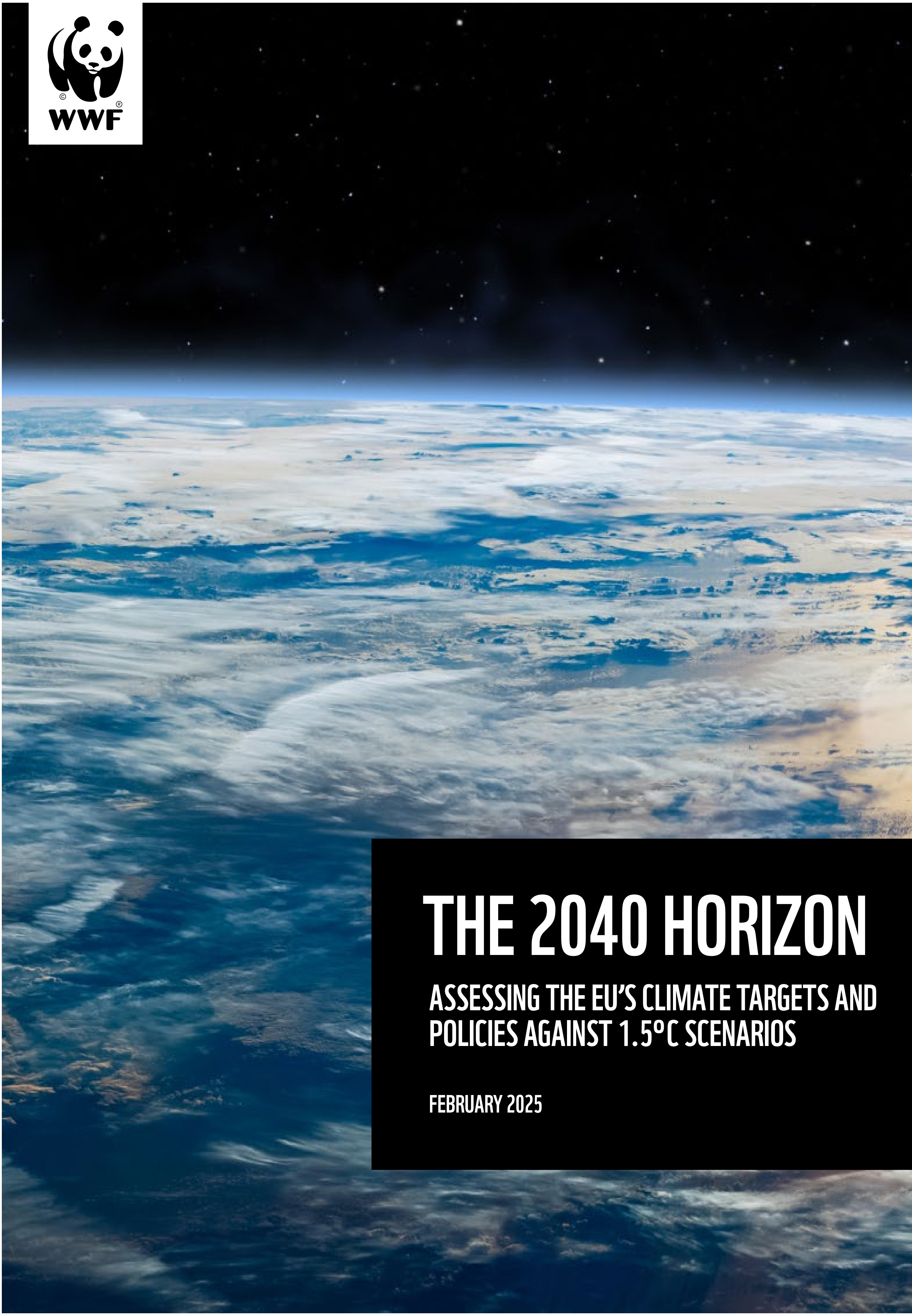

THE 2040 HORIZON

ASSESSING THE EU'S CLIMATE TARGETS AND POLICIES AGAINST 1.5°C SCENARIOS

FEBRUARY 2025

Written by the WWF European Policy Office.

WWF is an independent conservation organisation, with over 38 million followers and a global network active through local leadership in over 100 countries. Our mission is to stop the degradation of the planet's natural environment and to build a future in which people live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption

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LIST OF ACRONYMS AND ABBREVIATIONS

AFOLU	Agriculture, Forestry and Other Land Use
AR6	Sixth Assessment Report
CAP	Common Agricultural Policy
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Use
CDR	Carbon dioxide removals
CH_4	Methane
CO_2	Carbon dioxide
COP	Conference of the Parties
EAP	Environment Action Programme
ECNO	European Climate Neutrality Observatory
EEA	European Environment Agency
EED	Energy Efficiency Directive
ESABCC	European Scientific Advisory Board on Climate Change
ESR	Effort Sharing Regulation
ETD	Energy Taxation Directive
ETS	Emissions Trading System
ETS2	Emissions Trading System for buildings and road transport
GHG	Greenhouse gas emissions
GMSL	Global mean sea level
ha	Hectares
ICE	Internal Combustion Engine
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
Mt	Megatonne
PAC	Paris Agreement Compatible
ppm	Parts per million
RED	Renewable Energy Directive
TEN-E	Trans-European Networks for Energy
UAE	United Arab Emirates
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WGIII	Working Group III
WMO	World Meteorological Organisation

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> ## "Leaders of developed countries must commit to reaching net-zero as close as possible to 2040, the limit they should all aim to respect."
>
> **- António Guterres, UN Secretary-General[1]**

1 United Nations, "*Secretary-General Calls on States to Tackle Climate Change 'Time Bomb' through New Solidarity Pact, Acceleration Agenda, at Launch of Intergovernmental Panel Report*", 20 March 2023. Available here.

EXECUTIVE SUMMARY

In February 2024, the European Commission published an impact assessment on a 2040 climate target for the EU, as an interim target between the 55% emissions reduction target for 2030 and the 2050 climate-neutrality objective. This report evaluates the 90% net greenhouse gas (GHG) emissions reduction relative to 1990 levels that the Commission proposed as a 2040 target against 1.5°C compatible pathways outlined by the Intergovernmental Panel on Climate Change (IPCC). It also evaluates trajectories and policies in five key sectors: energy, industry, agriculture and Land Use, Land Use Change and Forestry (LULUCF), transport, and buildings, drawing on work by the European Scientific Advisory Board on Climate Change (ESABCC), the IPCC, Copernicus, or the European Climate Neutrality Observatory (ECNO).

STATE OF PLAY OF GLOBAL AND EUROPEAN CLIMATE CHANGE

Global GHG emissions continue to rise, reaching a record of 53.8GtCO_2eq in 2022, far above the levels required to meet the Paris Agreement goals. Since 1850-1900, global temperatures have risen by 1.09°C on average, with 2024 marking the warmest year ever recorded. Europe faces accelerated warming, with land temperatures rising twice as fast as the global average. As a consequence, European land temperatures between 2013 and 2024 were on average already 2.12 to 2.19 warmer than the pre-industrial level. This global warming triggers self-reinforcing feedback loops like permafrost melt, releasing trapped carbon and ancient pathogens, further amplifying global warming.

Ocean warming compounds these effects, as marine heatwaves devastate ecosystems, sea levels rise, and oceanic carbon storage weakens. Sea levels have risen by 21cm since 1900, threatening coastal regions and ecosystems.

Climate change also exacerbates biodiversity loss, with over 1 million species at risk of extinction globally. Impacts extend to health, agriculture, and the economy, with extreme weather events causing billions in damages and thousands of deaths annually in Europe alone.

Future scenarios warn of the consequences of a 3°C rise, including severe droughts, reduced water supplies, ecosystem collapse, and catastrophic sea level rise. Even at 2°C, significant adverse effects on agriculture, biodiversity, and human health are expected. Without stronger action, the planet risks long-term ecological and economic destabilisation.

THE EU'S FAIR SHARE IN GLOBAL CLIMATE MITIGATION EFFORTS

According to the Paris Agreement, climate action should be implemented to reflect "*equity and common but differentiated responsibilities and respective capabilities*". This means that the EU must take into account its historical responsibility in the ongoing global warming and its capacity to act when cutting its emissions: this is the EU's fair share of global mitigation efforts. Regarding historical responsibility, over the 1850-2021 period, the EU-27 was the world's second largest emitter, responsible for 17% of global GHG emissions. This means that even if its share in global emissions has reduced considerably over that time, and dropped to 8% in the 2015-2021 period, the EU has an obligation under the Paris Agreement to make up for its past emissions, which have accumulated in the atmosphere and are accelerating global warming.

Moreover, over the 2015-2021 period, the EU could be considered as big a direct emitter as China from an equity point of view. The EU emitted 21GtCO_2 over the period, while China emitted 73GtCO_2, but per capita emissions of the EU and China were comparable (47.1tCO_2 and 52.1tCO_2 respectively).

As regards the EU's scope for future emissions, the ESABCC confirms that: "*under some of* [the different equity] *principles, the EU has already exhausted its fair share of the global emissions budget*". Other stakeholder resources, such as the Civil Society Equity Review report, and the Climate Equity Reference Calculator, states that, on the basis of historical responsibility and capacity to act, the EU should reach climate neutrality by 2027.

KEY FINDINGS

The following findings compare the EU's projected outcomes for a 2040 climate target, as outlined in the European Commission's impact assessment, with pathways compatible with limiting global warming to 1.5°C. These pathways were derived by downscaling scenarios from the IPCC's Sixth Assessment Report (AR6), specifically from Working Group III (WGIII).

EU targets

The IPCC AR6 WGIII indicates that limiting global warming to 1.5°C requires reducing global GHG emissions by 43% by 2030 and by 69% by 2040, relative to 2019 levels. For the EU, this translates to 57% and 77% reductions compared to 1990 levels respectively, but this does not take into account any equity considerations.

The EU's current 2030 target of a 55% emissions reduction falls short of an equitable reduction target compatible with a 1.5°C pathway. From an equitable point of view, taking into account historical responsibility and capacity to act, the EU should reach climate neutrality by 2027. This being unrealistic, the EU should increase its 2030 target to reduce cumulative emissions and ensure greater fairness.

The proposed 90% reduction target for 2040 exceeds the 77% IPCC recommendation for global emissions reductions in the same year, suggesting consistency with global climate science, but it fails to address the EU's historical responsibility, its capacity to act, and the additional cumulative emissions resulting from a lack of ambition in the 2030 target.

Power sector

In the power sector, EU projections for emissions reductions by 2030 (-67% compared to 2015 levels) are significantly lower than the IPCC recommendations (-87-90%). The same goes for the share of renewable energy in gross final energy consumption by 2030 and 2040. The phasing out of fossil fuels and the integration of storage solutions are critical to achieving decarbonisation goals.

Some inconsistencies in energy policy remain, such as the inclusion of fossil gas in the EU Taxonomy, the lack of definition for residual emissions, the lack of application of the "energy efficiency first" principle, the lack of a cross-cutting EU ban on fossil fuel subsidies, and the current Energy Taxation Directive (ETD) which means that electricity may continue to be subject to higher taxes or levies than fossil fuels such as gas in many Member States.

Therefore, the EU should introduce a legally binding timeline to achieve a complete phase out of fossil fuel use, with coal phased out by 2030, fossil gas by 2035 and oil by 2040, supported by a robust just transition mechanism. The EU should accelerate renewable energy deployment and reach 50% of renewable energy in its mix by 2030, and 100% by 2040. The EU should also enhance its Emissions Trading System (ETS) to ensure effective carbon pricing for power generation.

Industry

In the industrial sector, decarbonisation strategies are lagging, particularly in energy-intensive sectors such as cement, steel and chemicals. EU projections for emissions reductions by 2030 (-51% compared to 2015 levels) are significantly lower than the IPCC recommendations (-65-80%). The same goes for the share of electricity in final energy demand by 2040. Regarding the deployment of carbon capture and use and storage, the future targeted application of these technologies is currently missing from the Commission's impact assessment on the 2040 target, while the ESABCC rightly recommends that they be used only for activities with no or limited alternative mitigation options.

Some inconsistencies identified by the ESABCC and by stakeholders remain, such as the high levels of free emissions allowances under the EU ETS awarded to heavy industry, in combination with the lack of a carbon price on material imports. There is also a lack of policies addressing demand management and material efficiency.

Therefore, the EU should phase out free ETS allowances as of now and develop alternatives to free allocation to address any genuine risk of carbon leakage for sectors not yet covered by the Carbon Border Adjustment Mechanism, which should be effectively applied. The EU should also drive energy efficiency improvements and direct electrification of industrial processes whenever possible. Finally, the deployment of carbon capture and storage (CCS) technologies should be limited to unavoidable emissions in targeted resource and energy intensive industries that have no alternatives to decarbonise.

Transport

In the transport sector, most EU projections are not aligned with a 1.5°C compatible pathway. EU projections regarding emissions reductions by 2030, 2040 and 2050, the share of electricity in final energy demand by 2030, 2040 and 2050, and the share of low-carbon fuels including electricity in final energy demand by 2030 are all below the recommendations of the IPCC.

Additionally, many policy inconsistencies remain, according to the ESABCC and to stakeholders. Current CO_2 emission performance standards incentivise car manufacturers to prioritise larger and less efficient vehicles; there is no tax for commercial aviation and maritime fuels; extra-EU aviation and half of extra-EU maritime transport remain exempt from the ETS; the Air Services Regulation does not define measure to ban short-haul flights; and there is a lack of measures to improve the efficiency of transport systems and to reduce demand, beyond changes in technologies, to promote a modal shift from emission-intensive to lower-emission transport modes.

