emission reduction targets and climate finance responsibilities for 42[1] European countries based on a 1.5°C compatible global carbon budget.

## 1. The carbon budget concept

There is robust scientific understanding that global temperature rise is near-linear proportional to the total amount of $CO_2$ that the world emits (and removes). This knowledge has led to the development of the global carbon budget concept which identifies the cumulative amount of total $CO_2$ that can be emitted - between pre-industrial times and the moment net zero $CO_2$ emissions are achieved - to stay within a certain temperature limit. Deducting the amount of $CO_2$ already emitted from the total carbon budget provides an estimation of the remaining carbon budget. The level of certainty with which this remaining budget can be defined has improved substantially over the last decade[2], as reflected by its inclusion in the Glasgow Climate Pact[3] (COP26, November 2021): *"3. Expresses alarm and utmost concern that human activities have caused around 1.1°C of warming to date, that impacts are already being felt in every region, and that carbon budgets consistent with achieving the Paris Agreement temperature goal are now small and being rapidly depleted".*

## 2. A 1.5°C compatible remaining carbon budget

The contribution of IPCC Working Group I (WG1) to AR6 from August 2021[4] provides an estimation of the remaining carbon budgets to limit temperature rise to 1.5°C, 1.7°C and 2°C, with likelihoods between 17% and 83% (see table SPM.2 below). The lower the temperature target and/or the higher the likelihood, the lower the remaining budget. In this exercise, given AR6's clear evidence of the risks of overshooting 1.5°C,

1 This includes: 27 EU Member States, 7 official candidate EU Member States (Albania, Moldova, Montenegro, Northern Macedonia, Serbia, Ukraine and Turkey), 3 potential candidates (Bosnia & Herzegovina, Georgia and Kosovo), 1 former member (UK) and 4 EFTA Member States (Iceland, Liechtenstein, Norway and Switzerland)

2 Joeri Rogelj (2021). A Deep Dive Into The IPCC's Updated Carbon Budget Numbers. In: www.realclimate.org/index.php/archives/2021/08/a-deep-dive-into-the-ipccs-updated-carbon-budget-numbers

3 UNFCCC (2021). Decision -/CMA.3. Glasgow Climate Pact. 13 November 2021. unfccc.int/documents/310497

4 IPCC WG 1 (2021). Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group 1 to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf

we consider that limiting temperature rise to 1.5°C is the only correct interpretation of the commitments made in the 2015 Paris Climate Agreement5, and aim for a reasonable likelihood of 66% (following the approach of both the UNFCCC and UNEP in their assessment reports6) of keeping temperature rise to 1.5°C by the end of the century. Furthermore, in line with the IPCC WG III (WG3) contribution to AR6[7], the date for reaching net zero $CO_2$ emissions globally is set at 2050.

This limits the estimated remaining carbon budget for the period 2020 to 2050 to 400 $GtCO_2$.

**Table SPM.2 | Estimates of historical carbon dioxide ($CO_2$) emissions and remaining carbon budgets.** Estimated remaining carbon budgets are calculated from the beginning of 2020 and extend until global net zero $CO_2$ emissions are reached. They refer to $CO_2$ emissions, while accounting for the global warming effect of non-$CO_2$ emissions. Global warming in this table refers to human-induced global surface temperature increase, which excludes the impact of natural variability on global temperatures in individual years.
{Table 3.1, 5.5.1, 5.5.2, Box 5.2, Table 5.1, Table 5.7, Table 5.8, Table TS.3}

| Global Warming Between 1850–1900 and 2010–2019 (°C) | | Historical Cumulative $CO_2$ Emissions from 1850 to 2019 ($GtCO_2$) | | | | | |
|---|---|---|---|---|---|---|---|
| 1.07 (0.8–1.3; likely range) | | 2390 (± 240; likely range) | | | | | |
| Approximate global warming relative to 1850–1900 until temperature limit (°C)[a] | Additional global warming relative to 2010–2019 until temperature limit (°C) | Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$) *Likelihood of limiting global warming to temperature limit*[b] | | | | | Variations in reductions in non-$CO_2$ emissions[c] |
| | | *17%* | *33%* | *50%* | *67%* | *83%* | |
| 1.5 | 0.43 | 900 | 650 | 500 | 400 | 300 | Higher or lower reductions in accompanying non-$CO_2$ emissions can increase or decrease the values on the left by 220 $GtCO_2$ or more |
| 1.7 | 0.63 | 1450 | 1050 | 850 | 700 | 550 | |
| 2.0 | 0.93 | 2300 | 1700 | 1350 | 1150 | 900 | |

## 3. Challenges to the use of the carbon budget

A number of challenges remain with regard to using the carbon budget concept for climate policy development. These challenges focus around four key elements where carbon budgets differ from many of the Nationally Determined Contributions (NDCs) that are part of the 2015 Paris Agreement infrastructure.

