Zeroing in on net-zero

The role of carbon dioxide removals and carbon sequestration in EU member states' climate planning.

CARBON MARKET WATCH

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Glossary

BECCS: Bioenergy with Carbon Capture and Storage

bio-CCS: Biomass with Carbon Capture and Storage

CCS: Carbon Capture and Storage

CCU: Carbon Capture and Utilisation

CDR: Carbon Dioxide Removal

CMS: Carbon Management Strategy

DACCS: Direct Air Capture with Carbon Storage

ESR: Effort Sharing Regulation

ETS: Emission Trading System

GHG: Greenhouse Gas

IPCC: Intergovernmental Panel on Climate Change

LNe: Long-term Negative Emissions Strategy

LTS: Long-Term Strategy

LULUCF: Land Use, Land-Use Change and Forestry

NECP: National Energy and Climate Plan

SOC: Soil Organic Carbon

Executive Summary

European Union countries are failing to responsibly govern negative emissions (i.e., processes that draw down more carbon from the atmosphere than they emit) in their national climate plans. This report reveals that Germany, the Netherlands, Poland, Spain, and Sweden still lack a structured, strategic and equitable approach to carbon dioxide removals (CDR) and sequestration in biomass and soils, based on the review of their National Energy and Climate Plans (NECPs) and Long-Term Strategies (LTSs). The report adds to the evidence from a prior analysis of the role of CDR and negative emissions from land in climate plans of Austria, Finland, France, Italy, Ireland, Norway, and the European Commission.

Countries are hoping that highly vulnerable carbon sequestration in biomass and soils will offset emissions and help them reach climate neutrality, despite projections in many countries showing these sinks are declining alongside continued failures to protect them. In addition, permanent removals barely feature in some countries' plans, despite them being a necessity to stay within the bounds set by the Paris Agreement. Spain and Poland do not outline any plans to build permanent CDR capacity and seem to defer the issue to the future, leaving a central pillar of long-term climate neutrality effectively unplanned.

Even when permanent removals are addressed, there is a lack of vision for their sustainable deployment. Only Germany and Sweden connect projected removal volumes to any feasibility basis, and even these rest on optimistic assumptions about deployment speed and available storage capacity. Poland's plan does not meaningfully distinguish CDR from fossil carbon capture and storage (CCS), and the Netherlands' main financing instrument likewise conflates the two, making it unclear whether public money supports genuine negative emissions or goes to support fossil-fuel-emitting industries.

Underpinning all the reviewed countries' climate plans is a lack of clarity regarding the end use of negative emissions. Only Spain and Sweden quantify residual emissions, while the reasoning for which emissions would remain is thin. Germany, the Netherlands, and Poland leave residual emissions largely undefined. Without a clear, participatory process to determine which emissions are too difficult for societies to abate, the EU and its member states risk deferring the issue to the

future. This costs valuable time and makes already hard societal transformations even harder. The longer we delay drastic emissions cuts and the parallel development of CDR strategies and safeguards to guide CDR development, the more costly and uncertain the outcome will be.

The EU Governance Regulation - which sets out the rules for reporting and planning within Member States' NECPs and LTSs - is scheduled for review starting in late 2026. Together with the new versions of countries' plans, due in 2029, this presents a golden opportunity to fix this strategic gap in the EU's climate plans.

Table 1: Country performance overview

	Germany	Netherlands	Poland	Spain	Sweden
Separate targets for CDR	In progress	No	No	No	Partial
Dedicated strategy for CDR	In progress	Yes	No	No	Partial
Residual emissions definition	No	No	No	Partly	No
Residual emissions quantification	Yes	No	No	Yes	Yes
Role of biomass & soils	High risk	Low risk	Medium risk	High risk	High risk

See the annex for a more detailed version of this table.

Introduction

To prevent the most catastrophic impacts of climate change and limit global temperature rise in line with the Paris Agreement, global emissions must be slashed rapidly. However, even under the most aggressive decarbonisation scenarios, the best available science tells us that certain emissions will remain due to technological, economic, and broader societal constraints. Therefore, carbon dioxide removals (CDR) - methods that permanently remove CO_2 from the atmosphere - will be unavoidable.

Emissions projected to be extremely hard to completely avoid due to technological or economic constraints are commonly labelled as "hard-to-abate emissions". However, a significant portion of emissions typically classified as hard-to-abate could be reduced by measures supporting behavioural change, which could limit reliance on CDR considerably. This means technological or economic barriers alone cannot determine what is unavoidable. Deciding which emission genuinely cannot be eliminated, and can be expected to be truly "residual" emissions, is not a purely technical or economic question, but also a societal one.

A participative process will be needed to decide which emissions are truly unavoidable for societies, and thus allowed at the state of net-zero as "residual". This process must also explore how residual emissions should be addressed, including through compensation with carbon dioxide removals (CDR). Achieving a genuine state of greenhouse-gas neutrality, and net-negative emissions thereafter, requires CDR, measures that actively withdraw CO_2 permanently from the atmosphere to balance out residual emissions. But without structured governance of permanent removals with a long-term perspective at its core, it will be extremely difficult to achieve and maintain net-zero and net-negative emissions. Additionally, unidentified or neglected trade-offs can cause severe damage to ecosystems, economies, and human health.

Furthermore, the relationship between emission reductions and CDR is a central consideration. The Intergovernmental Panel on Climate Change (IPCC) is clear that CDR can never substitute for deep emission reductions. If public policy and national strategies are not structured to reflect this primacy of emission reductions before CDR, countries risk locking in high emission levels and deterring necessary climate mitigation. This risk is referred to as "mitigation deterrence", and scientific research tells us that it is a real threat to effective climate action. Thus, embedding a stringent separation between emission reductions and CDR in climate policy is a necessary minimum requirement to mitigate this risk.

The most prominent CDR methods for permanently removing CO_2 from the atmosphere, currently seen as most attractive by EU member states, are biomass with

Carbon Capture and Storage (bio-CCS) and Direct Air Capture with Carbon Storage (DACCS). The former captures biogenic emissions from processes burning, fermenting, or gasifying biomass, while the latter directly captures CO_2 from the atmosphere; both then store them permanently in geological formations underground. There are, however, a plethora of methods in development and testing that may become more relevant over time. These include using the ocean as a carbon reservoir or utilising exchanges between the ocean and the atmosphere to extract carbon for geological storage. Which technologies and processes will be applied in the end is dependent on a wide range of factors, including political choices, technological developments, resource constraints, and public acceptance.

The role of carbon sequestration in biomass and soils

Beyond the abovementioned permanent CDR methods, processes that can also draw down carbon from the atmosphere include sequestration in biomass (e.g., trees) and soils (e.g., agricultural fields through cover crops or reduced tilling). However, these methods yield a highly limited climate benefit as they can only store carbon temporarily

Forests can provide habitat for animals, keep our soil healthy, reduce flooding, and support livelihoods for millions of people. However, shaping forest policy to maximise short-term carbon sequestration results in vulnerable monoculture forests with poor biodiversity and soil health. It is important to understand that carbon stored in trees, plants and soils is never permanent. Wildfires, droughts, pests, and land-use change can release it back into the atmosphere within years or decades. Since climate effects will intensify biomass losses in forests and accelerate their degradation, scientific research tells us that Europe's forests should not be seen as a natural solution to climate change.