First of all, the EU should maintain the current policy certainty of the Internal Combustion Engine (ICE) phase out in 2035, and create further incentives for electric vehicles. The EU should also promote the expansion of rail and other public transport, and prioritise investments in cross-border rail infrastructure and urban public transit. Regarding the decarbonisation of aviation and shipping, the EU should mandate sustainable fuels for both sectors, and include them fully in the ETS, as well as tax commercial aviation and maritime fuels.

Agriculture and LULUCF

EU projections for non-CO_2 emissions by 2050 (a maximum of 194MtCO_2eq emitted) are higher than those by the IPCC (a maximum of 170MtCO_2eq) in a 1.5°C compatible pathway. Regarding the LULUCF sink, a 1.5°C compatible pathway requires the EU to reach at least 540MtCO_2eq per year (yr^{-1}) by 2050, while EU projections reach only 330MtCO_2eq yr^{-1}.

Many aspects of the Common Agricultural Policy (CAP) are either actively counterproductive or seriously deficient on climate grounds, for example in that they provide direct support to emission-intensive agricultural practices such as livestock production instead of supporting the transition to less emission-intensive activities. In addition, EU bioenergy policies continue to promote the burning of trees and crops, despite this increasing emissions compared to fossil fuels. Agriculture and LULUCF are both currently excluded from the EU carbon-pricing regime. Therefore there is no EU-wide (financial) incentive for farmers and land managers to reduce GHG emissions and/or enhance Carbon Dioxide Removal (CDR). Finally, Member States are allowed to use excess removals in the LULUCF sector to offset emissions covered by the Effort Sharing Regulation (ESR).

Therefore, the EU should set a binding ambitious sectoral gross emission reduction target compatible with the objective of the Paris Agreement to create a pathway for the EU agri-food sector to contribute its share of needed emission reductions. The EU should also provide stronger incentives for climate action in the agri-food sector, including through the revision of the CAP, and promote a dramatic reduction in livestock numbers accompanied by a shift to healthier diets. It is also critical that the EU end all subsidies and other incentives for burning primary woody biomass, and for biofuel or other energy crops that involve the dedicated use of land.

Buildings

EU projections for the share of electricity in final energy demand by 2050 (64%) are not aligned with the IPCC 1.5°C compatible recommendation of 70-81%. On the same note, the 2030 target for energy efficiency from the EU (-11.7 %) is not compatible with a 1.5°C pathway (-20% by 2030, relative to PRIMES 2020[2] projections).

The ESABCC identifies some policy inconsistencies in the building sector: subsidies to fossil gas persist as they are allowed under the ETD, and the new revised Energy Efficiency and Energy Performance of Building Directives do not explicitly aim to leverage sufficiency.[3]

For all these reasons, the EU should increase the EU 2030 energy efficiency target from 11.7% to 20%, and set a 2040 target of 50% for primary energy consumption and at least 40% for final energy consumption. The EU should also ensure that Member States transpose in the strictest way possible the net-zero emissions building requirements, to get closer to net-zero emissions. It should incentivise renewable-heating solutions through subsidies for heat pumps or other non-biomass based renewable heating systems. There should also be mandatory energy renovation requirements to ultimately spur more (and deeper) energy renovations for existing buildings, with a focus on the worst-performing ones.

CONCLUSION

The proposed 2040 target, though nominally aligned with the level of global emissions reduction prescribed by climate science, does not adequately compensate for inadequate action in the period to 2030 and hence cumulative EU emissions. Additionally, neither this target nor the existing 2030 target reflect the EU's fair share in global climate mitigation efforts. Accelerating progress is critical to avoid locking in high cumulative emissions that would jeopardise 1.5°C compatibility, which is at high risk. Short-term (annual) warming does not equate to a permanent breach of the 1.5°C Paris Agreement goal, but this long-term breach could happen shortly: according to Copernicus, if the 30-year warming trend leading up to December 2020 continued, global warming would reach a long-term average of 1.5°C by January 2034.

Achieving climate neutrality by 2050 requires systemic transformations across all sectors. Current projections indicate significant gaps in the pace of reductions needed to meet interim milestones. The European Environment Agency (EEA) notes that the average rate of absolute emission reductions must more than triple just to meet the - in WWF's view inadequate - 2030 climate target. Furthermore, without strengthened policies, the EU risks falling well short of its anticipated 2040 target and its 2050 goal as well.

To lead global climate efforts and meet its legal commitments under the Paris Agreement, the EU must accelerate its sectoral transformations dramatically to take account of cumulative historical emissions, and ensure consistency between EU policies and climate goals.

2 EU Reference Scenario 2020: an analysis tool in the areas of energy, climate and transport based on the policy framework in place in 2020. More information available here.

3 Sufficiency (defined by the IPCC): "A set of measures and daily practices that avoid demand for energy, materials, land, and water while delivering human well-being for all within planetary boundaries."

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POLICY RECOMMENDATIONS

Emissions targets

- Adopt a higher 2030 target: increase the 2030 GHG reduction target to at least 65% gross compared to 1990 levels.
- Reach climate neutrality by 2040 to decrease EU's cumulative GHG emissions and increase its fairness in global mitigation efforts.

Power sector and other cross-cutting energy issues

- Phase out fossil fuels: introduce a legally binding timeline for the EU to achieve a complete phase out of fossil fuel use, with coal phased out by 2030, fossil gas by 2035 and oil by 2040, supported by a robust just transition mechanism.
- Accelerate renewable energy deployment: reach 50% renewable energy in the EU energy mix by 2030, and 100% by 2040. Renewable energy deployment must respect environmental and social safeguards.
- Upgrade grid infrastructure: modernise the EU grid to handle variable renewable energy and cross-border electricity flows.
- Strengthen carbon pricing: enhance the EU ETS to ensure effective carbon pricing for power generation.

Industry

- The EU ETS must be made fit for net-zero. To do so, the EU should phase out free EU ETS allowances as of now and develop alternatives to free allocation to address any genuine risk of carbon leakage for sectors not yet covered by the Carbon Border Adjustment Mechanism.
- Apply Carbon Border Adjustment Mechanism: ensure fair competition by taxing embedded carbon in imports, while expanding its scope to cover indirect emissions as well as direct emissions.
- Support both energy efficiency improvements and direct electrification: increase considerably direct electrification of industrial processes over indirect electrification (like renewable hydrogen) whenever possible to make sure the industry sector phases out the use of fossil fuels.
- The deployment of CCS technologies should be limited to unavoidable emissions in targeted resource and energy intensive industries that have no other alternatives to decarbonise. CCS must not be used as an excuse for continued fossil fuel use and is clearly not a silver bullet to address all industrial emissions, in particular before 2030.
- Support circular economy: incentivise the use of recycled materials and resource efficiency in industrial processes.
- Scale-up the deployment of technologies like renewable hydrogen (produced from solar and wind) targeted only at sectors that can't be electrified, such as steel.
- Sectoral roadmaps: require all industrial emitters to have 2030 and 2040 decarbonisation roadmaps.

Transport

- Maintain the current policy certainty of the Internal Combustion Engine phase out in 2035, with incentives for electric vehicles.
- Expand rail and public transport: prioritise investments in cross-border rail infrastructure and urban public transit.
- Decarbonise aviation and shipping: mandate sustainable fuels for both sectors, alongside efficiency and demand-management measures.

Agriculture and LULUCF

- Set a binding and 1.5°C compatible sectoral gross emission reduction target compatible with the objective of the Paris Agreement to create a pathway for the EU agri-food sector to contribute its share of emission reductions. Limit non-CO_2 emissions: set and enforce strict non-CO_2 reduction targets, especially from livestock and manure management. Develop a strategy on the future of animal farming in the EU.
- Provide stronger incentives for climate action in the agri-food sector, including through the revision of the CAP.
- Member States should comply with the legal requirements stemming from the Renewable Energy Directive (RED) to assess their level of harvesting and make appropriate considerations on its impact on the LULUCF sink. Member States should better integrate in their modelling biodiversity, nature restoration, and nature-based solutions to enhance carbon sinks and resilience. It must be ensured that action to increase sinks also improves resilience and biodiversity.
- Ensure the strict protection of all remaining primary and old-growth forests.
- Increase close-to-nature afforestation efforts, incentivise reforestation and forest-ecosystem restoration. Incentivise close-to-nature forest management and agricultural soil management practices.

- Avoiding conversion and degradation of wetlands and other organic soils & enhance soil carbon storage: support practices such as live cropping and reduced tillage.

- Full implementation of the EU Deforestation and Forest Degradation Regulation.

Building sector

- Increase the EU 2030 energy efficiency target from 11.7% compared to PRIMES 2020 to 20% compared to PRIMES 2020. Set an EU 2040 energy efficiency target of 50% for primary energy consumption and at least 40% for final energy consumption by 2040 compared to PRIMES 2020 projections.

- Establish mandatory energy renovation requirements to ultimately spur more (and deeper) energy renovations for existing buildings, with a focus on the worst-performing ones. Ensuring regulatory tools are always coupled with adequate financing and technical assistance to achieve deep energy renovations in a fair way.

- Ensure that Member States transpose in the strictest way possible the net-zero emissions building requirements to get closer to net-zero emissions. Legislation should be the baseline and Member States shouldn't be able to go below this baseline in building zero emission buildings.

- Incentivise renewable-heating solutions: provide subsidies for heat pumps or other non-biomass renewable-based heating systems (i.e. solar thermal, geothermal etc.) installations in residential and non-residential buildings.

- Expand district heating: develop renewable district heating and cooling networks in urban areas.

Cross-cutting recommendations

- To ensure a just transition, EU policies should build on systematic impact assessment and subsequent evaluations of the socio-economic aspects of climate policies and measures in specific contexts.

- Apply a strengthened Just Transition framework with well-resourced territorial and whole-of-society approaches, targeting i) regions most in need of rapid transition and least able to secure resources for themselves and ii) citizens most in need of social protection, employment skills and opportunity, housing renovation for energy efficiency, support for mobility etc.

- Increase the share for climate and biodiversity spending under the next Multiannual Financial Framework to at least 50% and 10% respectively.

- Ensure an effective implementation of the 'Do no significant harm' principle across the EU budget in line with the new requirements established under the Financial Regulation, notably through a horizontal exclusion list defining activities that cannot be funded under the EU budget, thereby creating additional fiscal space for climate investments

- End all subsidies and other incentives for burning primary woody biomass, and for biofuel or other energy crops that involve the dedicated use of land. Keep biomass demand within its sustainable limits. Prioritise its use for niche sectors or purposes where it will add the highest value and/or deliver the greatest climate benefit.

- Eliminate all fossil fuel subsidies by the end of 2025, redirecting funds toward renewable energy and social safety nets for vulnerable groups.

- Promote energy efficiency standards and behavioural changes to lower energy and material consumption.

- Address any policy which is inconsistent with the climate-neutrality objective and the phase-out of fossil fuels in the EU.

- After 2030, the Emission Trading System for buildings and road transport (ETS2) should aim for a carbon price signal high enough to incentivise emissions reductions in line with reaching EU climate neutrality, and for an increasing convergence of the carbon price between ETS and ETS2.

- The deployment of Carbon Capture and Use (CCU) and CCS, renewable hydrogen, and bioenergy should be targeted towards activities with no or limited alternative mitigation options.

- The EU should take further policy action to drive the required increase in public and private investment in climate mitigation.

- Pursue more ambitious reductions in energy and material demand through new and strengthened policies, both through efficiency improvements and behavioural changes.

More information on WWF's position on the EU 2040 target can be found in this position paper.

OBJECTIVES OF THE REPORT

This report aims to **assess the 1.5°C compatibility of the EU's impact assessment for a 2040 climate target and current EU climate policies.** To this end, the report will:

- determine the EU's fair share to global climate change mitigation;
- compare 1.5°C compatible pathways with the Commission's impact assessment for a 2040 target;
- assess the progress towards the achievement of the EU 2030 and 2050 climate targets;
- analyse the consistency of Union measures towards the EU climate-neutrality objective.

Finally, this report will provide policy recommendations on the required EU contribution towards keeping the global temperature rise to 1.5°C, reversing the ongoing climate crisis and halting biodiversity loss.

1.5°C compatible pathways are characterised by reaching net-zero GHG emissions, but also by very rapid near-term emission reductions to stay within a certain GHG budget. This means that this report considers not only what steps are required for the EU to reach climate neutrality by 2050, but also what steps are necessary to align the EU with the Paris Agreement's commitment of keeping the temperature rise to 1.5°C, on the basis of equity.

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CONTEXT

1. STATE OF PLAY ON GLOBAL AND EUROPEAN CLIMATE CHANGE

a. Planetary boundaries

Since the dawn of the industrial revolutions, societies have transitioned from using energy from water, wind and living organisms, to a reliance on carbon-based energy and the unsustainable exploitation of natural resources within a techno-industrial framework.[4, 5] This shift in the relationship between humanity and its surroundings - especially its environment - has triggered ecological challenges such as climate change and biodiversity loss. Consequently, the past two centuries have witnessed significant biophysical alterations on the Earth, going beyond what would occur under natural circumstances. Consequences on Earth are wide and not only limited to climate change, or temperature rise, and call for a broad understanding of ongoing and upcoming ecological disasters and the urgent action needed to address them.