### (a) CO2 only

The carbon budget concept applies to $CO_2$ emissions only, and not to all greenhouse gases. There is therefore a certain level of uncertainty in the definition of the remaining carbon budget (as reflected in the far right column of table SPM.2 above). This coincides with assessments that reporting and monitoring of non-$CO_2$ emissions is not as accurate as reporting on $CO_2$ emissions, as evidenced in Figure 1 below (in particular look at the differences in methane emission reporting under the "Invest in new data streams" heading). While climate policies and targets, especially in Europe, are often targeting

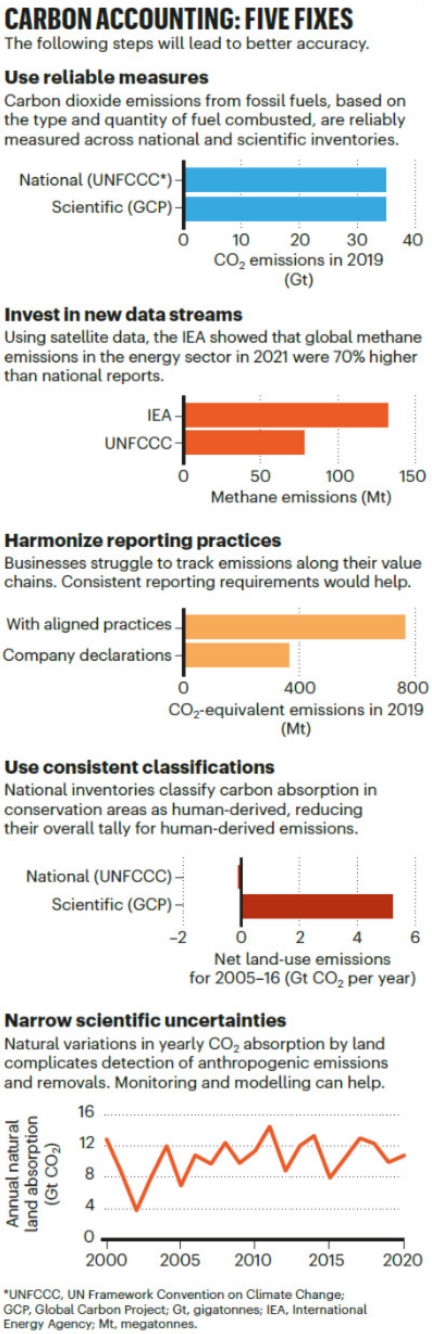
5 United Nations (2015). Paris Agreement. 12 December 2015. unfccc.int/sites/default/files/english_paris_agreement.pdf

6 see: UNFCCC (2021). Nationally determined contributions under the Paris Agreement. Revised synthesis report by the secretariat. 25 October 2021. unfccc.int/documents/307628; and: UNEP (2021). The Heat Is On. A world of climate promises not yet delivered. Emissions Gap Report 2021. October 2021. www.unep.org/resources/emissions-gap-report-2021

7 IPCC WG 3(2022). Summary for Policymakers. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group 3 to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf

all greenhouse gas emissions, in this exercise we focus on $CO_2$ emissions only. For many (most) European countries there is a strong alignment between reductions in $CO_2$ and other greenhouse gases which means that $CO_2$ reduction targets can be easily translated to greenhouse gas targets. However, for a few European countries such as Denmark, Estonia, Greece, Ireland, Malta and Portugal, differences in the share of $CO_2$ in total greenhouse gas emissions observed in the last 5 years are close to or beyond 5% and more careful consideration might be needed for those countries.