Mitigating risks requires good planning

It is important to note that all carbon dioxide removal methods come with specific tradeoffs. These range from high energy and land-use demands and uncertain permanence and reversal risks, to potential impacts on biodiversity, water resources, and local communities. A high reliance on Bioenergy with Carbon Capture and Storage[1] (BECCS), for instance, which would require biomass from standing forests, can increase emissions from deforestation. The relative weight of these tradeoffs varies significantly by method and context, making case-by-case assessment essential rather than treating

[1] Bioenergy with carbon capture and storage captures carbon dioxide from processes burning biomass to produce energy. The separated carbon is then transported to reservoirs underground for permanent storage. It is part of the CDR methods described by the umbrella-term bio-CCS, which encompass a range of CDR processes using biomass and storing captured CO_2 permanently underground.

CDR as a uniform category of intervention. Therefore, high-quality assessments and the alignment of short-term measures with long-term planning are necessary.

In recent years, the integration of CDR into climate policy has accelerated in the European Union. The 2022 announcement of the Carbon Removals and Carbon Farming Regulation, a certification framework for CDR as well as climate interventions in farming and the temporary storage of CO_2 in products, spurred rapid developments. This prompted the EU to decide on the architecture of CDR governance systems within the next few years. The European Commission has recently proposed integrating CDR volumes into the EU Emissions Trading System, which is meant to manage greenhouse gas emissions from power and heat generation, energy-intensive heavy industries, domestic commercial aviation, and large maritime transport. Additionally, the European Commission is preparing proposals for the Effort Sharing Regulation (ESR) and the Land Use, Land-Use Change and Forestry (LULUCF) Regulation, which will set emissions-reduction targets for the remaining sectors not covered by the ETS. The redesign of the EU climate policy architecture, aiming to set out the path to reduce net emissions by 90% by 2040 compared to 1990 levels, will show whether gross emission reductions in the ESR will remain separate or whether removals will be folded into headline reduction figures alongside emission reductions. Nowhere is this tension more visible than in the planning instruments member states use to project their established and planned measures into the future. The most comparable national planning instruments for climate action in the EU are countries' National Energy and Climate Plans (NECPs) and Long-Term Strategies (LTSs), analysed in this report.

What are NECPs and LTSs, and why do they matter?

Under EU Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, colloquially known as the "Governance Regulation", Member States are legally required to draft and update plans to outline their integrated policies and measures across five dimensions: (1) Decarbonisation, (2) energy efficiency, (3) energy security, (4) internal energy market, and (5) research, innovation and competitiveness. They must do so looking 10 years into the future, in their National Energy and Climate Plans (NECPs). A second type of planning tools mandated under the same regulation are the member states' Long-Term Strategies (LTSs), which must project at least 30 years ahead and map out national decarbonisation and neutrality pathways toward 2050 and beyond. Each EU member state has to regularly prepare updated versions of these documents - every 5 years for NECPs and every 10 years for LTSs. Together, these documents serve as a critical instrument of climate governance. They aim to coordinate short-term actions with mid-century targets, provide long-term regulatory predictability

to prevent stranded investments, and to establish a transparent, unified framework to monitor European climate progress.

The next deadline for the updated versions of both climate planning tools will be in January 2029, leaving a short window to analyse the current weaknesses of the NECPs and LTSs. Specifically regarding the role of CDR in the two planning tools, recent analysis by Carbon Market Watch identified grave shortcomings in five European countries' climate planning documents - Norway, Austria, Finland, France, Ireland and Italy. A key finding was general low-quality reporting on CDR in NECPs and LTSs. As a complement, this analysis examines how five other member states use these two reporting and planning documents to approach CDR and what role temporary sequestration in biomass and soils plays in their plans.

Methodology

This analysis reviews how carbon dioxide removal is governed in five European Member States' latest NECPs and LTSs as of July 2026. Where available, English language versions were analysed. Where these were not available, text was translated using DeepL.

Where relevant, the analysis also draws on supplementary national instruments referenced within the NECP/LTS text itself - such as national CDR strategies or legislation - but only when these are directly cited or incorporated by the core documents under review. The analysis method was pure desk research. It includes both temporary carbon sequestration in biomass and soils (LULUCF) and permanent removals (e.g., bio-CCS and DACCS), and assesses how nations have integrated these solutions into their broader climate frameworks.

The analysis evaluates five European Member States: Germany, the Netherlands, Poland, Spain, and Sweden. The countries were selected purposely rather than randomly, to maximise variation across the dimensions most relevant to CDR and LULUCF governance: stage of permanent-removal policy development, profile of national land sinks, and economic and geographic context. This approach prioritises depth and contrast over statistical representativeness, allowing the analysis to cover a wider range of governance models and challenges than a random or exhaustive sample of all 27 member states would within the same scope. The selection reflects the authors' assessment, informed by prior literature and policy tracking, of which member states offer the most instructive combination of progress and divergence on CDR governance.

The selected countries present distinct geographical, economic, and ecological realities. Their progress on permanent CDR ranges from the early research stage, like in Spain and Poland, to countries that are highly advanced and already have policy tools such as target-setting or investment mechanisms enshrined in law, like Germany and Sweden. The availability of domestic geological CO_2 storage and distance to international storage (e.g., under the North Sea) also differ widely between countries. Likewise, do the potentials to sequester carbon in biomass and soils. Sweden and Germany possess vast temperate and boreal forest sinks, whereas the Netherlands is geographically constrained with a land sink that remains a net source of emissions. Spain faces extreme vulnerability to climate-induced aridity and desertification, and Poland's land sink has experienced a severe forest collapse in recent years due to climate impacts.

The selection of countries has multiple benefits as it represents a wide array of economies and strategic approaches to climate mitigation, and includes some of the most advanced national CDR-policy landscapes in the world. However, it is not meant to

be a representative sample for the situation in Europe, and is definitely far from capturing complex global dynamics.

To ensure consistent assessment across countries, the following working definitions were applied. A "separate target" refers to a numerically specified, document-stated goal for permanent removals or biogenic sequestration that is distinct from a country's overall emissions-reduction target, whether or not it is legally binding. "Clear strategic framing" for CDR refers to the presence of explicit text that (a) articulates the intended role of permanent CDR relative to emissions reductions, and (b) references some basis (e.g., a feasibility study, modelling exercise, or stated assumption) for projected removal volumes. "Residual emissions" are considered sufficiently defined when a document quantifies which emissions are expected to remain unabated by the target year, explains the reasons for this, and indicates the sectors involved, rather than referring to residual emissions only in general terms.

The following research questions have guided the conducted work:

Overarching research question:

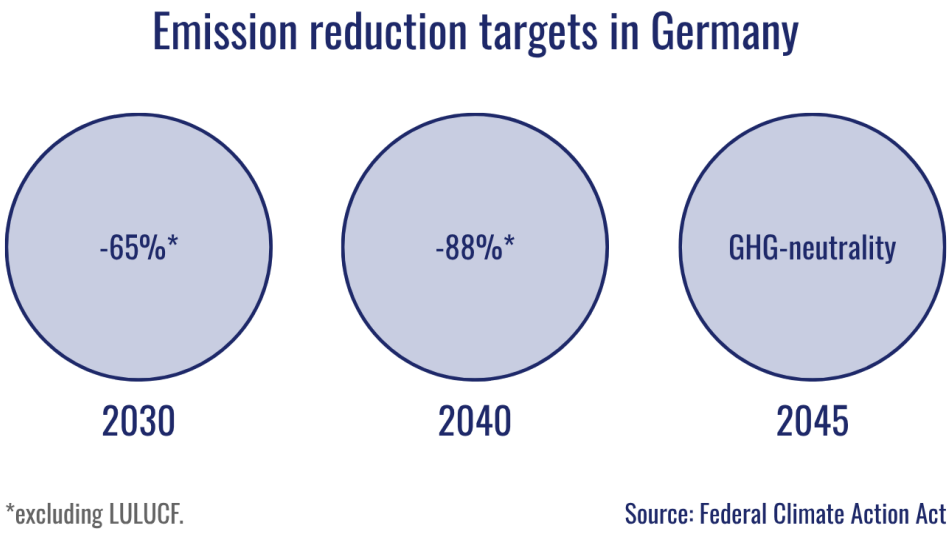
What are countries doing to govern carbon dioxide removals and carbon sequestration in biomass and soils in a way that helps the climate, ecosystems, and people?