Rockström *et al.* have developed a planetary boundaries framework, which identifies nine processes essential for maintaining the stability and resilience of Earth system as a whole.[6] Planetary boundaries are limits which, if respected, would allow Earth to remain in a state where global environmental functions and life-support systems stay as they have been over the past 10,000 years. As part of the 8th Environment Action Programme (EAP) to 2030, the European Parliament and the Council of the EU agreed on the long-term priority that "*by 2050 at the latest, people live well, within the planetary boundaries*".[7] Anthropogenic activities are the main drivers of perturbations that go against this stability and make the Earth overshoot these planetary boundaries: "*human activities with planetary-scale effects act as additional forcing on Earth system*".[8] The planetary boundaries framework includes 9 components of Earth system that are critically impacted by these human activities, and which are relevant to Earth's overall state. Each of these components has three levels of risk: (1) the safe operating space, where the Earth system remains stable; (2) the zone of increasing risk, where the boundary is already transgressed; and (3) the high risk zone.[9] Six out of nine of these components are outside of the safe operating space, and most of them are already in the high risk zone. Climate change is one of the planetary boundaries framework's components.

4 Jiménez, N & Ramírez, O. (2019, 1 4). Political ecology of adaptation: claiming a critical biomimicry for the Anthropocene. *Journal of Political Ecology* 26(1) :567-578. doi: 10.2458/v26i1.23492

5 Gallo, M & van der Wielen, S. (2022). Biomimicry teaching for the transition towards the circular economy. *Innoveren en Blijven Leren*. pp.36

6 Rockström *et al.*, "Earth beyond six of nine planetary boundaries", *Science Advances*, 13 September 2023: doi: 10.1126/sciadv.adh2458

7 European Parliament and Council of the EU, "Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030", Official Journal of the European Union, 12 April 2022, L 114/22.

8 Rockström *et al.*, "Earth beyond six of nine planetary boundaries", *Op. Cit.* p.1.

9 It is worth noting that the Earth system-level framework described by the planetary boundaries developed by Rockström *et al*. does not replace the tipping point approach used in climate science.

Current status of climate change in the planetary boundaries framework

Earth system process	Control variable(s)	Planetary boundary	Preindustrial Holocene base value	Upper end of zone of increasing risk	Current value of control variable
Climate change	Atmospheric CO_2 concentration (ppm CO_2)	350	280	450	419*
	Total anthropogenic radiative forcing at top-of-atmosphere (W m^{-2})	+1.0	0	+1.5	+2.91

Table extracted from Rockström et al. "Earth beyond six of nine planetary boundaries", and adapted with the current value of the control variable in 2023 (Copernicus).

The table above shows the climate boundary framework set up by Rockström *et al*: the planetary boundary for atmosphere CO_2 concentration is 350 parts per million (ppm) CO_2: this is the maximum amount of carbon in the atmosphere possible to remain within the safe operating space. The current value of this variable is 419ppm CO_2, which is close to the upper end of the zone of increasing risk, and thus close to the high risk zone. This atmospheric CO_2 concentration has been increasing since the pre-industrial era, following the global GHG emissions trend. Indeed, in 2022, global GHG emissions grew by 1.2% from the previous year, thus reaching a new record level. According to the United Nations Environment Programme (UNEP), these emissions "*must decline to levels between 33 and 41GtCO_2e by 2030 to get on a least-cost pathway to meeting the temperature goal of the Paris Agreement*".[10] In 2022, this figure was about 53.8GtCO_2eq.[11]

Additionally, the IPCC AR6 WGIII report reaffirms with high confidence that "*there is a near-linear relationship between cumulative anthropogenic CO_2 emissions and the global warming they cause*".[12]

b. Impacts of climate change

As stated earlier, anthropogenic activities have an impact on planetary boundaries and therefore on climate change. Biophysical alterations on Earth are already quite significant and go beyond what would occur under natural conditions; the first of these impacts is global warming.

i. Rising surface air temperatures on land

Data used in this section come from the IPCC, the EEA, the Earth Observation component of the EU Space Programme (Copernicus), and the World Meteorological Organisation (WMO). It should be noted that, under international agreements, the temperature increase is determined on a 20-year average period, which means that some months and years have already exceeded the 1.5°C threshold without this being considered a failure to meet the commitments of the Paris Agreement.

According to the last IPCC report, global surface temperature has reached 1.09°C above 1850-1900 levels in 2011-2020[13], leading to extreme weather and climate events, widespread adverse impacts and related losses and damages to nature and people, rising sea levels, and loss of (human) lives.

According to the WMO, the global mean temperature in 2023 was about 1.45°C above the 1850-1900 average.[14] In 2024, the WMO published its State of the global climate for the year 2023, confirming the increasing temperature trend: "*2023 was the warmest year in the 174-year observational record, clearly surpassing the previous joint warmest years, 2016 at 1.29 ± 0.12 °C above the 1850-1900 average and 2020 at 1.27 ± 0.13°C.*"[15], and ocean heat content reached its highest level in the 65-year observational record. Recently, Copernicus stated that 2024 was the new warmest year on record because of long-term climate change, and exceeded 1.5°C above pre-industrial level.[16]

The global surface air temperature even reached more than 2°C above the pre-industrial average two days in a row, in November 2023.[17] Recently, the WMO stated that there is an 80% likelihood that at least one year temporarily exceed 1.5°C between 2024 and 2028[18], and this already happened in 2024.[19] However, short-term (annual) warming does not equate to a permanent breach of the 1.5°C Paris Agreement goal, but this long-term breach could happen shortly: according to Copernicus, "*if the 30-year warming trend leading up to* [December 2020] *continued, global warming would reach 1.5°C by January 2034.*"[20]

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18 World Meteorological Organisation, *Global Annual to Decadal Climate Update*. June 2024. Available here.
19 Copernicus, *2024 virtually certain to be the warmest year and first year above 1.5 °C*. November 2024. Available here.
20 Copernicus, *How close are we to reaching a global warming of 1.5°C?"*. February 2021. Available here.

Copernicus, together with the WMO, published in 2024 a European State of the Climate for the year 2023, with even more alarming trends for the EU. The European continent "*has been warming twice as fast as the global average, becoming the fastest-warming continent on Earth*".[21] Concretely, Europe saw its warmest year on record in 2023, at 2.6°C above pre-industrial level, which was about 0.13-0.17°C cooler than the previous warmest year on record, in 2020.[22] On average, European land temperatures between 2013 and 2023 were 2.12 to 2.19°C warmer than the pre-industrial level.[23]

This temperature increasing trend generates a dangerous self-reinforcing feedback loop: as a consequence of the rise of temperature, permafrost is melting. As permafrost stores about half of the organic carbon of soils[24], when it melts, the stored carbon and methane are released in the atmosphere, contributing again to global warming. There may also be problems if ancient viruses and bacteria which are also contained in the permafrost are released.

ii. Ocean warming

The ocean plays a key role in mitigating climate change: about 90% of the excess heat associated with global warming has been absorbed by the ocean.[25] But the resilience of our ocean against this kind of heat intake is, however, being compromised: waters become more acidic, sea levels rise and the frequency of extreme weather changes, putting species at the foundation of ecosystems and food webs like seagrasses, kelp and coral at risk.[26] The impacts cascade across sea basins and the global ocean, with direct implications for industries such as tourism and fisheries. Extreme weather, meanwhile, affects the well-being (and even the future existence) of coastal communities ill-equipped to handle more frequent and intense storms. Cumulatively, the impacts of warming jeopardise the ocean's ability to store carbon and how it regulates climate. European seas are amongst the most intensively used in the world.

As a consequence of global warming, on average, on any given day in 2023, about a third of the global ocean was gripped by a marine heatwave, harming vital ecosystems and food systems; and over 90% of the ocean experienced heatwave conditions at some point during the year.[27] A marine heatwave in June 2023 in the Atlantic Ocean west of Ireland and around the United Kingdom was classified as 'extreme' and, in some areas, 'beyond extreme', with sea surface temperatures up to 5°C above average; in the Mediterranean Sea, marine heatwaves in July and August 2023 saw water temperatures reach 5.5°C above average in some areas.[28] On average, 2023's average sea surface temperature for the European ocean was the warmest on record, at 0.55°C above average.[29]

When it comes to assess the state of play on global and European climate change, change in mean sea level is an essential indicator: "*it reflects both the thermal expansion of the ocean in response to its warming and the increase in ocean mass due to the melting of ice sheets and glaciers*".[30]

Since 1993, which is when satellite altimetry measurement started, global mean sea level (GMSL) has increased, reaching a new high in 2023: 110mm.[31] The figure from the EEA is even more alarming: the EEA estimates that the GMSL has risen about 21cm since 1900, and at an accelerating rate.[32] These new records reflect the melting of glaciers and ice sheets, engendered by continued ocean warming. This is an exponential trend, since the rate of GMSL rise in the 2014-2023 period (4.3mm per year[33]) is more than twice the rate of sea level rise in the 1993-2002 period (2.1mm per year[34]).[35] In Europe, sea level is rising higher every year at an accelerating pace, increasing risks of coastal flooding and storm surges, coastal erosion and saltwater intrusion into groundwater. This presents a major threat to many coastal cities, regions and ecosystems in Europe.[36]

According to the United Nations, consequences of rising sea levels go beyond nature and climate. They have implications for the economic, social and cultural fabric of vulnerable nations across the world: "*saltwater flooding can damage coastal habitats* [...], *agricultural lands as well as infrastructure, including housing*", "*flooding can contaminate fresh water supplies, promote waterborne diseases threatening people's health*", and "*tourism revenues* [...] *can suffer as breaches, resorts and other tourist attractions like coral reefs are damaged*".[37] The United Nations conclude that the combination of all these factors can force people to leave their homes and ultimately migrate.

In the near-term perspective (2021-2040), and under a 1.5°C scenario, "*continued and accelerating sea level rise will*

21 Copernicus, *European State of the Climate - Summary 2023*. 2024. Available here.
22 *Ibid*.
23 European Environment Agency, *Global and European temperatures*. 26 June 2024. Available here.
24 Bockheim, J.G. & Hinkel, K.M. "The importance of "Deep" organic carbon in permafrost-affected soils of Arctic Alaska". Soil Science Society of America Journal, 71. 2007. doi.org/10.2136/sssaj2007.0070N
25 Lijing Cheng, John Abraham, Zeke Hausfather, and Kevin E. Trenberth. "How fast are the oceans warming?". Science, Vol 363, Issue 6423. 11 January 2019. DOI: 10.1126/science.aav7619
26 Kathryn E. Smith, Michael T. Burrows, Alistair J. Hobday, Nathan G. King, Pippa J. Moore, Alex Sen Gupta, Mads S. Thomsen, Thomas Wernberg, and Dan A. Smale. "Biological impacts of marine heatwaves. Annual Reviews, Vol. 15. January 2023. https://doi.org/10.1146/annurev-marine-032122-121437
27 World Meteorological Organisation, *Climate change indicators reached record levels in 2023: WMO*. 19 March 2024. Available here.
28 Copernicus, *European State of the Climate - Summary 2023. Op. Cit.*
29 *Ibid*.
30 *Ibid*.
31 World Meteorological Organisation, *Climate change indicators reached record levels in 2023: WMO. Op. Cit.*
32 European Environment Agency, *Global and European sea level rise*. 15 January 2024. Available here.*This figure comes from reconstructions based on tide gauge observations.*
33 Copernicus, *European State of the Climate - Summary 2023. Op. Cit.*
34 *Ibid*.
35 World Meteorological Organisation. *Climate. Op. Cit.*
36 European Environment Agency, *European Climate Risk Assessment - Executive Summary*. January 2024. Available here.
37 United Nations. "What is sea level rise and why does it matter to our future?". 26 August 2024. Available here.

encroach on coastal settlements and infrastructure, and commit low-lying coastal ecosystems to submergence and loss".[38] With further warming, and due to relative sea level rise, current 1-in-100 year extreme sea level events are projected to occur at least annually in more than half of all tide gauge locations by 2100, under all considered scenarios.[39] The IPCC concludes that over the next 2,000 years, GMSL will rise about 2 to 3 meters if global warming is limited to 1.5°C, and 2 to 6 meters if limited to 2°C.[40]

iii. Biodiversity loss, natural disasters, economic losses, food insecurity and health-related issues

Protecting and restoring nature is not just about saving wildlife. Nature contributes to our overall health and wellbeing. More than half of the global economy depends on nature and all the services it provides.[41] Healthy ecosystems are also a fundamental tool in tackling the twin climate and biodiversity crises: they make Europe more resilient to extreme weather events and are crucial for ensuring food security. Although the recognition of the importance of biodiversity is growing[42], we are still losing nature at an unprecedented rate. Globally, one million species are threatened with extinction.[43] In Europe too the situation of nature remains critical. Less than half of our bird species have secure status, over 80% of Europe's habitats are in poor condition and only 23% of species protected under the Habitats Directive are in good health.[44]

An updated synthesis of the impacts of climate change on wild species, and on the ecosystems they live in, was recently published by the IPCC. These impacts include increasing heatwaves and droughts that are driving mass mortality events in trees, birds, bats, and fish. Climate changes have also been linked to the loss of whole populations of more than 1,000 plant and animal species and the first extinctions of entire species are happening.[45] While land-use change is considered the largest driver of biodiversity change, according to the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), climate change could overtake it as the primary driver of biodiversity loss by mid-century.[46] The Climate Risk Assessment highlights that climate change is already one of the main drivers of biodiversity loss and ecosystem degradation in Europe.[47]

Impacts of climate change are wider than on temperature, sea level rises and biodiversity loss: they have economic consequences, as well as consequences on weather events, and therefore on human lives. Climate change is already increasing people's exposure to coastal and inland flooding, storms, water shortages and wildfires. Indeed, 97 million people - around 21% of the EU population - are already exposed to these climate hazards.[48] In Europe in 2023, according to the European space observatory Copernicus, climate change led to:

- Losses estimated at 13.4 billion euros;
- Flooding affecting around 1.6 million people and 81% of economic losses;
- Storms affecting around 550,000 people;
- Wildfires affecting around 36,000 people;
- At least 63 deaths due to storms, 44 deaths due to floods, and 44 deaths due to wildfires.[49]

Climate change has a direct impact on people's health, as "*heat and cold are recognised environmental risk factors for human health*".[50] In the first two decades of the 2000s, heat-related deaths increased in 94% of European regions. This is also an increasing trend, since 23 of the 30 most severe heatwaves have occurred in the last 24 years, and five of them in the last 3 years. The impact on people's lives is also important: "*between 55,000 and 72,000 deaths due to heatwaves were estimated in each summer of 2003, 2010 and 2022*".[51] By 2030, climate change is projected to lead to around 250,000 additional deaths per year on the planet[52], and this is still a 'conservative estimate'[53]. Indeed, weather and extreme climate events are aggravating factors of disease, wars, and food insecurity: as an example, the number of people in the world who face acute food insecurity has more than doubled, from 149 million people before the COVID-19 pandemic to 333 million people in 2023.[54]

38 IPCC, 2022: Summary for Policymakers In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 3–33, doi:10.1017/9781009325844.001.