Figure1




### (b) CO2 emissions and removals

The carbon budget reflects what the atmosphere sees in terms of $CO_2$ emissions and removals, and thus in principle coincides with net-zero policies that combine emissions and removals (such as in the revised EU NDC of reducing net emissions by at least 55% by 2030). However, in many countries the accounting methodologies for land-based $CO_2$ removals do not reflect the same principle of reporting what the atmosphere sees. There are substantial differences to be observed between the removals accounted for and actual $CO_2$ removals on the ground as evidenced in Figure 1 above (under the heading "Use consistent classifications"). This may lead to overly optimistic approaches in certain countries. As a result of current accounting for instance, Sweden's $CO_2$ emissions in 2020 were net negative, meaning the country reported a greater amount of removals than the amount of $CO_2$ it had emitted. Given the many questions that remain, and given the huge diversity of impacts of adding removals (e.g. some countries such as Bulgaria, Croatia, Finland, Latvia, Lithuania, Romania, Slovakia and Slovenia report, next to Sweden, removals covering at least one quarter (and often much more) of their $CO_2$ emissions) it would be rather difficult to include $CO_2$ removals in this exercise.

### (c) Different time frames

While budget approaches (as used in the Kyoto Protocol commitments[8]) better reflect what the atmosphere sees than end year targets (which is the default option for most NDCs), climate policy in general is very much focused on end year targets within specific time frames (e.g. 2030 and/or 2050 targets). The carbon budget approach does not necessarily fit within this concept. Definitely when working within a very limited remaining carbon budget of 400 $GtCO_2$, many European countries would need to reach zero $CO_2$ emissions well before 2050 and some even before 2030. In this exercise, we first calculate the remaining domestic carbon budget for every country, then calculate the

8 The Kyoto Protocol commitments were expressed in average annual reduction targets for a period of 5 years in the first commitment period (2008-2012) and a period of 8 years in the second (2013-2020). This meant that emissions needed to be on average x% below the base year every single year of the 5/8 year period, which was normally reflected in emission reductions being lower than the average at the start of the period and equally higher than the average at the end of the period.

number of years of current (2020) $CO_2$ emissions the remaining carbon budget would cover, and then assume countries will be able to halve their emissions within this time frame, which will allow the deadline for reaching zero $CO_2$ emissions to be set at double the number of years (of 2020 emissions) that can be covered by the remaining carbon budget.

#### (d) Limited experience with effort-sharing of carbon budgets

Sharing the effort to avoid dangerous climate change across countries, rich and poor, is a hotly debated issue on which no agreement has been found to date in the international climate negotiations. Many different approaches have been developed (see below) but almost all these approaches have been developed to share emission reduction efforts to achieve certain end year targets. Only few of these effort-sharing approaches have been applied to share the remaining carbon budget[9]. In this exercise we combine two approaches to set both domestic carbon budgets and equitable shares of the global carbon budget, and show how the carbon budget concept can in fact guide both domestic target setting as well as international support for emission reductions abroad.

## 4. Sharing the remaining global carbon budget

As indicated above, there is both a scientific and a political debate on how to share efforts to avoid climate change evenly and/or equally across all counties. One of the central questions is how to interpret one of the core principles of the international climate architecture, as reflected in the 1992 Framework Convention on Climate Change, which states that countries "should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities."[10]

Many proposals[11] have been developed to suggest how efforts to tackle climate change can be shared among countries, and they can roughly be divided into three categories:

- **Per capita** approaches whereby countries are assigned a slice of the remaining budget on the basis of their share of the global population;
- **Best potential** approaches whereby countries are assigned a slice of the budget taking into account a country's potential for emission reductions and possibly also the costs of such reductions;
- **Equity** approaches whereby countries are assigned a slice of the remaining budget taking into account their historical emissions and/or economic wealth. One specific proposal that is widely supported in the NGO movement is the Climate Equity Reference Project[12] that assigns each country a certain responsibility for global emission reductions.

9 One example of applying the carbon budget concept to effort-sharing approaches is: Van Den Berg, NJ e.a. (2020). Implications of various effort-sharing approaches for national carbon budgets and emission pathways. In: Climatic Change 162, October 2020. www.link.springer.com/article/10.1007/s10584-019-02368-y

10 United Nations (1992). United Nations Framework Convention on Climate Change. unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change

11 For an overview of such proposals, see: Hohne N e.a. (2013). Regional GHG reduction targets based on effort sharing: a comparison of studies. In: Climate Policies 14:1. October 2013. www.tandfonline.com/doi/abs/10.1080/14693062.2014.849452

12 see: climateequityreference.org

The above approaches define different types of responsibilities. Equity approaches in general do not specifically focus on setting domestic emission reduction efforts but rather look at the share of total emission reductions a country should be responsible for, irrespective whether these emission reductions take place at home or abroad. Per capita and best potential approaches typically focus on the potential or need for domestic emission reductions, irrespective of who will be (financially) responsible for making these reductions happen.