Supporting research questions:

1. **Separate targets:** Do countries have separate targets for permanent removals, carbon sequestration in soils and biomass, and emission reductions? If not, how far along is the process of establishing them?
2. **Clear strategic framing:** Do countries include dedicated strategic considerations for permanent CDR, clearly framing its role as a supplement to emission reductions and including feasibility assessments that support projected volumes?
3. **The use case**: Which emissions do countries foresee balancing with permanent removals? Are residual emissions defined, and what role does sequestration in biomass and soils play?

Country Case Studies: Germany

The German federal climate act sets the goal of achieving net greenhouse-gas (GHG) neutrality by 2045. Gross GHG emissions, excluding the LULUCF sector, need to be reduced by at least 65% by 2030 and by at least 88% by 2040 compared to 1990 levels. Part of the foreseen efforts by Germany to reach GHG-neutrality involves stabilising land-based sequestration through a wide range of actions, from peatland rewetting to reducing soil sealing, and expanding the capacity for permanent removals.



Residual emissions in Germany

There is no officially adopted definition of residual emissions in Germany yet. The country frames its 2045 GHG-neutrality target around a distinction between emissions that can be reduced by deploying technologies and those that are seen as structurally unavoidable. Its NECP and LTS identify these residual emissions as concentrated in raw materials industries (e.g., lime, cement, steel, basic chemicals), waste incineration, and agricultural methane. Under a scenario that accounts for future measures, total emissions in 2045 are projected at roughly 160 Mt CO_2eq, of which 65 Mt are classified as non-energy residual emissions - 47 Mt from agriculture and 17 Mt from industrial processes.

Germany's approach clearly distinguishes the contribution of CCS, but conflates temporary sequestration with permanent sinks. CCS and potentially CCU are intended to reduce emissions from hard-to-abate industrial processes. Under the forthcoming Carbon Management Strategy, state funding would be restricted to genuinely unavoidable emissions. Any residual emissions that still reach the atmosphere shall be

balanced by sequestration in biomass and soils (LULUCF) and permanent removal methods, such as BECCS and DACCS.

Land Use, Land-Use Change and Forestry in Germany

Targets

For carbon sequestration in soil and biomass, Germany has net targets at both the EU and federal levels. The country's EU target under the LULUCF Regulation is to increase its net land-based carbon sink by 3.8 Mt CO_2eq by 2030 compared to 2016-2018. The country's Federal Climate Action Act sets the goal of reaching an average net sink of -25 Mt CO_2eq for the 2027–2030 period. For the years 2037 to 2040, the federal target for the average annual net sequestration from LULUCF is 35 Mt CO_2eq. For 2042 to 2045, the target is 40 Mt of average net removals.

The carbon pools included in the federal LULUCF target are consistent with those set out in the EU LULUCF accounting framework. Land-use categories are separated into forest land, cropland, grassland, wetland, settlements, and other land types (e.g., bare soil, rock, or ice). Changes in carbon stocks are estimated in living biomass (standing trees and vegetation), soil organic carbon (carbon from biogenous sources found underground), harvested wood products (e.g., carbon in wood used in buildings), and three different types of dead organic matter. The German Federal Climate Action Act does not split up the federal LULUCF target into the different carbon stocks.

EU-level and federal targets differ in their calculation methods and the data used. Therefore, comparing the two pieces of legislation is complex. Nevertheless, Germany's NECP notes that the federal 2030 target is aligned with the EU LULUCF Regulation target.

Table 2: Overview of binding targets for net-sequestration in biomass and soils in Germany

Law	**EU LULUCF Regulation**		**Federal Climate Action Act**		
Timeframe	2021-2025	2030	2027-2030	2037-2040	2042-2045
Removal target	No-debit	Additional 3.8 Mt net sequestration	-25 Mt average	-35 Mt average	-40 Mt average
Baseline	Category specific	2016-2018	n/a	n/a	n/a

Progress

The latest projections included in Germany's NECP show that the LULUCF sector is a net emitter, meaning the total emissions in the sector exceed the amount of carbon

sequestered. The included projections show that under the highest-ambition scenario, the German LULUCF sector would only achieve a net balance of -2.2 Mt CO_2eq in 2030, thereby failing to meet both the EU and the federal LULUCF targets for this year. By 2050, when the EU as a whole should balance all remaining emissions with removals, the sector is projected to again become a net source of emissions. The large difference between the projection and the federal LULUCF target is partly due to updated modelling methodologies, with net removals now being about 15 Mt lower, resulting in the earlier projections being far closer to the set targets. The only quantified measure listed to achieve LULUCF targets is peatland rewetting, which aims to reduce emissions from drained peatlands by 5 Mt CO_2eq by 2030.

Permanent Removals in Germany

Targets

Regarding permanent removals, the German NECP does not include any projections or estimates of future capacities or volumes. Germany plans to outline how to achieve GHG neutrality by 2045 in its Long-term Negative emissions strategy (LNe), which is in development and, at the time of writing, has not been published.

Targets for permanent removals are currently missing, but the country has begun developing them. The German federal climate law prescribes setting separate targets for permanent removals for 2035, 2040, and 2045. A communication by the German Ministry of Economics and Climate states that the targets shall be set on the basis of the LNe.

The LNe is supposed to include both permanent and temporary removals. Germany's NECP also mentions a planned Carbon Management Strategy (CMS) that would focus on CCS and CCU to help reduce industrial emissions. The German NECP states that the CMS would focus on the portion of process emissions that are hard or impossible to avoid, while the LNe should address the handling of unavoidable residual emissions that cannot be mitigated at the source.

The volume of expected removals or even captured emissions in general remains undisclosed in the German NECP and LTS. The European Commission, in its assessment of member states' NECPs, criticises the lack of estimates of available CO_2 storage capacity in Germany and of targets of annual injection capacity (i.e., the ability to actually bring the captured carbon into permanent storage sites).

Progress

Germany is taking crucial steps in research and planning. The German NECP mentions two key research programs, CDRterra and CDRmare. They are tasked to look into CDR methods' "large-scale feasibility, interactions with other sustainability goals, and complex interactions in the Earth and climate system", with the latter focusing on interactions with the marine environment and appropriate monitoring approaches for marine CDR. The two research programs are supposed to substantially inform the LNe.

There is additional information available beyond Germany's climate planning documents under the Governance Regulation. Investment for CDR in Germany is underway. The German government plans to support the development of technologies and markets for negative emissions both by promoting specific projects and technologies and by a purchase programme designed to strengthen the voluntary market. The investment sum for these programs is not yet disclosed.

Short Summary Assessment

Considering the approaching 2045 climate neutrality target, Germany's climate planning documents have not successfully defined the role of carbon removal and sequestration. The NECP and LTS fall far short of the necessary considerations and quantitative analysis of CDR and sequestration in biomass and soils.

The German interpretation of hard-to-abate and residual emissions is currently being developed within the German CMS and LNe. While the country's plans indicate some sectors where residual emissions would likely persist - raw materials industries (lime, cement, steel, basic chemicals), waste incineration, and agricultural methane - in-depth analyses, including a quantitative breakdown, are missing.

Germany does not yet have separate targets for permanent removals enshrined in federal law. However, the German federal climate law already prescribes that separate targets are to be set. Therefore separate permanent removals targets will be set based on strategic considerations in the LNe. Feasibility assessments for permanent removals are missing, but research programs (CDRterra, CDRmare) are currently underway to help provide them.