39 IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001

40 *Ibid*.

41 World Economic Forum. *Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy*. 2020. Available here.

42 World Economic Forum. *The Global Risks Report 2024*. 2024. Available here.

43 IPBES. *Summary for policy makers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. 2019. Available here.

44 EEA. State of nature in the EU. Results from reporting under the nature directives 2013 – 2019. 2020. Available here.

45 WWF. Living Planet Report 2022 - Building a nature positive society. 2022. Available here.

46 Henrique M. Pereira et al., Global trends and scenarios for terrestrial biodiversity and ecosystem services from 1900 to 2050. *Science* 384, 458-465 (2024). DOI: 10.1126/science.adn3441

47 European Environment Agency, *European Climate Risk Assessment - Executive Summary*. January 2024. *Op. Cit*.

48 European Commission, *Ninth Report on Economic, Social and Territorial Cohesion*, March 2024. Available here.

49 Copernicus, *European State of the Climate - Summary 2023*. *Op. Cit*.

50 European Commission, *Ninth Report on Economic, Social and Territorial Cohesion*. *Op. Cit*.

51 *Ibid*.

52 World Meteorological Organisation, *Climate Change*. Available here.

53 *Ibid*.

54 World Meteorological Organisation. *Climate*. *Op. Cit*.

iv. Forward-looking: how will a 3°C future impact the world?

Most of the following projections are based on IPCC scenarios (the IPCC's Representative Concentration Pathways[55], the Special Report on Emissions Scenarios[56], and the Shared Socioeconomic Pathways[57], for instance). Overall, "*climate change is likely to cause wet places to get wetter and dry places to get drier*".[58]

The annual UNEP emissions gap report analyses the discrepancy between pledged GHG emission reductions and the reductions required to align with the Paris Agreement. In its latest report, the UNEP stated that current pledges would put the world on course for a temperature increase of 2.6-3.1°C over the course of this century.[59] For this reason, this subsection highlights what it would mean in terms of impacts if the temperature reaches 3°C above pre-industrial levels.

Extreme weather events associated with heat are expected to become more frequent and intense, with droughts particularly affecting the Mediterranean region, western Europe, and northern Scandinavia. Currently, the average region in Africa experiences between one and three heatwaves annually. However, if global temperatures rise by 3°C by the end of the century, the frequency of heatwaves could quintuple by the middle of the century.[60]

A similar temperature increase is expected to decrease underground water reserves, which currently supply roughly one-third of drinking water in the U.S., most of the public water in England, and about two-thirds of the public water in western Australia. In the region of East Anglia, England, a 3°C rise in temperature could lead to a 22% reduction in groundwater recharge by mid-century. This level of warming could also result in the loss of 43% of Himalayan high mountain glaciers, which presently supply water to 800 million people.[61]

With a 3°C rise in temperature, many trees, plants, and smaller animals would struggle to migrate quickly enough to adapt to the changing climate. This mismatch would likely lead to local extinctions.[62]

The previous subsections mentioned sea level rise. This is an ongoing trend which could continue even faster in a 3°C future: at some point rising temperatures will trigger the near-complete melting of the Greenland ice sheet, which would ultimately lead to a sea level rise of seven metres or more.[63]

A 3°C temperature rise also increases the possibility that fragile nature systems like the Arctic or Amazon experience "*abrupt and irreversible changes*" by melting entirely, or drying out, for example.[64]

Agricultural yields decline sharply as temperatures rise between 1°C and 3°C, a trend already evident within the EU. Once local temperatures reach 3°C above pre-industrial levels, all crops are negatively affected globally. Similarly, fish species face local extinctions, significantly disrupting fisheries. A 3°C increase in temperature would lead to a steep drop in food production worldwide.[65]

These are the impacts that are likely to take place globally and in the EU if temperature rises by 3°C. It is worth noting that this will be the scenario if Parties to the Paris Agreement achieve their current pledges on climate action; however, If they don't, the temperature is likely to rise even further. Some scenarios foresee a temperature increase of 4°C above pre-industrial levels, causing unbearable heat, with three quarters of the world's population experiencing potentially deadly temperatures for at least 20 days a year. A temperature increase of 4°C above pre-industrial levels also means that a significant part of the world could experience medium to high levels of food insecurity by the 2080s. Under the same scenario, the whole European continent (excluding Iceland) will be affected by more frequent and severe extreme droughts. The GMSL would rise by nearly nine meters over several hundred years and inundate all the world's coastal city locations (especially the Netherlands in the EU). Last but not least, unmitigated global warming could reduce global average incomes by 23% by 2100, compared to what they would have been.[66]

Even at 2°C, impacts are likely to be dramatic: extreme heat events would seriously damage agriculture, food supplies would be at risk, there would be changes to rainfall and consequent water shortages, virtually all warm water coral reefs would disappear, and 25% of the 80,000 plants and animal species in the world's most naturally rich areas could face local extinction.

55 Columbia University, "Socio-economic data and scenarios". November 2019. Available here.

56 IPCC, "IPP Special Report on Emissions Scenarios". 2000. Available here.

57 Carbon Brief, "Explainer: How 'Shared Socioeconomic Pathways' explore future climate change". April 2018. Available here.

58 WWF, "Backgrounder: Comparing climate impacts at 1.5°C, 2°C, 3°C and 4°C". Available here.

59 UNEP, "Emissions Gap Report 2024". 24 October 2024. Available here.

60 WWF, "Backgrounder: Comparing climate impacts at 1.5°C, 2°C, 3°C and 4°C". *Op. Cit*.

61 *Ibid*.

62 *Ibid*.

63 *Ibid*.

64 *Ibid*.

65 *Ibid*.

66 *Ibid*.

2. LEGAL REQUIREMENTS

In response to the ongoing climate crisis, and in order to reverse this trend, as well as nature loss, most countries around the world have been Parties to the Paris Agreement since 2015 - this is the case for the EU and all its Member States. Collectively, Parties to the Paris Agreement need to strengthen their global response to climate change, especially by "*holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels*".[67] In this regard, every fraction of a degree matters, and the level of risks or impact of climate change on nature and people is significantly higher with a temperature increase of 2°C instead of 1.5°C. The same article of the Paris Agreement also states that climate action should be implemented to reflect equity, differentiated responsibilities and respective capabilities.

To achieve this long-term temperature goal, Parties of the Paris Agreement are also committed "*to reach global peaking of greenhouse gas emissions as soon as possible* [...] *and to undertake rapid reductions thereafter, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century*".[68] This means reversing the increasing trend of GHG emissions and reaching climate-neutrality. Global 1.5°C compatible pathways which also reach net-zero GHG emissions are characterised not only by reaching net-zero GHG emissions, but also by very rapid near-term emission reductions: reaching net-zero emissions is not enough in itself to align with the 1.5°C objective. As stated previously, cumulative GHG emissions and atmospheric CO_2 concentration are crucial when it comes to tackling global warming. Therefore, paths with slow near-term action might still reach net-zero emissions by mid-century, but be incompatible with the Paris Agreement's 1.5°C threshold. Indeed, the IPCC physical science assessment makes clear that stabilising global temperature requires reaching zero net emissions at a global level, but also limiting cumulative GHG emissions to within a budget.[69]

Following the Paris Agreement, the EU enshrined the climate-neutrality objective in EU law. In 2021, the European Parliament and the Council of the EU adopted the EU Climate Law, which aims at achieving climate neutrality by 2050 at the latest: "*Union-wide greenhouse gas emissions and removals regulated in Union law shall be balanced within the Union at the latest by 2050, thus reducing emissions to net-zero by that date, and the Union shall aim to achieve negative emissions thereafter.*"[70] This should require a contribution from all economic sectors for which emissions or removals of GHG emissions are regulated in Union law.

In the EU climate governance framework, Member States may adopt their own national climate laws; however, to collectively achieve this EU-wide climate-neutrality objective, Member States are bound to reach national interim targets determined in the EU ESR and the LULUCF Regulation, and to implement the ETS.[71]

In the path towards the EU-wide climate-neutrality objective, the EU has intermediate climate targets, working as milestones to reach the 2050 target. Indeed, the EU is also committed to reducing its GHG emissions by 55% by 2030 compared to 1990 levels. Additionally, in the very near future, the EU will set a Union-wide climate target for 2040: "*at the latest within six months of the first global stocktake* [...] *the Commission shall make a legislative proposal, as appropriate, based on a detailed impact assessment, to amend this Regulation to include the Union 2040 climate target*".[72] In February 2024, the European Commission published its impact assessment, together with a communication presenting "*a 90% net GHG emission reduction compared to 1990 levels as the recommended target for 2040*".[73]

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67 Paris Agreement, Article 2.

68 *Ibid*., Article 4.

69 Intergovernmental Panel on Climate Change, *The Physical Science Basis*. 2021. Available here.

70 European Parliament and Council of the European Union, "Regulation (EU) 2021/1119 of 30 June 2021 establishing the framework for achieving climate neutrality", *Official Journal of the European Union*, L 243/1, 30 June 2021, Article 2.

71 European Parliament and Council of the European Union, "Regulation (EU) 2018/842 of 30 May 2018 on binding annual greenhouse gas emission reduction by Member States from 2921 to 2030 contributing to climate action to meet commitments under the Paris Agreement", *Official Journal of the European Union*, L 156/26, 30 May 2018, Annex I.

72 European Parliament and Council of the European Union, "Regulation (EU) 2021/1119 of 30 June 2021 establishing the framework for achieving climate neutrality", *Op. Cit.*, Article 4.

73 European Commission, "Communication on Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society", *Official Journal of the European Union*, COM(2024) 63 final, 6 February 2024.

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GLOBAL CLIMATE CHANGE MITIGATION: THE EU'S FAIR SHARE

1. PRINCIPLES TO DETERMINE THE EU'S FAIR SHARE

Every fraction of a degree matters: this is why it is important to determine the EU's remaining GHG budget with the highest likelihood of limiting global warming to 1.5°C compared to 1850-1900 levels. According to the IPCC, in order to limit global warming to 1.5°C with an 83% likelihood, the global remaining CO_2 budget from the beginning of 2020 is 300GtCO_2.[74] This remaining carbon budget estimate considers the warming from non-CO_2 drivers. This represents the amount of anthropogenic GHG emissions that can be emitted into the atmosphere to have an 83% chance of keeping the temperature rise to 1.5°C. It is worth mentioning that the scenarios analysed by the ESABCC in its 2040 climate target advice are consistent at a global level with a chance of at least 50% of limiting warming to 1.5°C[75], which opens the door for bigger global carbon budgets, up to 500GtCO_2. As a reference for comparison, in the 1850-2019 period, around 2,390GtCO_2 have been emitted; this shows the level of action needed to stay within the remaining carbon budget.[76]

As said in Article 2 of the Paris Agreement, "*climate action should be implemented to reflect equity and differentiated responsibilities and respective capabilities*".[77] This refers to the fair share of global mitigation efforts. Indeed, according to the IPCC, "*the adoption and implementation of net-zero emission targets by countries and regions also depend on equity and capacity considerations*".[78] The EU's fair share can be calculated with different principles:

- the first of them is of course its alignment with the 1.5°C temperature rise limit of the Paris Agreement. Carbon budgets which don't have a high likelihood of meeting the temperature threshold are inconsistent with the intention of the goal of the Paris Agreement;

- the second principle to calculate the EU's fair share is practical, and refers to the historical responsibility and the capacity to act. The former rlates to countries' cumulative GHG emissions, which means the amount of emissions they have emitted in a defined time-period; the latter relates to countries' higher income and wealth, level of development and access to technologies. Current per capita emissions are also worth considering when assessing a country's or region's fair share.

2. CHALLENGING THE EU-WIDE 2030 AND 2050 CLIMATE TARGETS ON THE BASIS OF THE EU'S FAIR SHARE

The following table shows the historical responsibility of the biggest emitting countries across the world in different time periods:

Global share of greenhouse gas emissions from the biggest emitters

	EU-27	USA	China	India
1850-2021	17%	24%	14%	3%
1990-2021	12%	19%	22%	5%
2015-2021	8%	14%	29%	7%

Data from the ESABCC report on the 2040 target advice.[79]

As seen in this table, over the 1850-2021 period, the EU-27 was the second largest emitter around the world. It is worth mentioning that GHGs have different average lifetime in the atmosphere which, for some of them, are quite long. Carbon dioxide's average lifetime in the atmosphere is hundreds to thousands of years, and about 25% of it lasts effectively

74 Intergovernmental Panel on Climate Change, *The Physical Science Basis. Op. Cit.*
75 ESABCC, *Scientific advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030-2050*. June 2023. Available here.
76 *Ibid.*
77 Paris Agreement, *Op. Cit.*
78 IPCC, Climate Change 2023 - Synthesis Report. 2023. Available here.
79 ESABCC, *Scientific advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030-2050. Op. Cit.*

forever.[80] This means that emissions currently warming the Earth are the one emitted hundreds to thousands years ago, mostly from the EU-27 and the USA. This is where the EU's historical responsibility lies in global climate change: even if its share in global emissions has considerably reduced and dropped to 8% in the 2015-2021 period, the EU has a responsibility to make up for past emissions currently accelerating global warming.