In this exercise we use a combination of approaches to:

a. define countries' domestic carbon budgets by using a per capita division of the remaining global carbon budget; and

b. define countries financial obligations to support emission reductions abroad (both within Europe and outside) by using the Climate Equity Reference Calculator[13] to define a country's responsibility and deduct the domestic effort, as defined under (a), to identify what a country would need to support abroad (or, for countries with a responsibility below their domestic efforts, what support they need to receive from their European neighbours).

A country's equitable share of the remaining global carbon budget is thus expressed in a domestic carbon budget plus a climate finance obligation (or need).

## 5. Setting domestic carbon budgets

To identify the domestic carbon budget for each country, we divide the remaining carbon budget of 400 $GtCO_2$ on the basis of the average of each country's total population in 2020 and the estimated population for 2050. For example, the EU27 in 2020 represented 5.76% of the world's population[14]. This is expected to drop to 4.35% in 2050.[15] The average for the 2020–2050 period is thus 5.06%. This would mean that the EU's per capita share of the remaining $CO_2$ budget to limit temperature rise to 1.5°C, would be 5.06% of 400 $GtCO_2$, which equals 20.23 $GtCO_2$.

Column 3 of Table 1 gives an overview of the remaining carbon budget for the biggest European countries (full numbers for all 42 European countries can be found in Annex 1). Column 4 identifies the number of years of 2020 $CO_2$ emissions that can be covered by a country's remaining budget and gives (in brackets) the deadline when $CO_2$ emissions need to go to zero (by doubling the number of years that can be covered, plus one). Columns 5 to 8 then define annual average emission reduction targets[16] (as compared to 1990 $CO_2$ emissions) for the periods 2021-2025; 2026-2030; 2031 to 2035; and 2036 to 2040.

13 with following settings: 1.5 Low Energy Demand pathway; cumulative emissions since 1850; development threshold plus additional progressivity factors; not including non-CO2 emission

14 see: World Bank: data: Total Population: data.worldbank.org/indicator/SP.POP.TOTL

15 see: World Bank: databank.worldbank.org/source/population-estimates-and-projections

16 Note that average annual emission reduction target refer to the concept that emissions would need to be reduced on average by a given percentage every single year of the period. Usually the reduction will be lower than average at the start of the period and higher than average at the end.

**Table 1: Remaining domestic carbon budgets and average 5-year annual reduction targets for Europe's 7 biggest $CO_2$ emitters**

| Country | % of global population 2020 + 2050 | Domestic carbon budget 2020-2050 $GtCO_2$ | n° of years of 2020 $CO_2$ emissions in remaining budget (date when budget expires) | Average annual reduction/1990 $CO_2$ emission 2021-2025 | Average annual reduction/1990 $CO_2$ emission 2026-2030 | Average annual reduction/1990 $CO_2$ emission 2031-2035 | Average annual reduction/1990 $CO_2$ emission 2036-2040 |
|---|---|---|---|---|---|---|---|
| **France** | 0,791 | 3,165 | 11 (2042) | -37% | -53% | -70% | -86% |
| **Germany** | 0,942 | 3,766 | 6 (2033) | -53% | -78% | -98% | -100% |
| **Italy** | 0,655 | 2,621 | 9 (2038) | -42% | -61% | -81% | -97% |
| **Poland** | 0,415 | 1,660 | 5 (2032) | -40% | -74% | -99% | -100% |
| **Spain** | 0,531 | 2,122 | 10 (2040) | -21% | -44% | -66% | -89% |
| **EU27** | 5,058 | 20,232 | 8 (2036) | -44% | -66% | -87% | -100% |
| **Turkey** | 1,045 | 4,180 | 10 (2041) | 136% | 70% | 4% | -61% |
| **UK** | 0,807 | 3,229 | 10 (2040) | -53% | -67% | -81% | -94% |
| **Non-EU** | 2,748 | 10,993 | 10 (2040) | -44% | -60% | -77% | -93% |
| **Europe** | 7,806 | 31,225 | 8 (2037) | -44% | -64% | -83% | -99% |
| **World** | 100,00 | 400,00 | 12 (2046) | 40% | 9% | -22% | -53% |