By contrast, LULUCF targets are already enshrined in both EU and federal law, yet the sector is currently in decline and off track to meet either. The sector is currently a net-emitter, projected to recover around 2030 and then again become a net source of emissions by 2050. Given that Germany relies heavily on sequestration in biomass and soils to achieve climate neutrality, the policies and measures needed to stabilise the

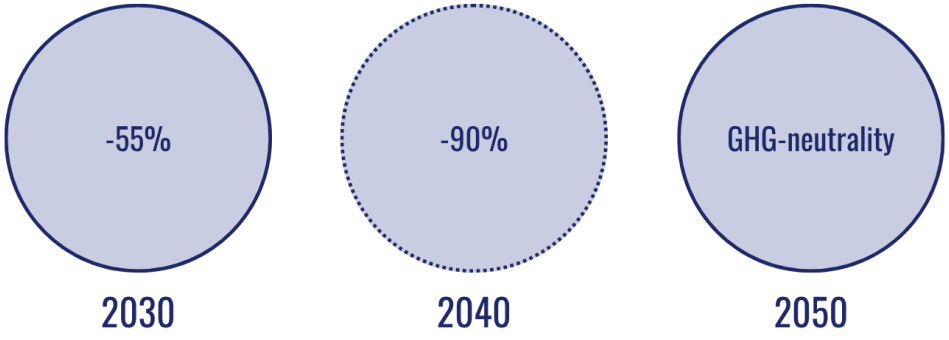
German LULUCF sector are insufficiently detailed in the reviewed climate governance instruments, with the only quantified measure being peatland rewetting.

Country Case Studies: Netherlands

The Netherlands' Climate Act sets legally binding targets for climate neutrality by 2050 and a 55% reduction in emissions by 2030 compared to 1990 levels. Additionally, the law sets out the aim to achieve net-negative GHG emissions after 2050. The Netherlands commits to designing a policy to reduce its emissions by 66% to meet its lower 2030 goal. The latest Climate Plan 2025-2035 additionally suggests a 90% net emission reduction target for 2040. However, this is not yet enshrined in law.

The Netherlands' strategy to reach net-zero and net-negative emissions, laid out in its NECP and LTS, rests on permanent removals via BECCS, carbon storage in products, and land-based measures such as afforestation, reforestation, and carbon sequestration in agricultural soils. Since its LULUCF sector is a net emitter and is projected to remain that way until 2050, the sector is not expected to contribute significantly to the overall target. Nonetheless, sequestration in the LULUCF sector is foreseen to offset its own emissions.

Emission reduction targets in the Netherlands



Source: Dutch Climate Act

Residual Emissions in the Netherlands

There is no official definition of residual emissions or hard-to-abate emissions included in the Dutch climate planning instruments. The Netherlands' LTS states that certain sectors will not be able to eliminate their emissions entirely, necessitating the use of carbon dioxide removals. Residual emissions are primarily expected to originate from hard-to-abate industrial processes and international transport sectors, specifically international aviation and shipping. However, what constitutes hard-to-abate processes, emissions or sectors is not defined. Furthermore, the Netherlands does not include the

mandatory projections for 2050 in its LTS, leaving the expected residual emissions and their sectoral breakdown unassessed.

Land Use, Land-Use Change and Forestry in the Netherlands

Targets

Under the EU LULUCF Regulation, the Netherlands needs to reduce net emissions from the sector by 0.435 $MtCO_2eq$ by 2030, compared with the average of 2016-2018. This translates into a net emissions goal of 4.9 $MtCO_2eq$ in 2030 for the country's LULUCF sector compared to a baseline of about 5.3 Mt. The Dutch Climate Act itself does not currently set separate, legally binding national LULUCF targets.

Table 3: Overview of binding targets for net-sequestration in biomass and soils in the Netherlands

Law	**EU LULUCF Regulation**	
Timeframe	2021-2025	2030
Removal target	No-debit	Additional 0.435 Mt net sequestration
Baseline	Category specific	2016-2018

Progress

The Netherlands' LULUCF net emissions have been relatively stable over the last two decades. The sector emitted 5.1 $MtCO_2eq$ in 1990 and about 5.1 $MtCO_2eq$ in 2022, with sequestration from forests consistently offset by emissions from grasslands, croplands, and peatlands. Projections show a gradual decline of net emissions to between 2.5 and 3.7 $MtCO_2eq$ by 2030, brought about by provincial peatland-rewetting programmes and the planting of over 13,000 hectares of new forest. However, the sector is projected to remain a net emitter until mid-century, with emissions of around 2.9 $MtCO_2eq$ in 2040 and 2.7 $MtCO_2eq$ in 2050.

Policy measures underpinning the 2030 target are organised around three tracks. The National Agricultural Soil Programme (NPL) targets 0.5 $MtCO_2eq$ of annual sequestration in agricultural soils by 2030 through improved soil management. A regional peat-meadow approach, raising groundwater levels, deploying underwater drainage and converting some agricultural land to wet crops or natural lands, targets a 1 Mt CO_2eq reduction in emissions from drained peatlands by 2030. The national Forest Strategy targets an additional 0.4- 0.8 Mt CO_2eq of sequestration by 2030 through afforestation, restoration, and agroforestry.

Permanent Removals in the Netherlands

Targets

The Dutch NECP does not include targets or projections for permanent removals. However, it notes the development of a "Carbon Dioxide Removals Roadmap" as a planning tool and policy agenda for negative emissions.

By now, the Dutch roadmap has been published and includes an estimate of the potential demand for CDR, based on residual emissions. It estimates the demand to be 10-40 Mt in 2050, with the upper end of this range meaning that fossil fuels have not been minimised or phased out. The CDR roadmap includes an indicative target to build domestic "CDR capacity" to 20-25 Mt by 2040 and maintain this level until 2050. This would correspond to about 10% of the Netherlands emissions in 1990. However, the document conflates temporary sequestration in biomass and soils with permanent CDR.

The roadmap estimates the techno-economic potential of different methods of CDR and sequestration in biomass and soil based on a report by the Netherlands' scientific Climate Council. Based on their estimations, the total potential for permanent CDR would be 27.6 $MtCO_2eq$ by 2050 - the largest part of which would come from bio-CCS (22.2 Mt) and the remainder from mineralisation. The potential negative emissions from DACCS are classified as unknown due to expected high prices for the technology.

Progress

In the CDR roadmap, the Netherlands leans on the European Union to provide new policy instruments to create market demand for CDR rather than building their own policy to build up this sector. The country instead understands its role as simply a provider of geological carbon storage capacity and facilitator using the instruments already at hand.

The main financing instrument the Netherlands wants to rely on is the Stimulation of Sustainable Energy Production and Climate Transition (SDE++) scheme. The subsidy tool is meant to support climate and energy solutions that would otherwise be financially unviable, covering the unprofitable portion of the measure. Originally designed to support renewable heating/energy and low-CO_2 production, including CCS and CCU, the subsidy scheme (with an €8 billion budget for 2026) also funds CDR when biogenic emissions are captured via CCS (i.e., bio-CCS). However, by treating CDR as merely a subset of CCS, the tool conflates climate mitigation actions with fundamentally different purposes. The CDR industry has not yet received any funding through the subsidy scheme.

Short Summary Assessment

The Dutch NECP and LTS show a heavy reliance on permanent carbon removals, while the documents fail to establish which policies shall achieve the expected removals. A CDR roadmap published after the submission of the final Dutch NECP clarifies the Netherland's plans.