Another way to determine the fair share of a country is to look at its per capita emissions. Even if the EU has considerably reduced its global share of GHG emissions, its per capita emissions are comparable to that of China, which is the current largest emitter. Indeed, in the 2015-2021 period, the EU emitted 21GtCO_2, while China emitted 73GtCO_2.[81] In relation to the population of the European Union[82], the EU's per capita emissions are around 47.1tCO_2 in this period; the Chinese per capita emissions are around 52.1tCO_2 in the same time period.[83] This is close enough to say that, from a per capita emissions perspective, the EU is as big an emitter as China.

Additionally, according to the ESABCC, "*under some of* [different equity] *principles, the EU has already exhausted its fair share of the global emissions budget*".[84] This is confirmed by the Civil Society Equity Review report, stating that "*most Global North countries have mitigation fair shares that are larger than can be met exclusively within their borders, even assuming ambitious domestic actions*".[85] According to this last report, the EU should aim to reach climate neutrality by 2027 to respect its fair share of climate action.[86] This is confirmed by the Climate Equity Reference Calculator, showing that taking into account both historical responsibility and capacity to act, the EU should be climate-neutral before 2030.[87]

The United Arab Emirates (UAE) Consensus: the EU does not contribute its fair share

At the Conference of the Parties (COP) in Dubai, Parties of the Paris Agreement recognised the findings in the Synthesis Report of the IPCC AR6 "*that limiting global warming to 1.5°C with no or limited overshoot required deep, rapid and sustained reductions in global greenhouse gas emissions of 43 per cent by 2030* […] *relative to the 2019 level and reaching net-zero carbon dioxide emissions by 2050*".[88]

When it comes to the implications of this for the EU, the first issue is obvious, and is related to the concept of global net-zero by 2050. Taking into consideration the EU's responsibility in relation to climate change, its historical emissions, its current per capita emissions, its capacity to act compared to other third-party countries, and its role of global leader of the climate transition, the EU should aim to reach carbon neutrality before the 2050 global deadline, and already reach negative emissions by that date to increase the fairness of its contribution. As said by António Guterres, developed economies should aim to reach climate neutrality as close as possible to 2040[89]; and this statement makes even more sense if the overall globe is to be carbon neutral by mid-century.

The second issue is less obvious and is related to what should be the global 2030 target, which is to reach a 43% cut of GHG emissions by 2030, compared to 2019 levels. Translated to a 1990-level basis, this would mean that the EU should aim to decrease its GHG emissions by around 57% by 2030, compared to 1990 levels.[90] This highlights two issues:

- The EU-wide -55% target by 2030, enshrined in the EU climate law, is below the IPCC pathway which was recognised in the UAE Consensus at COP28;
- The EU-wide -55% target does not reflect any kind of responsibility for historical emissions, the EU's current per capita emissions, its capacity to act, and hence does not reflect a fair share of global climate efforts.

In other words, by recognising at COP28 that the global 2030 ambition should be a 43% cut of GHG emissions compared to 2019 levels (i.e. 57% compared to 1990 levels for the EU), and by keeping an EU-wide climate target of 55% cut of GHG emissions, the EU relies on greater effort by other third-party countries to reach the global target. And even more so if the EU is responsible for historical emissions, and responsible for current high levels of per capita emissions and has more resources and access to better technologies.

80 NASA, "Graphic: Major Greenhouse Gas Sources, Lifespans, and Possible Added Heat". June 2023. Available here.
81 ESABCC, *Scientific advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030-2050*. *Op. Cit*.
82 For the EU, demographic data come from Eurostat, and the average population in the EU from 2015 to 2021 has been calculated and represents 445,864,700 inhabitants.
83 Demographic data come from Statista, and the average population in China from 2015 to 2021 has been calculated and represents 1,402,271,429 inhabitants.
84 ESABCC, Scientific Advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030-2050. *Op. Cit*.
85 Civil Society Equity Review, *The 2023 Fair Shares Deficit. A Civil Society Equity Review of the NDCs and 2035 Mitigation Fair Shares*. December 2023. Available here.
86 *Ibid*.
87 Climate Equity Reference Calculator. Available here.
88 United Nations Climate Change, Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on its fifth session, held in the United Arab Emirates from 30 November to 13 December 2023. Addendum. Part two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement at its fifth session. March 2024. Available here.
89 United Nations, "*Secretary-General Calls on States to Tackle Climate Change 'Time Bomb' through New Solidarity Pact, Acceleration Agenda, at Launch of Intergovernmental Panel Report*", *Op. Cit*.
90 Calculation available in Annex I.

Reaching net-zero emissions in such a short time is not realistic; therefore, using a GHG budget for the EU is not relevant anymore, except to determine the extent to which it should take climate action beyond its borders and the extent to which it should be a net-negative emitter after reaching climate neutrality. Indeed, the fair shares of climate action of wealthier regions or countries with high historic emissions are generally larger than can be achieved solely through domestic climate action. Conversely, the mitigation potential in lower income countries is generally larger than their fair share of global effort. This is why, to make up for this shortfall, developed economies should use climate finance to address these two complementary realities. By cutting emissions rapidly in the short term, and providing help to third-party countries to take action beyond its borders, the EU could both decrease its cumulative GHG emissions and improve the fairness of its contribution. The ESABCC confirms: "*ambitious domestic emission reductions need to be complemented by measures outside the EU to achieve a fair contribution to climate change mitigation.*"[91]

91 ESABCC, Scientific Advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030-2050. *Op. Cit*.

IS 90% EMISSIONS REDUCTIONS BY 2040 1.5°C COMPATIBLE?

1. EU-WIDE NET GREENHOUSE GAS EMISSIONS

The following findings compare the EU's projected outcomes for a 2040 climate target, as outlined in the European Commission's impact assessment, with pathways compatible with limiting global warming to 1.5°C. These pathways were derived by downscaling scenarios from the IPCC's Sixth Assessment Report (AR6), specifically from Working Group III (WGIII). These findings do not necessarily reflect the position of WWF. For more information, please see Technical Annex.

a. Analysis of ambition gap

The IPCC AR6 WGIII is very clear: in pathways that limit warming to 1.5°C (>50% of likelihood) with no or limited overshoot, global GHG emissions are reduced compared to modelled 2019 emissions by 43%.[92] Regarding feasibility, it has been determined that "*the total emission mitigation potential achievable by the year 2030, calculated on sectoral assessments, is sufficient to reduce global greenhouse gas emissions to half of the* [2019] *level or less*".[93] This clearly means that the world and especially the EU are able to reach such a level of ambition.

Moreover, as explained above, the EU 2030 target is almost aligned with international commitments from the UAE consensus, but does not take into account any fair share considerations. Indeed, reaching a 43% cut of GHG emissions by 2030, compared to 2019 levels, means that the EU should reach a 57% cut of GHG emissions by that date, compared to 1990 levels.[94] With its 55% cut of GHG emissions by 2030 compared to 1990 levels[95], the EU is below the IPCC advice, and this without taking into account any fair share considerations and historical responsibility. This can be determined also by looking at the EU's annual rate of reduction of GHG emissions. Following the IPCC advice would mean that the annual rate of reductions of GHG of the EU should be 4.98%.[96] However, by reducing its net emissions by 55% by 2030 compared to 1990 levels, the EU's annual rate of reductions would be only 4.56% in the 2019-2030 period.[97]

Regarding the 2040 target advice from the IPCC AR6 WGIII, translated to 1990 levels, this would mean that the EU should cut GHG emissions by around 77% net by 2040. Therefore, the proposal from the European Commission to enshrine a 90% cut of GHG emissions by 2040 compared to 1990 levels[98] looks consistent with this advice. Indeed, the Commission's proposal is above the level implied by the IPCC AR6 WGIII advice. However, again, this figure of 77% is the result of a partial calculation, which does not take into account the EU's fair share and its historical responsibility in global GHG emissions, nor its capacity to act.

On the same note, the IPCC AR6 WGIII states that "*global net-zero CO_2 emissions are reached in the early 2050s in modelled pathways that limit warming to 1.5°C (>50%) with no or limited overshoot*"[99] (and global net-zero GHG emissions a bit later). It is true that it is not possible to compare an EU GHG budget with the Paris Agreement global temperature limit using physical climate science alone, since it requires assumptions about the EU's share of the global mitigation effort. This EU's share has not been determined with a specific figure in this report, since under some principles, it would already be exhausted. However, on the basis of EU's historical responsibility, emissions per capita and capacities, it is more than obvious that the EU should reach its climate-neutrality objective before the 2050s if the world as a whole, including less emitting countries, is to do so by that date. Indeed, according to the ESABCC, "*the lowest feasible budget estimates from the scenarios assessed* [88%] *are still higher than the equal per capita emissions allocations and other fair share estimates based on principles such as 'polluter pays' and 'ability to pay'*".[100] This means that the EU must be looking to address this shortfall as part of its commitment to the Paris Agreement temperature limit, both through international climate finance and by pursuing sustainable net-negative emissions as soon as possible: "*The EU should aim for the highest ambition in domestic emission reductions and sustainable carbon removals*", and "*should contribute to direct emission reductions outside the EU*".[101]

92 IPCC, 2022: Summary for Policymakers. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001.

93 *Ibid*.

94 Calculations available in Annex II.

95 European Parliament and Council of the European Union, "Regulation (EU) 2021/1119 of 30 June 2021 establishing the framework for achieving climate neutrality", *Op. Cit.*, Article 2.

96 Calculations in Annex III.

97 Calculations in Annex IV.

98 European Commission, "Communication on Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society", *Op. Cit*.

99 IPCC, 2022: Summary for Policymakers. *Op. Cit*.

100 ESABCC, *Scientific advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030-2050. Op. Cit.*

101 *Ibid*.

Summary table - EU-wide net greenhouse gas emissions

Indicator	Reference period	1.5°C compatible pathway requirement (globally)	EU target
GHG emissions	2030, relative to 1990	57%	55%
Annual rate of reduction of GHG emissions	2021-2030	4.98%	4.56%
GHG emissions	2040, relative to 1990	77%	90%
GHG emissions	2050	Climate neutrality	Climate neutrality

Green: "the EU target or projection is compatible with a 1.5°C pathway";
Orange: "the EU target or projection is not compatible with a 1.5°C pathway, but is close to";
Red: "the EU target or projection is not compatible with a 1.5°C pathway"

- According to the IPCC advice, and without taking into account any fair share considerations and historical responsibility, the EU should reach around 57% of cut of GHG emissions by 2030 compared to 1990 levels. **The 55% target of the EU falls short of this recommendation**.
- According to the IPCC advice, the annual rate of reduction of GHG emissions of the EU should be 4.98% between 2021 and 2030. The Commission's modelling foresees an annual rate of reduction of around 4.56%, **leaving a gap with a 1.5 compatible pathway**.
- According to the IPCC advice, the EU should cut GHG emissions by around 77% net by 2040 compared to 1990 levels. The Commission's proposal of cutting GHG emissions by 90% looks consistent with this advice, **without taking into account the EU's fair share, its historical responsibility in global GHG emissions, and the additional cumulative emissions induced by a lack of ambition on the 2030 target.**
- According to the IPCC advice, the world should reach climate neutrality in the early 2050s. The Commission's commitment of reaching climate neutrality by 2050 looks consistent with this advice, **without taking into account the EU's fair share, its historical responsibility in global GHG emissions, and the additional cumulative emissions induced by a lack of ambition on the 2030 target.**

b. Progress towards the EU 2030 and 2050 targets

Net GHG emissions including international aviation in the EU-27 decreased by 31.72% between 1990 and 2022.[102] According to the EEA, the "*EU Member States' current projections suggest that a 48% reduction in net emissions will be reached by 2030 compared to 1990 levels*"[103], leaving a gap to the 2030 target. Still according to the EEA, "*the average rate of absolute GHG emission reductions must more than triple to reach the 2030 climate target*"[104] compared with the pace of emission reductions of the past 10 years. But this will still not be enough to reach the EU-wide climate-neutrality target by 2050, since the gap beyond 2030 is even wider. Indeed, while the Commission's impact assessment on the 2040 target states that "*an unchanged policy framework would amount to -88% in 2040 compared to 1990*"[105], the EEA disagrees and estimates that "*taking into account currently adopted and planned measures, net emissions are projected to reach a level of 60% below 1990 levels in 2040 and 64% in 2050*".[106]

The achievement of the EU-wide 2030 climate target requires an average of 141MtCO_2eq annual cut of GHG emissions from 2023 to 2030.[107] However, according to the ESABCC, GHG emissions fell by an average of 62MtCO_2eq yr^{-1} in the 2005-2022 period.[108] Therefore, the EU needs to more than double the pace of reduction of GHG emissions, and go even faster to reach the 2040 target recommended by the European Scientific Advisory body. For this reason, the ESABCC assesses current EU climate action as off track to meet the 55% reduction target by 2030. This is something that the European Commission itself agrees with, stating that overall, "*progress towards the EU climate targets appears insufficient*"[109], and that the pace of emission reduction needs to pick up. According to the Commission, additional action is most needed in the building, transport and agriculture sectors.