## 6. Identifying climate finance responsibilities and needs

If the world would continue to emit $CO_2$ at the same level it did in 2020 for the next 30 years, total $CO_2$ emissions between 2020 and 2050 would be 1.011 $GtCO_2$. To limit the remaining carbon budget to 400 $GtCO_2$ for the same period, countries would need to reduce emissions, as compared to a 2020 Business-As-Usual scenario, with 611 $GtCO_2$. We use the Climate Equity Reference Calculator to identify each European country's responsibility to help achieve this reduction.

This way for example we identify that the EU27 has a responsibility to reduce emissions with 111 $GtCO_2$ as compared to BAU (while the EU would emit only 83 $GtCO_2$ in the BAU scenario). By limiting its domestic carbon budget to 20 $GtCO_2$, the EU has a domestic contribution of reducing 63 $GtCO_2$. This represents a bit more than half of its responsible share of global emission reductions and needs to be complemented by financial support to emission reduction activities abroad.

There are many ways to define the cost of reducing one tonne of $CO_2$, which will be different from country to country and from year to year. Based on similar exercises for Germany[17] and France[18] we set the average cost for 2020 to 2050 of reducing a ton of $CO_2$ in countries whose equitable share of the carbon budget is lower than its per capita domestic budget, at 100 Euro/ton.

17 WWF Germany/Öko Institut (2021). Mind The Ambition Gap. Internationale Finanztransfers als Instrument zur Einhaltung nationaler CO2-Budgets. November 2021. www.oeko.de/aktuelles/2021/finanzstroeme-fuer-den-klimaschutz

18 Réseau Action Climat France/Climate Equity Reference Project (2022). France's Climate Fair Share. January 2022. reseauactionclimat.org/wp-content/uploads/2022/02/2022-02-01-report-final_en.pdf

Table 2 identifies the annual climate finance contributions of the seven countries with the highest finance responsibilities (a full overview for all 42 countries is available in Annex 2). Countries' finance responsibilities are divided by (a) contributions to poorer EU member States (responsibility only applicable to EU Member States); (b) contributions to poorer European countries outside of the EU (responsibility shared among all 'richer' European countries); and (c) responsibilities outside of Europe.

**Table 2: Fair shares of global $CO_2$ emission reductions and annual climate finance contributions inside Europe and abroad for Europe biggest contributors**

| Country | Equitable share of global $CO_2$ reductions 2020-2050 $GtCO_2$ | Domestic $CO_2$ reductions 2020-2050 $GtCO_2$ | Total annual climate finance obligation 2020-2050 bn Euro | Annual climate finance to 'poorer' EU Member States 2020-2050 bn Euro | Annual climate finance to 'poorer' European countries 2020-2050 bn Euro | Annual climate finance to countries outside EU 2020-2050 bn Euro |
|---|---|---|---|---|---|---|
| **France** | 18,36 | 6,06 | 39,70 | 6,26 | 4,58 | 28,86 |
| **Germany** | 31,90 | 16,48 | 49,74 | 7,85 | 5,73 | 36,16 |
| **Italy** | 12,99 | 6,87 | 19,74 | 3,12 | 2,28 | 14,35 |
| **Netherlands** | 8,24 | 3,68 | 14,69 | 2,32 | 1,69 | 10,68 |
| **Sweden** | 4,32 | 0,65 | 11,82 | 1,86 | 1,36 | 8,59 |
| **EU27** | 110,86 | 63,10 | 182,94 | 28,87 | 21,09 | 132,99 |
| **Switzerland** | 5,29 | 0,71 | 14,79 | 0 | 1,70 | 13,09 |
| **United Kingdom** | 22,14 | 7,27 | 47,96 | 0 | 5,53 | 42,43 |
| **Total non-EU** | 37,73 | 24,06 | 73,64 | 0 | 8,49 | 65,15 |
| **Total Europe** | 148,59 | 87,16 | 256,58 | 28,87 | 29,57 | 198,15 |
| **Total World** | 611,29 | 611,29 | - | - | - | - |

# Conclusions

The remaining carbon budget of 400 $GtCO_2$ is extremely small, especially when taking into account that almost a quarter will have been consumed by now. Substantial emission reductions are therefore necessary and European countries need to prepare to achieve zero $CO_2$ emissions in the very near future as well as substantial emission reduction in the coming years. For some countries, in particular those with high per capita $CO_2$ emissions, the remaining domestic carbon budget will look challenging. And in fact, it is challenging to keep temperature rise below 1.5°C. But not doing so will be even more challenging for our society.