The Dutch CDR roadmap sets an indicative capacity target of 20-25 Mt by 2040, sustained through 2050. However, the country lacks an official definition of residual or hard-to-abate emissions. Its LTS fails to include the mandatory sectoral emission projections for 2050, leaving the expected scale and origin of residual emissions unassessed and undisclosed.

On LULUCF, the Netherlands has a binding but modest EU target for 2030, and no separate national target under its Climate Act. Since the sector is projected to remain a net emitter through mid-century, sequestration within it is not expected to contribute to overall climate neutrality, but merely to partly offset emissions within the LULUCF sector.

The Netherlands' main financing instrument, the SDE++ scheme, is currently theoretically applicable to permanent CDR, but it fails to treat CDR as its own distinct category. By conflating it with CCS funding, the tool fails to take the different technological readiness levels of CDR methods and financing needs into account. Funding for fundamental research, which would be necessary to diversify CDR methods and analyse tradeoffs is missing. The Netherlands is counting on EU-level policy instruments to create market demand for CDR, rather than building its own regulatory framework.

Country Case Studies: Poland

Poland did not update its 2023 NECP draft by the deadline required in the Governance Regulation, at the end of June 2024. After legal pressure from the European Commission, the Polish government published an updated NECP in June 2026. However, as of September 2026, Poland has still not submitted its mandatory LTS.[2] In April 2026, the Polish government announced it would resume work on the LTS, and it is expected to be completed by the end of 2026. Therefore, the country's final NECP is the centre of this analysis.

Poland does neither have national climate targets enshrined in law, nor a climate strategy to achieve climate neutrality. However, the country is bound by the European Climate Law and the underlying ETS, LULUCF and Effort Sharing Regulation (ESR) pillars to reduce emissions in the covered sectors and to contribute to collective emissions reductions and climate neutrality by 2050. The Polish NECP states that net sequestration from the LULUCF sector may be used to offset emissions from other sectors, without specifying which.

Emission reduction targets in Poland

Relying on EU targets

Residual emissions in Poland

Poland's NECP does not include a definition of residual emissions. But it notes that some greenhouse gas emissions will be unavoidable. The Polish NECP does not define residual emissions. However, the document explicitly notes that possible emission reductions in the agricultural sector will be limited, but it does not specify which emissions or activities would be impossible to abate.

[2] In October 2025, the European Commission referred Poland to the Court of Justice of the European Union for failing to submit its LTS. Poland is the only member state that has not yet submitted its LTS. Source: https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2157

Hard-to-abate emissions or sectors are likewise not defined. The Polish NECP only brings up hard-to-abate emissions when discussing use cases for renewable hydrogen. There it indicates which sectors would count as hard-to-abate, listing industry (specifically the production of cement, lime and basic chemicals), heavy industry, maritime, aviation, and energy storage. However, it is not clear whether hard-to-abate emissions are expected to be managed only by switching to hydrogen, or if CCS and CDR would play a role.

Land Use, Land-Use Change and Forestry in Poland

Targets

Under the EU LULUCF Regulation, Poland must increase its total net sequestration in the land use sector by 3.278 $MtCO_2eq$. This translates to achieving a total net sequestration level of 38.098 $MtCO_2eq$ in its land-use sector by 2030. Poland has not set separate sequestration targets at the national level.

Table 4: Overview of binding targets for net-sequestration in biomass and soils in Poland

Law	**EU LULUCF Regulation**	
Timeframe	2021-2025	2030
Removal target	No-debit	Additional 3.278 Mt net sequestration
Baseline	Category specific	2016-2018

Progress

Poland's total net sequestration in biomass and soils has declined sharply in recent years. But the country plans to reverse this trend through aggressive forestry management, including reducing timber harvesting, combatting general mortality, and restoring degraded peatlands and wetlands.

Projections in the Polish NECP show that under the currently established measures the country would not be compliant with its LULUCF Regulation target for 2030. This scenario would lead to an annual shortfall of 9.3 $MtCO_2eq$ to the 2030 target - about a quarter of current net-sequestration in the sector.

A second scenario in the projections, that includes additional measures, indicates that if the measures planned for the coming years are implemented as foreseen, a net-sequestration level of 46.5 $MtCO_2eq$ would be achieved by 2030. This would exceed the LULUCF target number of 38.098 Mt by about 8 Mt.

To achieve the projected net sequestration levels for biomass and soil, Poland is relying largely on the forestry, agriculture and wetland sectors. The Polish NECP includes measures ranging from ambitious biodiversity-focused forest restoration and improved forest management to solutions with high reversal risks like sequestration in agricultural soils (e.g., using the CRCF carbon farming scheme), afforestation, and peatland and wetland restoration. The NECP quantifies two measures. First, timber harvesting shall be reduced by 5.8% by 2030 compared to 2022 levels. Secondly, 20% of publicly owned Polish forests will be protected from economic logging. The planned measures are projected to increase national forest cover to 33% by 2050, up from 29.6% in 2023.

Official figures from the Polish statistics agency show that forest harvesting has decreased by over 10% from 2022 to 2025. It remains to be seen whether this trend will continue and if reduced forest harvesting levels will be embedded in the Polish economy for the long-term.

Permanent Removals in Poland

Targets

Poland has not defined a specific national target for permanent removals. The country's NECP focuses on CCS technology primarily targeted at the cement, lime, and chemical industries to avoid EU ETS costs. Only in the longer term, for post-2040 projections, Poland suggests that biomass boilers equipped with CCS could provide negative emissions to offset GHG emissions in sectors where reduction is technologically and economically impossible. Which, as noted above, Poland has not defined.

Progress

Poland's progress toward permanent carbon removal and CCS is currently in the legislative and preparatory phases, with no commercial installations operating yet. Historically, Polish regulations only permitted demonstration CCS projects, which prevented commercial deployment. In December 2025, Poland's Ministry of Climate and Environment introduced a draft regulation expanding onshore CO_2 storage, permitting commercial projects in specific land and Baltic Sea areas. This amendment to the Geological and Mining Law is expected to enable CO_2 storage close to industrial emitters. However, the NECP states that "at present, Poland is not in a position to indicate the amount of CO_2 emissions that can be captured annually until 2030".

The Polish NECP notes that CO_2 transport infrastructure would be a major barrier to the country's CCS plans. It estimates that adapting existing pipelines would be the most cost-efficient way to deploy a transport infrastructure, with potential costs at only 1-10%

of building new dedicated pipelines. The Polish NECP does not contain any further assessment regarding this matter.

Short Summary Assessment

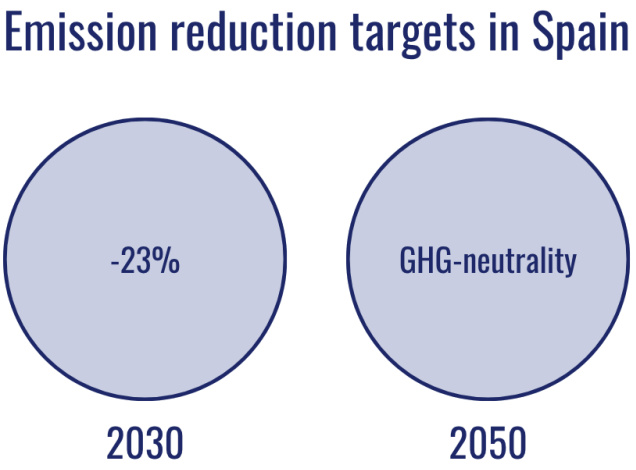
Poland is lacking a long-term perspective on the development of its emissions and is currently still lacking a net-zero strategy. While the Polish NECP shows that ambitious economy-wide decarbonisation may be possible - with projections of envisioned measures showing a reduction of up to 52.7% of total GHG by 2030 - the difference between the current state of affairs and the projections is significant. Poland's decarbonisation plans rely heavily on vulnerable temporary sequestration in the LULUCF sector, and it is optimistic about the availability and cost-efficiency of CCS. Furthermore, permanent CDR does not feature as a relied-upon measure in the Polish climate plans.