102 Eurostat, *Greenhouse gas emissions by source sector*. 2024. Available here.
103 European Environment Agency, *Total net greenhouse emission trends and projections in Europe*. 24 October 2023. Available here.
104 *Ibid*.
105 European Commission, *Impact Assessment Report - Part 1 - Securing our future - Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society*. 6 February 2024. Available here.
106 European Environment Agency, *Total net greenhouse emission trends and projections in Europe*. *Op. Cit.*
107 *Ibid*.
108 ESABCC, *Towards EU climate neutrality: progress, policy gaps and opportunities*. 18 January 2024. Available here.
109 European commission, *Climate Action Progress Report 2023*, October 2023. Available here.

Regarding the 2040 target, the Ecologic Institute states that "*with existing measures [...] the EU is projected to only reduce net emissions by 54% in 2040, and 62% if additional measures are implemented*". According to this think tank's analysis, based on projections from the EEA, the EU is currently set to miss both its climate neutrality target for 2050 and its 55% reduction target for 2030.[110]

This view is shared by ECNO, which is an independent progress monitoring initiative that uses an indicator-based framework and scientifically rigorous analysis to help the EU achieve climate neutrality. According to ECNO latest report, the transition to climate neutrality needs to pick up speed to reach the target by 2050 at the latest.[111] This report then assesses the pace of emission reductions for different sectors and cross-cutting building blocks towards climate neutrality: most of them are too slow and two of them (CDR and finance) are even going in the wrong direction.

Indeed, in the ESR sectors, emissions projections suggest a big gap by 2030, with the emissions reaching a reduction of 32% instead of the target of 40% compared to 2005 levels.[112] This is without mentioning the LULUCF sector where the projections submitted by Member States in March 2023 suggest that the EU-wide target of 310MtCO_2eq removals by 2030 won't be reached, and where figures have not moved in the right direction.[113]

The following subsections aim to give an overview of ambition gap, policy inconsistency, and progress towards climate neutrality in 5 key sectors by using data from the IPCC, the EEA, the European Commission, the ESABCC, and ECNO: energy, industry, agriculture, building, and transport. The following findings come from a comparison of the impact assessment on a 2040 target's EU projections with 1.5°C compatible pathways produced by downscaling the IPCC scenarios.


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110 Meyer-Ohlendorf, Nils et al. (2024): Implementing the EU 2040 Climate Target. Ecologic Institute: Berlin. Available here.
111 European Climate Neutrality Observatory, *State of EU progress to climate neutrality*. July 2024. Available here.
112 ESABCC, *Towards EU climate neutrality: progress, policy gaps and opportunities. Op. Cit.*
113 European Commission, *Climate Action Progress Report 2023. Op. Cit.*

2. POWER SECTOR AND OTHER CROSS-CUTTING ENERGY ISSUES

The following findings compare the EU's projected outcomes for a 2040 climate target, as outlined in the European Commission's impact assessment, with pathways compatible with limiting global warming to 1.5°C. These pathways were derived by downscaling scenarios from the IPCC's Sixth Assessment Report (AR6), specifically from Working Group III (WGIII). These findings do not necessarily reflect the position of WWF. For more information, please see Technical Annex.

Summary table - Energy sector

Indicator	Reference period	1.5°C compatible pathway requirement	EU target
GHG emissions	2030, relative to 2015	87-90%	67%
GHG emissions	2040, relative to 2015	94-99%	100%
Share of renewables in generated electricity	2030	85%	79%
Share of renewables in generated electricity	2040	85-99%	91%
Share of renewables in generated electricity	2050	98-100%	93%
Share of fossil gas in the power sector	2040	0-6%	3-8%
Final electricity demand	2050, relative to 2015	+100%	+31-34%

IPCC 1.5°C compatible pathways do not provide figures regarding the share of renewable energy in gross final energy consumption. Therefore, the following table uses data from the Paris Agreement Compatible (PAC) scenario from Climate Action Network Europe and the European Environment Bureau.

Summary table - Energy sector - PAC scenario

Indicator	Reference period	1.5°C compatible pathway requirement	EU target
Share of renewable energy in gross final energy consumption	2030	50%	42.5%
Share of renewable energy in gross final energy consumption	2040	100%	75%

On the ambition gap, the EU projection for reducing the energy sector's GHG emissions in the 2015-2030 period is well below the IPCC recommendation for a 1.5°C compatible pathway. Therefore, even if the EU 2040 projection for reducing the energy sector's GHG emissions looks consistent with a 1.5°C compatible pathway, this does not take into account **the additional cumulative emissions resulting from a lack of ambition on the 2030 target.** Additionally, the projected shares of renewables in generated electricity by 2030 and by 2050 are well below the IPCC recommendation for a 1.5°C compatible pathway. Finally, the EU projected shares of renewable energy in gross final energy consumption by 2030 and 2040 are not consistent with a 1.5°C compatible pathway.

This ambition gap might be partially solved by a higher ambition on reducing the share of fossil gas in the power sector by 2040, since the upper end of the range targeted by the European Commission is higher than the limits set by a 1.5°C compatible pathway. A higher projection for final electricity demand might also partially solve the issue related to the ambition gap in the energy sector's GHG emissions.

Regarding progress towards the EU targets (ESABCC, the Ecologic Institute and ECNO):

- For 2040, existing and additional measures indicate reductions of emissions of 79%, leaving a gap of 7-9 percentage points with the projections in the Commission's impact assessment.
- Progress in reducing GHG emissions of electricity generation is "too slow": the average rate of reduction of GHG emissions up to 2030 needs to increase by a factor of 1.6 compared with 2005-2022 to be consistent with the 55% target, according to the ESABCC. According to ECNO, the pace of GHG reduction of electricity generation needs to be 1.2 times faster in 2023-2030 than in 2018-2023 to meet the EU objective.
- Progress in reducing the share of fossil fuel-fired power generation is "too slow"; Progress in reducing the share of gas fired power generation is "far too slow"; Progress in reducing the share of coal-fired power generation is "too slow": the phase-out rate for fossil fuels should double up to 2030 to ensure the 2030 target is reached, and more than triple thereafter.
- Progress in increasing the share of variable renewable electricity is "too slow": solar photovoltaic and wind energy need to scale up widely to make the electricity system net-zero by 2040 at the latest.
- The average pace of reduction in final energy use in 2005-2021 would need to increase fivefold in 2022-2030 to achieve the Energy Efficiency Directive (EED) target.

The ESABCC and stakeholders identified some policy inconsistencies and gaps:

- The Trans-European Networks for Energy Regulation, some stated aid rules, and above all the EU Taxonomy are not consistent regarding the role of fossil gas in future energy systems. The latter risks diverting available financial resources from genuinely green and urgently needed technologies, including wind and solar power, electricity storage, and grid expansion and interconnection.
- Residual emissions are currently not defined at the EU or Member States level.
- EU policies are not ambitious enough regarding the application of the energy efficiency first principle, and many relevant projects are exempt from assessment of energy efficiency solutions because of a too high threshold in the EED.
- The current ETD means that electricity may continue to be subject to higher taxes or levies than fossil fuels such as gas in many Member States.
- There is a lack of a cross-cutting EU ban on fossil fuel subsidies.

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3. INDUSTRY

The following findings compare the EU's projected outcomes for a 2040 climate target, as outlined in the European Commission's impact assessment, with pathways compatible with limiting global warming to 1.5°C. These pathways were derived by downscaling scenarios from the IPCC's Sixth Assessment Report (AR6), specifically from Working Group III (WGIII). These findings do not necessarily reflect the position of WWF. For more information, please see Technical Annex.

Summary table - Industry sector

Indicator	Reference period	1.5°C compatible pathway requirement	EU target
GHG emissions	2030, relative to 2015	65-80%	51%
GHG emissions	2040, relative to 2015	84-100%	88%
GHG emissions	2050	Net-zero or negative	Negative emissions
GHG emissions of industrial processes	2040	-19 to 72MtCO_2eq	10MtCO_2eq
Share of electricity in final energy demand	2040	50-63%	48%
Share of electricity in final energy demand	2050	59-64%	62%
CCUS	2040	5 to 236MtCO_2 yr^{-1}	140MtCO_2 yr^{-1}

On the ambition gap, the EU target for reducing the industry sector's GHG emissions in the 2015-2030 period is well below the IPCC recommendation for a 1.5°C compatible pathway. Therefore, even if the EU 2040 projection for reducing the industry sector's GHG emissions looks consistent with a 1.5°C compatible pathway, this does not take into account **the additional cumulative emissions resulting from a lack of ambition on the 2030 target.** The same goes for the EU 2050 projection for reducing the sector's GHG emissions.

Moreover, the EU projection regarding the share of electricity in final energy demand by 2040 falls short of the 1.5°C compatible pathway requirements. Therefore, even if the EU 2050 projection regarding the share of electricity in final energy demand looks consistent with a 1.5°C compatible pathway, this does not take into account **the additional cumulative emissions induced by a lack of ambition on the 2040 target.** Finally, the projection for the deployment of CCS and CCU technologies by 2040 is consistent with a 1.5°C compatible pathway. However, the future targeted application of CCU and CCS is currently missing from the Commission's impact assessment on the 2040 target; as requested by the ESABCC, "*the deployment of carbon capture and utilisation/storage (CCU/CCS), hydrogen, and bioenergy should be targeted towards activities with no or limited alternative mitigation options*".[114]

114 ESABCC, *Towards EU climate neutrality: progress, policy gaps and opportunities. Op. Cit.*

Regarding progress towards the EU targets (ESABCC, the Ecologic Institute and ECNO):

- In 2040, industry emissions are supposed to decrease by 92% relative to 1990 levels, according to the European Commission's impact assessment. However, industrial emissions are projected to decrease by only 61% in 2040, even if additional measures are implemented.
- Progress in reducing GHG emissions from industry is "too slow": the average annual reduction in 2005-2022 needs to accelerate to be consistent with the trajectories towards the overall 2030 and 2050 reduction objectives. According to ECNO, the pace of GHG emission reduction of the EU industry needs to be 1.3 times faster in 2022-2050 than in 2017-2022 to meet the EU objective.
- Progress in increasing the share of clean energy carriers in energy and feedstock use is "far too slow".
- Progress in increasing circular material use rate is "far too slow".
- Progress in reducing final energy consumed in this sector is "far too slow".
- According to the ESABCC, accelerated electrification of energy demand is not yet on track to reach the EU's climate objectives. Electrification needs to increase considerably, to align with the trajectories towards overall climate neutrality by 2050.

The ESABCC and stakeholders identified some policy inconsistencies and gaps:

- High levels of free emission allowances under the EU ETS to heavy industry, in combination with the lack of a carbon price on material imports, and the exclusion of the waste sector under the EU ETS, represent a failure to apply the polluter pays principle.
- Lack of policies addressing demand management, material efficiency, or dedicated policies to support early deployment and market formation of low-emissions technologies.
- Sectoral roadmaps, which could be valuable for industry sectors and sub-sectors, have not been developed to any significant extent so far.
- There is still a gap in reaching full maturity regarding promising low-carbon technologies, such as CCS for cement, hydrogen direct reduction of iron ore (steel) and electrification.
- EU policies to promote biomethane risk extending the use of fossil fuels, delaying electrification and lead to higher fugitive emissions.
- For other industrial sectors, emissions are mainly related to heat production, which can be reduced through direct electrification, complemented with other forms of renewable heat (e.g. based on hydrogen).

4. TRANSPORT

The following findings compare the EU's projected outcomes for a 2040 climate target, as outlined in the European Commission's impact assessment, with pathways compatible with limiting global warming to 1.5°C. These pathways were derived by downscaling scenarios from the IPCC's Sixth Assessment Report (AR6), specifically from Working Group III (WGIII). These findings do not necessarily reflect the position of WWF. For more information, please see Technical Annex.

Summary table - Transport sector

Indicator	Reference period	1.5°C compatible pathway requirement	EU target
GHG emissions	2030, relative to 2015	49-51%	19%
GHG emissions	2040, relative to 2015	87-90%	78%
GHG emissions	2050, relative to 2015	97-98%	95-96%
Share of electricity in final energy demand	2030	12-15%	6.5%
Share of electricity in final energy demand	2040	35%	20%
Share of electricity in final energy demand	2050	42-46%	29%
Share of low-carbon fuels including electricity in final energy demand	2030	23-24%	13%
Share of low-carbon fuels including electricity in final energy demand	2040	55-60%	67%
Share of low-carbon fuels including electricity in final energy demand	2050	83-86%	92%

On the ambition gap, the transport sector looks the least 1.5°C compatible. EU projections for reducing the transport sector's GHG emissions by 2030, 2040 and 2050 are all below the IPCC recommendation for a 1.5°C compatible pathway. Where the 2050 target is however close to the range recommended by the IPCC, the 2030 target falls short of this recommendation by at least 30 percentage points, leaving a huge gap in ambition.

On the same note, the EU projections of the share of electricity in final energy demand in the EU transport sector by 2030, 2040 and 2050 are also all below the IPCC recommendation for a 1.5°C compatible pathway, as well as the EU projection on the share of low-carbon fuels by 2030. The share of low-carbon fuels including electricity in final energy demand by 2040 and 2050 look consistent with a 1.5°C compatible pathway, however, this does not take into account **the additional cumulative emissions resulting from a lack of ambition on the 2030 target.**

Even though the RED sets a sub-target for the renewable share in the energy mix of the transport sector, it should go further and explicitly exclude inefficient uses of certain renewable energy carriers, in order to encourage the deployment of the right solutions in the right sectors (for example encouraging the burning of e-fuels in cars, as opposed to in hard to abate forms of transport such as aviation, is neither energy efficient nor consistent with a cost-effective approach to decarbonisation).