Even with limited domestic carbon budgets, many of the richer European countries have much greater responsibilities to reduce global carbon emissions than what they can achieve at home. Hence financial obligations are large and go well beyond the 100 billion dollar per year pledge made at COP15 in Copenhagen. In fact, European countries alone would need to provide almost double that amount to poor countries outside Europe.

by Wendel Trio
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## Annex 1- Remaining domestic carbon budgets and average 5-year annual reduction targets for 42 European countries

| Country | % global population 2020 + 2050 | Domestic $CO_2$ budget 2020-2050 ($GtCO_{2)}$ | n° of years of 2020 $CO_2$ in remaining budget (target year zero $CO_2$) | Average annual $CO_2$ reduction/1990 2021-2025 | Average annual $CO_2$ reduction/1990 2026-2030 | Average annual $CO_2$ reduction/1990 2031-2035 | Average annual reduction/1990 $CO_2$ emission 2036-2040 |
|---|---|---|---|---|---|---|---|
| **Austria** | 0,104 | 0,415 | 7 (2034) | -21% | -57% | -91% | -100% |
| **Belgium** | 0,137 | 0,547 | 6 (2033) | -42% | -72% | -97% | -100% |
| **Bulgaria** | 0,073 | 0,290 | 8 (2037) | -60% | -75% | -90% | -100% |
| **Croatia** | 0,043 | 0,170 | 10 (2041) | -38% | -55% | -72% | -99% |
| **Cyprus** | 0,015 | 0,059 | 8 (2037) | 16% | -27% | -70% | -99% |
| **Czechia** | 0,123 | 0,492 | 5 (2032) | -59% | -83% | -99% | -100% |
| **Denmark** | 0,070 | 0,279 | 9 (2040) | -56% | -69% | -82% | -95% |
| **Estonia** | 0,015 | 0,058 | 6 (2033) | -80% | -90% | -99% | -100% |
| **Finland** | 0,064 | 0,255 | 7 (2034) | -48% | -71% | -94% | -100% |
| **France** | 0,791 | 3,165 | 11 (2042) | -37% | -53% | -70% | -86% |
| **Germany** | 0,942 | 3,766 | 6 (2033) | -53% | -78% | -98% | -100% |
| **Greece** | 0,117 | 0,467 | 8 (2037) | -45% | -64% | -83% | -99% |
| **Hungary** | 0,107 | 0,427 | 9 (2039) | -46% | -63% | -80% | -96% |
| **Ireland** | 0,062 | 0,246 | 7 (2035) | -15% | -52% | -88% | -100% |
| **Italy** | 0,655 | 2,621 | 9 (2038) | -42% | -61% | -81% | -97% |
| **Latvia** | 0,020 | 0,080 | 11 (2043) | -69% | -76% | -84% | -92% |
| **Lithuania** | 0,030 | 0,118 | 9 (2038) | -68% | -79% | -89% | -99% |
| **Luxembourg** | 0,008 | 0,032 | 3 (2028) | -52% | -95% | -100% | -100% |
| **Malta** | 0,006 | 0,023 | 13 (2047) | -39% | -52% | -66% | -79% |
| **Netherlands** | 0,202 | 0,809 | 6 (2032) | -35% | -70% | -98% | -100% |
| **Poland** | 0,415 | 1,660 | 5 (2032) | -40% | -74% | -99% | -100% |
| **Portugal** | 0,114 | 0,454 | 10 (2042) | -20% | -41% | -62% | -84% |
| **Romania** | 0,208 | 0,832 | 11 (2043) | -63% | -72% | -81% | -90% |
| **Slovakia** | 0,061 | 0,243 | 8 (2037) | -59% | -74% | -89% | -100% |
| **Slovenia** | 0,024 | 0,094 | 7 (2036) | -31% | -58% | -85% | -100% |
| **Spain** | 0,531 | 2,122 | 10 (2040) | -21% | -44% | -66% | -89% |
| **Sweden** | 0,127 | 0,506 | 14 (2048) | -43% | -55% | -66% | -77% |
| **Total EU27** | 5,058 | 20,232 | 8 (2036) | -44% | -66% | -87% | -100% |
| **Albania** | 0,030 | 0,122 | 23 (2067) | -17% | -26% | -36% | -45% |
| **Bosnia & Herzegovina** | 0,035 | 0,140 | 6 (2032) | -23% | -63% | -97% | -100% |
| **Georgia** | 0,034 | 0,137 | 13 (2047) | -72% | -78% | -84% | -90% |
| **Iceland** | 0,004 | 0,018 | 5 (2031) | 7% | -61% | -100% | -100% |
| **Kosovo** | 0,020 | 0,080 | 9 (2039) | 36% | -6% | -48% | -89% |
| **Liechtenstein** | 0,001 | 0,002 | 12 (2046) | -42% | -67% | -92% | -100% |