Poland's LULUCF sector recently suffered a sharp decline in sink capacity due to climate impacts and ageing forests. Consequently, Poland is heavily reliant on implementing ambitious measures - specifically reducing timber harvests by 5.8% and halting logging in 20% of state forests - to avoid failing its LULUCF target for 2030.

In terms of permanent CDR, Poland is lacking dedicated plans. The country does not have CDR installations and the necessary transport infrastructure. Recent legislative pushes to legalise onshore geological storage and the drafting of a dedicated CCU & CCS strategy indicate that Poland is actively preparing to deploy carbon capture technologies for its heavy industries in the coming decade. However, the fact that Poland is prioritising CCS and CCU over CDR implies a potential preference for continuing to use and rely on fossil fuels, rather than investing in solutions to address genuine residual emissions in the long term.

Country Case Studies: Spain

The Spanish Law on Climate Change and Energy Transition sets out binding targets for Spain to achieve climate neutrality "before 2050 and in any case, in the shortest possible term" and to reduce GHG emissions economy-wide by at least 23% by 2030. The Spanish NECP includes a more ambitious target to achieve a 32% economy-wide reduction in emissions by 2030. However, this goal has not yet been made binding.



Source: Law 7/2021 on Climate Change and Energy Transition

Residual emissions in Spain

Spain defines residual emissions in its NECP as the final 10% of emissions that cannot be eliminated and must be absorbed by sinks. The Spanish LTS further breaks down the 2050 ambition into 29 $MtCO_2eq$ of residual emissions (down from 334 Mt in 1990) and -37 $MtCO_2eq$ from domestic sequestration in biomass and soils. The country is depending on temporary sequestration to offset human-caused emissions that partly persist in the atmosphere for centuries to millennia - therefore the warming effects of these emissions will likely remain and Spain would continue to contribute to the climate crisis.

The Spanish LTS explicitly notes that the hardest emissions to abate originate from "diffuse non-energy sectors", including agriculture and livestock, waste management, and fluorinated gases (from leaks in refrigeration and air conditioning equipment). According to the country's strategy, by 2050, these diffuse non-energy sectors will account for two-thirds of the remaining emissions in the Spanish economy, with agriculture and livestock accounting for more than half of all remaining emissions. Furthermore, Spain identifies industrial process emissions as hard to abate, noting that CCS and CCU should be used only as a last resort for these emissions.

Land Use, Land-Use Change and Forestry in Spain

Targets

Spain has no separate targets for sequestration in biomass and soils in its national legislation. However, under the EU LULUCF Regulation, the country must achieve an additional net sequestration of -5.3 $MtCO_2eq$ by 2030, translating to a total net sink of -43.6 $MtCO_2eq$.

Table 5: Overview of binding targets for net-sequestration in biomass and soils in Spain

Law	**EU LULUCF Regulation**	
Timeframe	2021-2025	2030
Removal target	No-debit	Additional 5.309 Mt net sequestration
Baseline	Category specific	2016-2018

Progress

Spain's LULUCF sector is currently a strong net sink, having absorbed -38.1 million tonnes of CO_2eq in 2018. However, according to the Spanish NECP, the sector is facing a severe crisis.

Sequestration in biomass and soils in Spain is slowing down. The Spanish NECP attributes this largely to climate change impacts, including increased aridity, droughts, heightened risk of forest fires, desertification, and the ageing of forest stands.

Spain expects to comfortably comply with the initial 2021-2025 "no-debit rule", projecting a surplus of approximately 10.2 $MtCO_2eq$ for this period. The country expects to meet its 2030 targets by utilising regulatory flexibilities and aggressively implementing new forestry measures. The European Commission's assessment of the Spanish NECP notes that the measures lack ambition, with the projections indicating a 6.11 Mt gap to the 2030 target.

However, beyond 2030, the outlook for the Spanish biomass and soil sinks appears more challenging. Spain projects in its LTS that, if no additional measures are taken, total sequestration will drop drastically to just -23.6 $MtCO_2eq$ by 2050 (a 38.4% decrease from 2018). For the 2026-2030 accounting period, this declining trend would result in approximately 30 $MtCO_2eq$ excess net emissions above the total assigned CO_2eq budget. Research shows that Spanish forests, the country's main source of carbon sequestration, have become increasingly prone to fires in recent decades, a trend projected to worsen. Despite these threats, the Spanish climate strategy continues to rely on sequestration in biomass and soils to be available in the long-term to balance residual emissions.

Permanent Removals in Spain

Targets

Spain does not establish explicit, quantified national targets for engineered permanent carbon removals. Instead, it focuses almost entirely on sequestration in biomass and soils to balance out residual emissions. Permanent removals are strictly framed as supplementary options.

Spain acknowledges the EU's Industrial Carbon Management strategy and the Net-Zero Industry Act (NZIA), noting that CCS will be necessary for industrial processes where mitigation options are limited.

The Spanish NECP explicitly states that decarbonisation through CCU and CCS should only be a last resort. Noting that the priority needs to be energy efficiency and direct emission reductions, and that the application of CCS and CCU will be limited to hard-to-abate sectors, such as process emissions. The document adds that BECCS could be a viable option in the future and may be tested in demonstration projects.

As Spain does not heavily rely on engineered permanent removals in its short- or medium-term planning, progress in this area is largely limited to research, development, and demonstration. The country's NECP notes that the potential to capture CO_2 in various processes is in an "emerging state". Spain plans to assess the availability of mature technologies and the necessary transport and storage development needed to deploy these solutions at an industrial scale in the future.

Short Summary Assessment

Spain's climate neutrality plans are reasonably transparent. They clearly communicate the breakdown of emission reductions and sequestration goals for 2050 (90% emission reductions and 10% sequestration in biomass and soils) and the sectors where emissions would be "most difficult to abate". However, the country's legally binding economy-wide emission reduction target of 23% by 2030 is far from the new indicative 32% reduction by 2030 ambition. The failure to enshrine the higher ambition as a binding target is a gap in the Spanish legislative climate architecture.

To achieve climate neutrality by 2050, Spain relies entirely on carbon sequestration in biomass and soils in the LULUC sector to balance residual emissions. At the same time, the Spanish LTS notes that Spain is geographically highly vulnerable to climate change, desertification, severe droughts, and escalating forest fires, which are already degrading the country's land sink capacity. If no additional measures are taken, the LTS projects a decline in sequestration capacity of more than 38% by 2040. According to the European

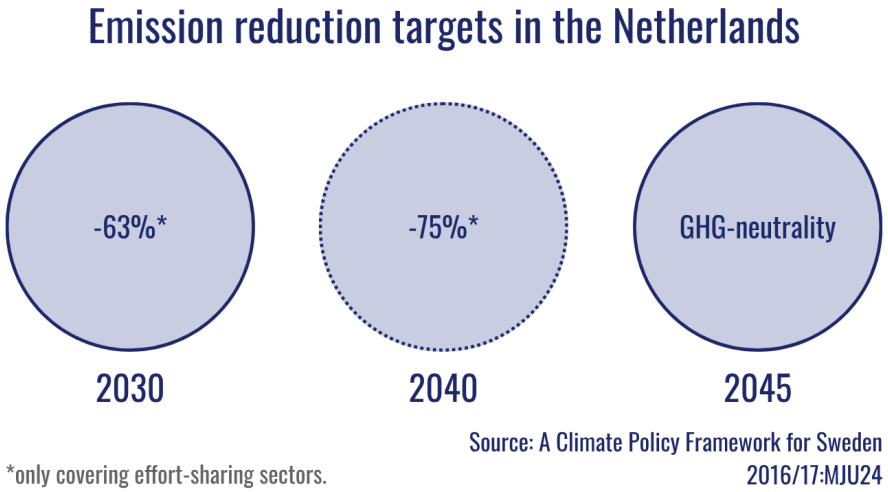
Commission's assessment, the measures to achieve Spain's EU LULUCF target for 2030 are already insufficient. Therefore, the country faces a severe challenge in stabilising its land sink in the medium- to long-term, and the Spanish climate neutrality target is precariously dependent on vulnerable sequestration in biomass and soils, a situation worsened by the climate crisis.