Regarding progress towards the EU targets (ESABCC, the Ecologic Institute and ECNO):

- In 2040, domestic transport emissions are supposed to decrease by 82% relative to 1990 levels, according to the European Commission's impact assessment. However, domestic transport emissions are projected to decrease by only 21% in 2040 if existing measures are implemented, and by 39% if additional measures are implemented.
- Even if some improvements in vehicle efficiency and the GHG intensity of transport have driven a reduction in emissions, these have been offset by increased overall transport demand and the shift towards heavier and less efficient passenger cars.
- Looking ahead to 2030, the Commission's mix 55-scenario envisions a 23% decrease in GHG emissions from the transport sector compared to 2005 - however, Member States' projections would leave a gap towards reaching this target, with the sector's GHG emissions expecting to drop by only 18% compared to 2005.
- Progress in reducing GHG emissions from the transport sector is "far too slow": the average rate of reduction since 2005 needs to increase more than tenfold to be consistent with the 55% target. ECNO concludes that the pace of GHG emissions reduction of transport needs to be 1.4 times faster in 2022-2050 than in 2017-2022 to meet the EU objective.
- Progress in increasing the total passenger transport volume is "too slow".
- Progress in increasing the total freight transport volume is "too slow".
- Progress in reducing the share of passenger transport volume on road is going in the "wrong direction".
- Progress in increasing the share of passenger transport volume on rail is going in the "wrong direction".
- Progress in reducing the share of freight transport volume on road is going in the "wrong direction".
- Progress in increasing the share of freight transport volume on rail is going in the "wrong direction".
- Progress in increasing the share of electric vehicles in passenger car stock is "far too slow".

The ESABCC and stakeholders identified some policy inconsistencies and gaps:

- Current CO_2 emission performance standards incentivise car manufacturers to prioritise larger and less efficient vehicles.
- The exemptions of tax for commercial aviation and maritime fuels.
- The promotion of transport biofuels that increase emissions compared to fossil fuels.
- Extra-EU aviation and half of extra-EU maritime transport remains exempt from the ETS.
- The Air Services Regulation, which does not define measures to ban short haul flights.
- The RED, which does not exclude inefficient uses of certain renewable energy carriers in the transport sector.
- Lack of measures to improve the efficiency of transport systems and to reduce demand, beyond changes in technologies, to promote a modal shift from emission-intensive to lower-emission transport modes, more resource-efficient vehicles, and a switch towards non-fossil, low-carbon fuels for those subsectors that cannot be fully electrified.

5. LULUCF AND AGRICULTURE

The following findings compare the EU's projected outcomes for a 2040 climate target, as outlined in the European Commission's impact assessment, with pathways compatible with limiting global warming to 1.5°C. These pathways were derived by downscaling scenarios from the IPCC's Sixth Assessment Report (AR6), specifically from Working Group III (WGIII). These findings do not necessarily reflect the position of WWF. For more information, please see Technical Annex.

Summary table - Agriculture sector and LULUCF

Indicator	Reference period	1.5°C compatible pathway requirement	EU target
LULUCF sink	2030	-290-360MtCO_2eq yr^{-1}	-310MtCO_2eq yr^{-1}
LULUCF sink	2050	At least 540MtCO_2eq yr^{-1}	330MtCO_2eq yr^{-1}
Afforestation and reforestation	2030	+16 million ha	+3 million ha
Non-CO_2 emissions (LIFE scenario)	2050	No more than 170MtCO_2eq	No more than 194MtCO_2eq

On ambition gap, even if the EU LULUCF target by 2030 is consistent with a 1.5°C compatible pathway, the target for 2050 does not follow a 1.5°C compatible route. The EU 2030 target for afforestation and reforestation is also far from a 1.5°C compatible pathway, with only 3 million ha of afforestation and reforestation instead of 16 million ha. Finally, the decrease of non-CO_2 emissions projected by 2050 is not compatible with 1.5°C compatible pathway requirements, with a projection representing a maximum level of non-CO2 emissions of 194MtCO_2eq instead of the 170MtCO_2eq recommended by the IPCC. These are huge gaps to address, especially in the context where the Agriculture, Forestry and Other Land Use (AFOLU) sector "*can provide 20-30% of the global mitigation needed for a 1.5°C or 2°C pathway towards 2050*".[115]

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115 IPCC, 2022: Summary for Policymakers. *Op. Cit.*

Regarding progress towards the EU 2030 and 2050 targets - agriculture (ESABCC and ECNO):

- According to the EEA, "*while non-CO_2 greenhouse gas emission reductions from the European Union agriculture sector are covered by national targets under the Effort Sharing Regulation, they only fell by 5% between 2005 and 2022. Estimates indicate that these emissions fell by a further 2% between 2022 and 2023.* [...] *The total reduction of agricultural emissions by 2030 would reach a level 7% below 2005 levels with the implementation of additional, currently planned measures*".[116]
- Progress in reducing GHG emissions from the agriculture sector is "too slow": reductions are needed to align with the EU's climate objectives. The pace of GHG emissions reduction of the agrifood sector needs to be 1.4 times faster in 2023-2050 than in 2017-2020 to meet the EU objective. However, the European Commission has stated that, under existing measures, the pace of emission cuts won't change by 2030.
- Progress in reducing cattle meat consumption is "too slow";
- Progress in reducing the use of nitrogen fertiliser is "too slow";
- Progress in increasing the share of organic farming in total agriculture area is "far too slow";
- Progress in reducing livestock numbers is going in the "wrong direction";
- Progress in reducing manure management emissions intensity of cattle is going in the "wrong direction";
- Progress in reducing the volume of food waste is going in the "wrong direction";
- Progress in reducing emissions from food processing, transport, and packaging is "far too slow".

Regarding progress towards the EU 2030 and 2050 targets - LULUCF (ESABCC and ECNO):

- Progress in enhancing net removals from LULUCF is going in the "wrong direction". The pace of GHG emission reduction of the LULUCF sector needs a U-turn to meet the EU objective.
- Progress in improving growth in forest area is going in the "wrong direction";
- Progress in improving growth of carbon stock in forest land is going in the "wrong direction";
- Progress in increasing concentration of organic carbon in arable land is going in the "wrong direction";
- Progress in reducing net CO_2 emissions from croplands, grasslands and wetlands is "far too slow".

The ESABCC and stakeholders identified some policy inconsistencies and gaps:

- Many aspects of the CAP are either actively counterproductive or seriously deficient on climate grounds, and provide direct support to emission-intensive agricultural practices such as livestock production instead of supporting the transition to less emission-intensive activities.
- Agriculture and LULUCF are both currently excluded from the EU carbon-pricing regime. Therefore there is no EU-wide (financial) incentive for farmers and land managers to reduce GHG emissions and enhance CDR. It also implies that the incentives for using forest biomass for energy purposes versus maximising the LULUCF carbon sink continues to be unevenly distributed between private and public actors.
- There is a lack of measures to prevent agricultural practices that lead to high soil carbon emissions from grasslands.
- EU bioenergy policies continue to incentivise the burning for energy of trees and crops, which increases emissions compared to fossil fuels.
- Member States are allowed to use excess removals in the LULUCF sector to offset emissions covered by the ESR.
- There is a lack of policy to promote improved forest management, reduced deforestation and degradation, grassland and savanna conversion and fire management, petland conservation and restoration, coastal wetland protection and restoration, etc.

116 European Environment Agency, "Greenhouse gas emissions from agriculture in Europe". 31 October 2024. Available here.

6. BUILDINGS

The following findings compare the EU's projected outcomes for a 2040 climate target, as outlined in the European Commission's impact assessment, with pathways compatible with limiting global warming to 1.5°C. These pathways were derived by downscaling scenarios from the IPCC's Sixth Assessment Report (AR6), specifically from Working Group III (WGIII). These findings do not necessarily reflect the position of WWF. For more information, please see Technical Annex.

Summary table - Building sector

Indicator	Reference period	1.5°C compatible pathway requirement	EU target
CO_2 emissions	2030, relative to 2015	-50-63%	-57%
CO_2 emissions	2050, relative to 2015	-95-98%	Near net-zero
Share of electricity in final energy demand	2030	41-48%	43%
Share of electricity in final energy demand	2050	70-81%	64%
Share of low-carbon fuels including electricity in final energy demand	2030	64-66%	73%
Share of low-carbon fuels including electricity in final energy demand	2040	81-89 %	92%
Share of low-carbon fuels including electricity in final energy demand	2050	At least 98%	Near 100%

IPCC 1.5°C compatible pathways do not provide figures regarding the levels of energy efficiency targets and building renovation rates. Therefore, the following table uses data from the PAC scenario from Climate Action Network Europe.

Summary table - Building sector - PAC scenario

Indicator	Reference period	1.5°C compatible pathway requirement	EU target
Energy efficiency	2030, relative to PRIMES 2020 projections	-20%	-11.7%
Final energy consumption	2040, relative to 2020 levels	-40%	-41-45%

On the ambition gap, the building sector looks consistent with a 1.5°C compatible pathway. However, the projected share of electricity in final energy demand by 2050 is not consistent with the 1.5°C objective, and is not compensated for by a high share of low-carbon fuels in final energy demand by the same year. Moreover, the EU 2030 energy efficiency target falls short of the requirements to keep the EU on track on the 1.5°C objective. Additionally, this report does not evaluate the consistency of the EU building renovation rate with a 1.5°C compatible pathway, while this aspect is a key component of the decarbonisation of the EU's building sector. It is worth noting that there is no mandatory EU renovation target, and that the objective of doubling the current renovation rate in the next decade comes from a communication (the Renovation Wave Strategy) and not a Directive or Regulation.

As 75% of buildings in the EU are deemed inefficient, it is safe to say that the portion of 'worst-performing buildings' is the highest across residential and non-residential sector, coupled with the low energy renovation rates (1.2% per annum, and 0.1% deep), it means urgency to improve this segment is needed. Renovating (deeply) this segment can entail the highest energy savings potential (and linked CO_2 emissions cuts) and it can alleviate energy poverty. This phenomenon is on the rise and now affects 10.6% of the EU population which cannot keep their homes adequately warm during winter. Energy poverty is an intersecting issue, beyond energy, it affects mainly low income/vulnerable households which are likely to occupy these worst-performing buildings.

Regarding progress towards the EU 2030 and 2050 targets (ESABCC and ECNO):

- Progress in reducing GHG emissions from buildings is "far too slow": the average rate of GHG emissions reductions would need to almost triple in 2023-2030 compared to 2005-2022. The pace of GHG emissions reduction of the building sector needs to be 2.6 times faster in 2023-2030 than in 2017-2022 to meet the EU objective.
- The reduction of the demand for heating of residential buildings needs to be 4.7 times faster in 2021-2030 than in 2016-2021 to meet the EU objective. The increase of the share of renewable energy in heating and cooling needs to be 4 times faster in 2022-2030 than in 2017-2022 to meet the EU objective.
- Progress in reducing demand of cement of concrete blocks and bricks is going in the "wrong direction".
- Progress in reducing the average space per capita is going in the "wrong direction".
- Progress in reducing demand for heating of residential buildings is "far too slow".
- Progress in increasing investments for energy renovation is "far too slow".
- Progress in increasing the average renovation rate is "far too slow".
- Progress in increasing deep renovation rate of residential buildings and non-residential buildings is "far too slow".
- Progress in increasing the share of renewable energy in heating and cooling is "far too slow". Consequently, one could assume that progress in phasing out fossil fuel-based heating systems is also far too slow.

The ESABCC identified some policy inconsistencies and gaps:

- Subsidies to fossil gas persist as they are allowed under the ETD;
- The new revised EED and Energy Performance of Building Directive do not explicitly aim to leverage sufficiency.

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CROSS-CUTTING ISSUES AND ENABLING CONDITIONS

The Commission's 2040 Impact Assessment and the ESABCC Scientific advice both identify factors that will need to be addressed explicitly in order to ensure that measures to achieve the 2040 target can be implemented in 'real-world' conditions. These include ensuring a just transition by identifying the impacts of transition-related policies on different categories of households, workers and regions and providing support to mitigate these impacts. Key approaches identified, and which require further elaboration include:

- Strengthened synergies between EU climate policies and social policies;
- Adequate targeting and resourcing of measures that compensate for regressive policy impacts;
- Transition-related policy across all sectors need to account for local contexts, engage stakeholders and ensure equity and justice;
- Address energy poverty (European Commission's recommendations of October 2023).

Models used in the Commission's impact assessment showed relatively low levels of aggregate impact on employment. However this overall assessment of impacts (which also needs to be understood in light of trends affecting employment including digitalisation and demographic change) masks sometimes dramatic changes that can be expected within specific sectors and/or locations. The variation in opportunities and impacts between regions means that a close coordination will be required between sectoral policy, social policies and cohesion policies.

Scenarios for 2040 targets must of course also be analysed on the basis of cost. The 2040 target will also only be achievable if significant funds are committed to finance the transition through a strong investment framework. The annual investment needs for energy and transport between 2031 and 2050 to achieve the EU's climate targets average €1.5 billion.[117] Ramping up private finance to meet this investment challenge will be crucial. However, a large share of investments will have to be funded by governments. For instance, on average 45% of the measures identified in the National Energy and Climate Plans are expected to be paid for by public investments.[118] With the recent revision of the EU fiscal rules, member states' ability to meet these public investment needs at national level will be limited.[119] At the same time, the expiration of the Recovery and Resilience Facility at the end of 2026 will significantly reduce the availability of funds for the green transition at EU level. The upcoming negotiations on the Multiannual Financial Framework post-2027 therefore provide a crucial opportunity to revamp the EU's public finance architecture.