| Country | % global population 2020 + 2050 | Domestic $CO_2$ budget 2020-2050 ($GtCO_{2)}$ | n° of years of 2020 $CO_2$ in remaining budget (target year zero $CO_2$) | Average annual $CO_2$ reduction/1990 2021-2025 | Average annual $CO_2$ reduction/1990 2026-2030 | Average annual $CO_2$ reduction/1990 2031-2035 | Average annual reduction/1990 $CO_2$ emission 2036-2040 |
|---|---|---|---|---|---|---|---|
| **Moldova** | 0,030 | 0,111 | 13 (2047) | -75% | -80% | -85% | -91% |
| **Montenegro** | 0,007 | 0,028 | 12 (2046) | 4% | -19% | -42% | -66% |
| **Northern Macedonia** | 0,023 | 0,091 | 10(2041) | -7% | -34% | -60% | -86% |
| **Norway** | 0,068 | 0,273 | 7 (2034) | -8% | -50% | -90% | -100% |
| **Serbia** | 0,073 | 0,291 | 7 (2035) | -43% | -66% | -88% | -100% |
| **Switzerland** | 0,106 | 0,423 | 12 (2044) | -33% | -49% | -65% | -80% |
| **Turkey** | 1,045 | 4,180 | 10 (2041) | 136% | 70% | 4% | -61% |
| **Ukraine** | 0,467 | 1,869 | 10 (2042) | -77% | -83% | -90% | -96% |
| **United Kingdom** | 0,807 | 3,229 | 10 (2040) | -53% | -67% | -81% | -94% |
| **Total Non-EU** | 2,748 | 10,993 | 10 (2040) | -44% | -60% | -77% | -93% |
| **Total Europe** | 7,806 | 31,225 | 8 (2037) | -44% | -64% | -83% | -99% |
| **Total World** | 100 | 400 | 12 (2046) | 40% | 9% | -22% | -53% |

## Annex 2: Fair shares of global $CO_2$ emission reductions and annual climate finance contributions (and needs) inside Europe and abroad for 42 European countries