Permanent removals are treated as a last resort, with the country so far depending on EU funding for Research and Development (R&D) activities. No deployment ambitions or targets can be found in the Spanish climate strategy documents. The fact that Spain acknowledges the possibility of residual emissions remaining from industrial processes, but lacks a strategy or tools to develop permanent removals to balance them at the point of climate neutrality, shows that the country does not have a credible strategy to achieve a reliable state of climate neutrality.

Country Case Studies: Sweden

The Swedish Climate Policy Framework sets an indicative 2045 net-zero GHG-emissions target that covers domestic activities in all sectors. Furthermore, the framework sets out intermediate non-binding targets for the effort-sharing sector (including domestic transport, buildings, agriculture, small industry, and waste), aiming for a 63% reduction in emissions by 2030 and a 75% reduction by 2040. For the 2030 and 2040 targets, the framework limits the contribution of so-called "complementary measures", which include net sequestration in biomass and soils, verified emission reductions through investments in other countries (i.e., international carbon credits), and bio-CCS. For the 2030 target, the maximum contribution of complementary measures can replace 8 percentage points, and 2 percentage points for the 2040 target. The bill further notes the need to increase complementary measures over time to achieve net negative emissions.

While the quantified climate targets in Sweden's Climate Policy Framework are not legally binding, the Swedish Climate Change Act obliges the Swedish government to act in line with the long-term climate neutrality target and to report progress and explain any failures.



Residual emissions in Sweden

Sweden's Climate Policy Framework sets out that its territorial greenhouse gas emissions (excluding LULUCF) must be at least 85% lower by 2045 than 1990 levels. 15% of this reduction can be met through "complementary measures" - effectively defining a residual emission share of 15% compared to 1990 levels.

The Swedish NECP projects that, by 2045, Sweden will still emit over 20 million tonnes of residual emissions (excluding LULUCF). The document notes that these residual

emissions are projected to come from "industry, electricity and district heating, domestic transport, work machinery, and agriculture". It further notes that abating agricultural emissions "in a cost-effective and competitively neutral way" is much more difficult than in other sectors, and they will have to be offset through "complementary measures", meaning sequestration in biomass and soils, bio-CCS, or international carbon credits. At the same time, emissions from electricity, transport, and heavy industry must be reduced as close to zero as possible.

Land Use, Land-Use Change and Forestry in Sweden

Targets

Sweden has not set net removal targets for sequestration in biomass and soils; instead, it relies on the EU LULUCF Regulation to provide binding targets. For the period from 2020-2025, the no-debit rule applies; gross emissions in Sweden's LULUCF sector may not exceed sequestration levels. The LULUCF Regulation sets a target for additional net sequestration of 3.955 $MtCO_2eq$ by 2030, calculated in the Swedish NECP to a targeted total net-sequestration level of 49 Mt in 2030.[3]

Table 6: Overview of binding targets for net-sequestration in biomass and soils in Sweden

Law	**EU LULUCF Regulation**	
Timeframe	2021-2025	2030
Removal target	No-debit	Additional 3.955 Mt net sequestration
Baseline	Category specific	2016-2018

Progress

While Sweden's LULUCF sector has historically maintained a high net-sequestration level, it has more recently started to decline, raising serious doubts about target compliance. According to the Swedish NECP, the country's LULUCF sector recorded net sequestration of -41 $MtCO_2eq$ in 2022, a decline of about 10 Mt compared to 1990 levels, with a sharper fall in recent years.

The projections for the Swedish LULUCF sector in the country's NECP include a medium-growth and a less optimistic reduced-growth scenario that assumes higher climate change-related impacts. Under the medium-growth scenario, the country would still fail to reach its set 2030 target of 49 $MtCO_2eq$ by 7 $MtCO_2eq$, with a total net

[3] The LULUCF Regulation includes target numbers of 47.3 Mt in 2030 for Sweden. Source: https://commission.europa.eu/document/download/26d2c93e-641d-489f-a160-a7052fde58bb_en?filename=SE_FINAL%20UPDATED%20NECP%202021-2030%20%28English%29.pdf

sequestration level of about 42 $MtCO_2eq$. In the reduced-growth scenario, the target would be missed by 19 $MtCO_2eq$.

The Swedish government declares in its NECP that it would be highly difficult to meet the LULUCF and ESR targets through domestic measures alone. Therefore, it is planning to rely heavily on EU regulatory flexibilities, including acquiring Effort Sharing and LULUCF credits from other member states, and utilising transfers of EU ETS allowances.

In the long term, the included projections show a gradual decline in Sweden's total LULUCF net sequestration levels to 18-33 $MtCO_2eq$ in 2040 and 16-31 Mt in 2045. Despite this, the measures included in the country's NECP and LTS lack quantified, targeted measures projected to deliver the needed recovery in carbon sequestration rates. Sweden's LULUCF measures focus on general forest management, with a strong emphasis on voluntary implementation of measures, peatland and wetland rewetting, and agricultural soil sequestration. The achieved and expected climate benefits from the established measures - about 6 $ktCO_2eq$ emissions avoided through wetland and peatland rewetting in 2023 and 176 $ktCO_2eq$ of expected soil carbon sequestration through intermediate crops between 2023 and 2027 - are outstandingly small compared to the current and anticipated challenges of the Swedish LULUCF sector.

Permanent Removals in Sweden

Targets

The Swedish NECP places a heavy emphasis on permanent, technological removals, specifically bio-CCS, to fulfil its 15% "complementary measures" allowance for 2045.

While there is no statutory 2030 target for permanent removals, the Swedish Energy Agency's baseline scenario models an implementation of over 1.5 Mt of total carbon captured by 2030. Bio-CCS is projected to contribute 1.2 to 2.2 million tonnes of carbon dioxide removals annually from 2030 onward.

A report by the Swedish Climate Policy Roadmap Committee (Klimatpolitiska vägvalsutredningen) concluded that the realisable annual capacity for bio-CCS in Sweden would be at least 10 $MtCO_2eq$ per year by 2045. This would be supported by the country's large biogenic point sources, such as paper and pulp mills and biogenic waste-to-energy plants, which have a theoretical capture potential of 20 to 30 Mt annually.

Progress

Sweden is already actively financing bio-CCS. The government is implementing a state-aid scheme for the technology utilising reverse auctions, in which industrial

operators bid on how much biogenic CO_2 they can capture and permanently store, and at what cost. The Swedish Energy Agency serves as the administrator and is authorised to distribute SEK 36 billion (approx. €3.1 billion) between 2026 and 2046 to cover both the capital and operational expenses of successful bidders. Additionally, the government has established a long-term program, the "Industrial Leap", intended to provide upfront capital grants for industrial decarbonisation and negative-emissions research. Its budget has increased significantly over time from SEK 500 million (approx. €44.8 million) in 2019 to SEK 1,457 million (approx. €127 million) in 2024 and was then slightly reduced to SEK 1,357 million (approx. € 118 million) in 2025. According to the Swedish Energy Agency, about 8.5% of public funding from the program went to bio-CCS projects.