A cross-cutting issue which touches upon different sectors is the lack of necessary electricity grid infrastructure, for example in terms of the capacity and/or modernisation of distribution networks, transmission systems and interconnection and the shift to more digitalised grids. Some European countries have massively constrained electricity grids, which is a major issue for the transport sector. It is beyond the scope of this report to examine this in detail, but the EU clearly needs a European-led major policy initiative to enable the near-full electrification of buildings, industry and road transport and the deployment of low-carbon fuels based on renewable electricity for aviation and shipping.

Additionally, to a large extent the decarbonisation of the power sector depends heavily on demand-side measures, whether in industry, transport or buildings, and in terms of both demand reduction and demand side response (meaning flexibility). In the transport sector, additional policies and measures are required urgently to improve the efficiency of transport systems and to reduce demand, beyond changes in technology. There should be more incentives to facilitate the huge changes in lifestyles, behaviour and modal shifts required to decarbonise the transport and related sectors, from better public transport within and between cities and regions to car sharing schemes and cycling. There are currently significant concerns as to whether policies in these areas will deliver. Indeed, ECNO assesses that progress in reducing per-person material footprint is going in the wrong direction, and that progress in reducing per-person carbon footprint from household expenditure is far too slow.[120] In the industry sector, a shift to a much more circular economy is essential, in order that material efficiency be dramatically increased and demand for virgin raw materials be reduced. An important range of strategies are left on the side to achieve the transformation of EU heavy industries, whereas they should be at the core of EU industrial policy to ensure strategic independence, build resilience and bring together wide EU Green Deal objectives. Embracing the principles of a circular economy, the EU should emphasise in its policies demand-side reduction measures, reuse and recycling of materials and products, substitution of critical raw materials and material efficiency in industry. Europe should diversify its solutions to address this epochal challenge and go beyond a

117 European Commission, *Impact Assessment Report - Securing our future - Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society. Op. Cit.*

118 European Investment Bank. Investment report 2020/2021. 2021. Available here.

119 Sebastian Mang and Dominic Caddick. Navigating Constraints for Progress: Examining the Impact of EU Fiscal Rules on Social and Green Investments. 2024. Available here.

120 ECNO, *State of EU progress to climate neutrality. Op. Cit.*

simple access-to supply-response, which must tackle the root cause of the problems and not the symptoms.

Another cross-cutting issue, which is relevant to all energy using sectors and the LULUCF sector, is related to EU's policies on bioenergy, which are set out in the RED. These continue to incentivise sources of bioenergy that increase emissions compared to fossil fuels, and are therefore completely inconsistent with climate goals. Specifically:

- The RED will continue to incentivise the dedicated use of land for biofuel, biogas and other energy crops, despite that being counterproductive in climate terms compared to using such land for food or feed production or carbon sequestration. The only restriction is a cap on the use of food and feed crops for biofuels in the transport sector, which itself should be reduced to zero.
- The RED will continue to incentivise the burning of trees taken from forests, even though the JRC and others have made clear that burning such feedstocks will increase emissions for decades or even centuries compared to fossil fuels.
- The completely inadequate bioenergy criteria in the RED are also relied upon as a basis for other EU policies, including the ETS, the ESR, the sustainable finance taxonomy, and to a marginally lesser extent in ReFuelEU Aviation and FuelEU Maritime.

As regards carbon pricing, according to the ESABCC, "*achieving climate neutrality requires a policy mix with a sufficiently high, credible and consistent price signal for GHG emissions*".[121] In most sectors, the Scientific Advisory Board states that internalising the externalities of GHG emissions in the market is an effective tool to incentivise producers and service providers to adopt lower-emission processes, while incentivising a reduction of GHG-intensive products and services from consumers. However, the ESABCC also insists that "*carbon pricing needs to be complemented by measures to address social impacts and other market failures and to support investment in infrastructure and innovative new technologies, as well as action to prevent carbon leakage*".[122]

Regarding finance and investment, the ESABCC states that investment in clean energy and transport needs to at least quadruple to achieve the EU's climate goals. According to the Advisory Body, the annual average of investment in these sectors should be EUR 1,241 billion.[123] The EU should also develop a more ambitious policy on research, development and deployment to accelerate innovation and support competitiveness. Indeed, ECNO states that progress in increasing clean technology industry added value is too slow, and that progress in increasing private energy R&I spending is far too slow. Generally, progress in bridging the climate investment gap is too slow, and in cutting fossil fuel subsidies is going in the wrong direction.[124]

Finally, climate governance should be improved through the revision of the Governance Regulation, especially the National Energy and Climate Plans, the national Long-Term Strategies and progress reports, which are pivotal to the delivery of the EU's climate objectives: "*their timeliness and quality can be further improved*".[125] ECNO confirms that progress in improving thorough implementation of EU governance requirements at national level is far too slow.[126] On the same note, the ESABCC is concerned that the compliance mechanisms in the ESR are currently too weak.

121 ESABCC, *Towards EU climate neutrality: progress, policy gaps and opportunities. Op. Cit.*
122 *Ibid.*
123 *Ibid.*
124 ECNO, *State of EU progress to climate neutrality. Op. Cit.*
125 ESABCC, *Towards EU climate neutrality: progress, policy gaps and opportunities. Op. Cit.*
126 ECNO, *State of EU progress to climate neutrality. Op. Cit.*

CONCLUSION

The European Commission's impact assessment for the EU's 2040 climate target marks a significant step forward in Europe's efforts to mitigate climate change. This document provides a strategic foundation; however, it is evident that a higher level of ambition is essential across most sectors to meet and exceed the stated climate goals. Europe's pathway to climate neutrality will require decisive action to align with 1.5°C compatible trajectories, involving both deeper emission cuts and substantial investments in renewable energy, energy efficiency, and sustainable infrastructure. Aligning financial mechanisms, policy frameworks, and sectoral targets will be crucial to ensuring that the EU meets its climate-neutrality goal while contributing fairly to global climate efforts. This assessment, addressing the gaps and pressing needs across sectors, forms a critical roadmap for achieving a sustainable, resilient, and equitable 1.5°C compatible future for the European Union. One of the main findings above is the critical role that sectoral transformation plays, especially within high-emission sectors such as power, industry and transport.

POWER SECTOR AND OTHER CROSS-CUTTING ENERGY ISSUES

The energy sector's transition towards renewables is pivotal, yet the pace must accelerate beyond the current trajectory to meet the EU climate objectives and remain compatible with 1.5°C pathways, especially for the deployment of non-biomass or hydropower renewables such as wind and solar. Targeting financial resources towards genuinely sustainable solutions rather than fossil gas projects would be a strategic step towards achieving the EU's climate targets. This could help the energy sector to decarbonise in a 1.5°C compatible way: even if the EU's target for 2040 is consistent with such pathways, the additional cumulative emissions resulting from a lack of ambition on the 2030 target mean that the overall trajectory for this sector will not be 1.5°C compatible.

INDUSTRY

In the industry sector, existing frameworks such as the ETS provide a foundation, but certain inconsistencies, such as the granting of free emissions allowances for heavy industries and the lack of a comprehensive ban on fossil fuel subsidies, hinder overall progress. Addressing these policy gaps is essential to applying the "polluter pays" principle fully. Progress towards the current targets is too slow, and, even if the 2050 target for reducing emissions from this sector looks consistent with 1.5°C, the additional cumulative emissions resulting from a lack of ambition on the 2030 target mean that the overall trajectory for this sector will not be 1.5°C compatible.

TRANSPORT

The transport sector presents one of the least 1.5°C compatible projections of this study. The EU 2030, 2040 and 2050 projections for reducing GHG emissions in this sector, and to increase the share of electricity in final energy demand, are all inconsistent with a 1.5°C compatible pathway. And progress in reaching these unambitious targets is too slow, if not far too slow. The EU should revise inconsistencies in its transport policies, in particular related to biofuels and tax exemptions, among others.

LULUCF AND AGRICULTURE

Agricultural emissions have remained essentially stagnant for the last 20 years. Key measures such as reducing livestock emissions, advancing soil carbon sequestration, and optimising crop management will be crucial to become 1.5°C compatible. Policy gaps, including the need for stronger incentives for sustainable farming practices, must be addressed. Many aspects of the CAP are either actively counterproductive or seriously deficient on climate grounds, and need to be addressed. This is of the utmost importance since the EU projection for non-CO_2 emissions by 2050 is so far not consistent with 1.5°C compatible pathway requirements.

The LULUCF sector is essential to the EU's climate strategy, serving as a critical natural carbon sink. While LULUCF has potential to offset emissions through reforestation, improved land management, and soil carbon storage, current efforts are not sufficient to meet 2040 and 2050 climate targets. Strengthening policies to protect existing forests, restoring degraded lands, and enhancing carbon sequestration practices is vital. Also, even if the 2030 target for LULUCF removals looks consistent with a 1.5°C compatible pathway, a huge gap in the 2050 target could endanger both the achievement of climate neutrality and the 1.5°C threshold.

BUILDINGS

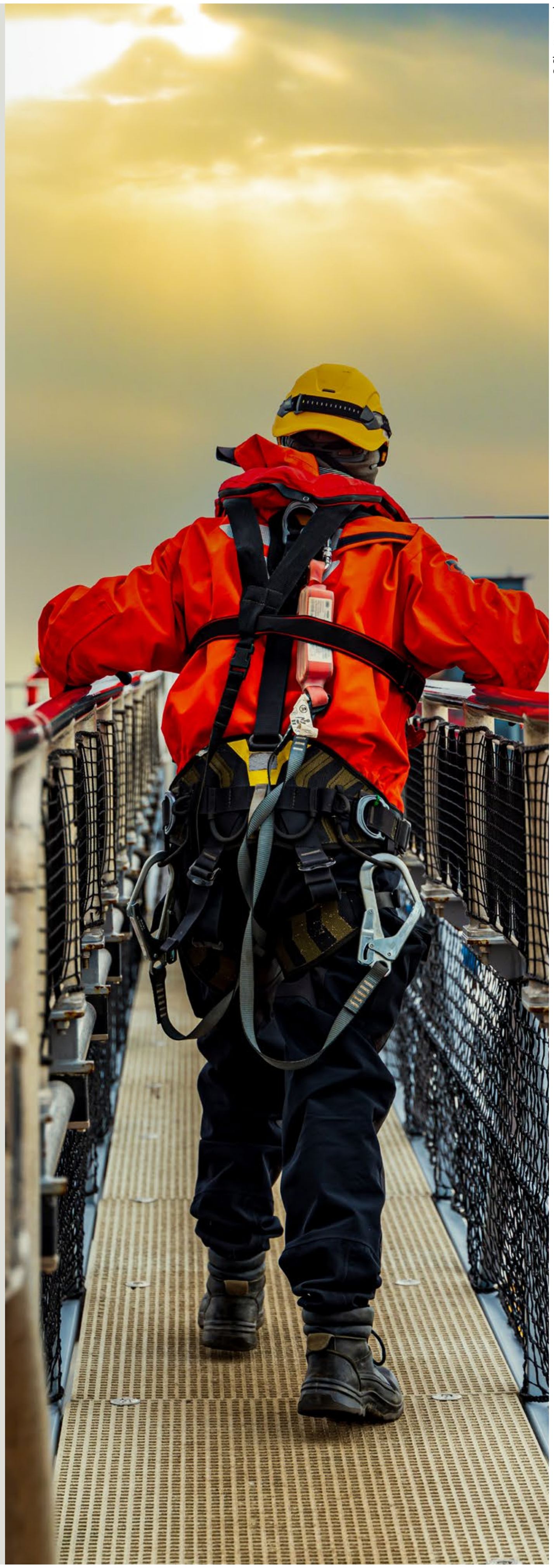
Regarding the building sector, the EU targets look consistent with a 1.5°C trajectory. However, some inconsistencies remain in EU policies, especially related to subsidies for fossil gas and a lack of ambition to leverage sufficiency. Moreover, even if the targets are 1.5°C compatible, the EU is not on track to meet them: progress in reducing GHG emissions is far too slow, as well as progress in increasing investment for energy renovation or the average renovation rate. The building sector is therefore a good example of a case where adopting 1.5°C compatible targets is not enough: implementing the right policies and measures to achieve them is also important.

FINAL WORDS

The EU's climate targets for 2030, 2040, and 2050 aim to sharply reduce GHG emissions, yet they fall short of equitable pathways compatible with limiting global warming to 1.5°C. The current 2030 target of a 55% reduction in emissions lags behind the IPCC recommendation of a 57% cut, underscoring an ambition gap, and so without taking into account the EU's fair share in global climate efforts. By 2040, the EU's proposed 90% emissions reduction aligns more closely with IPCC's 77% recommendation but still overlooks the additional reductions needed to reflect the EU's historical emissions and fair share of the global effort, as well as the additional cumulative emissions resulting from a lack of ambition in the period to 2030.

For 2050, the EU's climate-neutrality target is broadly compatible with the IPCC's directive to reach global net-zero emissions by mid-century, yet cumulative emissions resulting from lower targets in earlier years create challenges for the world to stay within a 1.5°C compatible greenhouse gas budget. Accelerated emission cuts across high-impact sectors - energy, transport, industry, agriculture, and LULUCF - are critical to closing these gaps.

Aligning the EU's targets with 1.5°C pathways will require strengthened policies, faster transitions, and equitable climate action that acknowledges both present responsibilities and future imperatives. By committing fully to these ambitions, the EU can set a powerful example in the global transition to a sustainable, resilient, and climate-safe future.



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