| Country | Responsible share of global CO2 reductions 2020-2050 | Per capita domestic CO2 reductions 2020-2050 | Annual climate finance obligation 2020-2050 | Annual financing need/obligation within EU | Annual financing need/obligation within Europe | Annual financing obligation outside Europe |
|---|---|---|---|---|---|---|
| **Austria** | 3,040 | 1,541 | 4,84 | 0,76 | 0,56 | 3,52 |
| **Belgium** | 4,415 | 2,336 | 6,61 | 1,04 | 0,76 | 4,80 |
| **Bulgaria** | 0,132 | 0,869 | 0 | -2,38 | 0 | 0 |
| **Croatia** | 0,189 | 0,358 | 0 | -0,54 | 0 | 0 |
| **Cyprus** | 0,105 | 0,177 | 0 | -0,23 | 0 | 0 |
| **Czechia** | 1,371 | 2,383 | 0 | -3,27 | 0 | 0 |
| **Denmark** | 3,179 | 0,635 | 8,21 | 1,30 | 0,95 | 5,97 |
| **Estonia** | 0,190 | 0,234 | 0 | -0,14 | 0 | 0 |
| **Finland** | 1,968 | 0,939 | 3,32 | 0,52 | 0,38 | 2,41 |
| **France** | 18,363 | 6,055 | 39,70 | 6,26 | 4,58 | 28,86 |
| **Germany** | 31,897 | 16,477 | 49,74 | 7,85 | 5,73 | 36,16 |
| **Greece** | 1,490 | 1,298 | 0,62 | 0,10 | 0,07 | 0,45 |
| **Hungary** | 0,513 | 1,048 | 0 | -1,73 | 0 | 0 |
| **Ireland** | 3,979 | 0,880 | 10,00 | 1,58 | 1,15 | 7,27 |
| **Italy** | 12,988 | 6,868 | 19,24 | 3,12 | 2,28 | 14,35 |
| **Latvia** | 0,109 | 0,143 | 0 | -0,11 | 0 | 0 |
| **Lithuania** | 0,215 | 0,310 | 0 | -0,31 | 0 | 0 |
| **Luxembourg** | 0,817 | 0,269 | 1,77 | 0,28 | 0,20 | 1,29 |
| **Malta** | 0,075 | 0,027 | 0,14 | 0,02 | 0,02 | 0,10 |
| **Netherlands** | 8,236 | 3,683 | 14,69 | 2,32 | 1,69 | 10,68 |
| **Poland** | 2,759 | 7,791 | 0 | -16,23 | 0 | 0 |
| **Portugal** | 1,184 | 0,895 | 0,93 | 0,15 | 0,11 | 0,68 |
| **Romania** | 0,557 | 1,471 | 0 | -2,95 | 0 | 0 |
| **Slovakia** | 0,419 | 0,724 | 0 | -0,98 | 0 | 0 |
| **Slovenia** | 0,304 | 0,305 | 0,01 | 0,00 | 0 | 0,01 |
| **Spain** | 8,049 | 4,691 | 10,83 | 1,71 | 1,25 | 7,87 |
| **Sweden** | 4,318 | 0,655 | 11,82 | 1,86 | 1,36 | 8,59 |
| **Total EU27** | 110,861 | 63,097 | 182,94 | 0 (28,87) | 21,09 | 132,99 |
| **Albania** | 0,009 | 0,042 | 0 | 0 | -0,11 | 0 |
| **Bosnia & Herzegovina** | 0,043 | 0,616 | 0 | 0 | -1,85 | 0 |
| **Georgia** | 0,022 | 0,193 | 0 | 0 | -0,55 | 0 |
| **Iceland** | 0,134 | 0,094 | 0,13 | 0 | 0,02 | 0,12 |

| Country | Responsible share of global CO2 reductions 2020-2050 | Per capita domestic CO2 reductions 2020-2050 | Annual climate finance obligation 2020-2050 | Annual financing need/obligation within EU | Annual financing need/obligation within Europe | Annual financing obligation outside Europe |
|---|---|---|---|---|---|---|
| **Kosovo** | 0,018 | 0,193 | 0 | 0 | -0,56 | 0 |
| **Liechtenstein** | 0,051 | 0,003 | 0,16 | 0 | 0,02 | 0,14 |
| **Moldova** | 0,005 | 0,155 | 0 | 0 | -0,49 | 0 |
| **Montenegro** | 0,006 | 0,043 | 0 | 0 | -0,12 | 0 |
| **Northern Macedonia** | 0,017 | 0,197 | 0 | 0 | -0,58 | 0 |
| **Norway** | 4,308 | 1,021 | 10,60 | 0 | 1,22 | 9,38 |
| **Serbia** | 0,086 | 0,955 | 0 | 0 | -2,80 | 0 |
| **Switzerland** | 5,292 | 0,706 | 14,79 | 0 | 1,70 | 13,09 |
| **Turkey** | 5,366 | 8,818 | 0 | 0 | -11,14 | 0 |
| **Ukraine** | 0,235 | 3,762 | 0 | 0 | -11,38 | 0 |
| **United Kingdom** | 22,137 | 7,269 | 47,96 | 0 | 5,53 | 42,43 |
| **Total non-EU** | 37,727 | 24,065 | 73,64 | 0 | -8,49 | 65,15 |
| **Total Europe** | 148,588 | 87,161 | 256,58 | 0 (28,87) | 0 (29,57) | 198,15 |
| **Total World** | 611,291 | 611,291 | - | - | - | - |