An expert report proposed setting BECCS targets of 1.8 $MtCO_2eq$ by 2030, rising only incrementally to 3-10 $MtCO_2eq$ by 2045 - a wide range that reflects how uncertain the delivery pathway still is. An independent assessment of Sweden's bio-CCS planning, published in 2020, shows that the assumptions for the availability of permanent removals in Sweden rest on highly optimistic assumptions and may lead to a large implementation gap.

While Sweden has invested heavily in incentives for bio-CCS, its NECP notes that it does not expect to have domestic geological storage capacity operational by 2030. The Geological Survey of Sweden is investigating potential domestic sites, but according to the NECP, in the medium term, Sweden is entirely dependent on exporting its captured carbon. Bidders under the reverse auction scheme are expected to export CO_2 by ship to Norway for geological storage. However, no assessment of the feasibility of this plan is included in the reviewed Swedish climate plans.

Short Summary Assessment

Sweden's framework separates emission reductions from complementary measures, including sequestration in biomass and soils, permanent removals, and international carbon credits. It is capping the contributions of complementary measures at 8% of the 2030 target and 2% of the 2040 target. Its gross reduction targets are however only indicative.

Biomass sequestration in biomass and soils, which the Swedish framework still counts on in the interim, is declining. Net LULUCF sequestration since 1990 fell by roughly 10 Mt to -41 Mt in 2022, and Sweden is projected to miss its 2030 EU LULUCF target by 7-19 Mt even under its most optimistic assumptions, with further decline expected through 2050. The policy response - sourcing flexibility credits from the ETS and ESR - addresses the accounting gap without addressing the underlying physical decline in sink capacity.

This raises the stakes for bio-CCS, which the Swedish framework understands as the key mechanism, alongside international carbon credits, to absorb the growing shortfall after 2040. The high expectations for bio-CCS required to achieve the Swedish 2045 net-zero target are not aligned with the current state of planning. Even though funding streams for the technological development of bio-CCS have been established, an assessment of the long-term capital investment required and where funds would come from. Given the absence of confirmed domestic geological storage before 2030 and an unassessed dependence on export capacity to Norway, the feasibility and sustainability of relying on bio-CCS are currently not credible. Central risk-assessments regarding the effect bio-CCS deployment at the envisioned scale would have on the Swedish LULUCF sink are missing.

Overall, Sweden's plans towards climate neutrality and governing CDR are transparent, but rest on a declining biomass stock and an unassessed export-dependent geological storage trajectory, both of which pose significant risk to achieving its targets.

Conclusion

The five EU member states' plans on CDR and sequestration in biomass and soils examined in this analysis reveal inadequate policy frameworks, planning, and implementation. While the EU has significantly accelerated its integration of carbon dioxide removals into its climate architecture since 2022, national climate planning documents remain ill-equipped to govern CDR with rigour and in line with environmental integrity and long-term targets.

Only Germany, Spain and Sweden have so far quantified residual emissions, doing so as a percentage of 1990 emissions (5% for Germany, 10% for Spain, and 15% for Sweden). While this transparency is commendable, setting a fixed threshold without providing in-depth assessments and a logic for deciding which emissions are residual, and failing to consider how these can be cut further with more drastic measures or technological advancements, falls short of genuine implementation. Germany's definition of residual emissions is still under development and not yet made official. The Netherlands and Poland leave their understanding of residual emissions largely undefined. Without a defined residual emissions baseline, there is no way to assess whether a country's planned removal capacity is proportionate to its actual abatement gap, leaving the door open to using CDR as a substitute for, rather than a complement to, emission reductions.

No country in this sample has fully enshrined distinct, legally binding targets for permanent removals. Germany's federal law prescribes that such targets be set, but they await the still-unpublished long-term negative emissions strategy. The Netherlands has only an indicative capacity range from a non-binding roadmap. Sweden conflates permanent removals with temporary sequestration and international carbon credits under "complementary measures" and caps them as a share of its overall targets for 2030 and 2040 rather than setting a standalone permanent removal goal. Poland and Spain have no quantified permanent-removal targets at all, neglecting their necessity in the long term.

In contrast, all five countries' planning documents include LULUCF targets, based on the EU LULUCF Regulation. But in four of them - Germany, the Netherlands, Sweden, and Poland - sinks are underperforming or projected to decline. While Spain communicates a transparent 90/10 split between reductions and sequestration to reach climate neutrality, the framing is undercut by its near-total dependence on a LULUCF sink that is currently degrading, a trend that is expected to continue.

Only Germany and Sweden take serious first steps to assess the feasibility of projected permanent removal volumes. Sweden foresees that bio-CCS capacity of between 1.2 to 2.2 million tons would be available by 2030 rising to up to 10 million tons until 2050. However, the country's deployment plan is highly optimistic given the slow progress in the last 6 years. Germany's approach is still pending a key strategy document, the LNe, but the process set up in the country, focused on in-depth research and assessments followed by informed, transparent and participative decision-making, is a blueprint of good practice that could be implemented by other countries. Poland's NECP does not meaningfully distinguish CCS from CDR, and the Netherlands' main financing instrument conflates the two. By failing to separate them, the countries obscure whether public funds are supporting fossil-fuel-emitting entities by allowing them to keep their business models and just capturing part of their emissions, or supporting actors actually building genuine CDR capacity.

Taken together, these findings point to a significant governance gap in achieving a genuine and stable net-zero emissions state. All five countries, in different ways, rely on carbon sequestration in biomass and soils to bridge the gap to climate neutrality. Yet in four of them, the underlying sink is shrinking due to continued high harvesting levels exacerbated by climate impacts. Meanwhile, permanent removals rest on thin evidence and often optimistic assumptions. Germany's large-scale research projects CDRterra and CDRmare are taking a significant step by providing fundamental research and data to build better and well-informed CDR policy. However, the reviewed countries' approaches are still dependent on unresolved questions of storage location and transport infrastructure, undercapitalised relative to the scale projected, and lack acknowledgement of the impacts it may have on the environment and human health as well as economic tradeoffs.

Complementing Carbon Market Watch's prior analysis of 6 European countries and the European Commission in the "Leaning on Uncertainty" report, this new investigation confirms that countries in Europe are not adequately prepared to slash their emissions sufficiently, protect and restore land sinks and contribute to a sustainable supply of permanent removals. They should do better, and the EU could help in this regard. With the next round of NECPs and LTSs due in January 2029, member states have a narrow but real opportunity to close these gaps. The planned revision of the Governance Regulation, which sets out the reporting requirements for countries' climate plans under the EU framework, has the potential to enhance countries' plans, serve as a platform to build and share capacity, and result in a more credible approach to EU-wide climate neutrality.

Recommendations

Carbon Market Watch urges EU legislators and national governments to improve the governance system for removals, enhance the assessment basis, and establish transparent, participatory processes to deliver robust, future-fit policies that achieve net-zero targets in a timely manner while respecting environmental limits. Just transitions towards climate-neutral economies must be well planned and resilient to political or physical reversals. Therefore, EU rules and national policies need to adapt to keep the focus on genuine emission reductions while building the necessary capacity for limited, permanent removals to balance the unavoidable, minimal last portion of emissions.

Carbon Market Watch recommends the following policy interventions at the EU and national levels to resolve the deficiencies identified in this analysis:

1. **Establishing an EU-wide residual emissions strategy and defining residual emissions in quantitative, sector-specific terms**. Decision-making must be based on bottom-up assessments of emission-reduction measures, with permanent removals as a last resort. Given the complexity of the underlying decisions, a transparent and participatory process should be established to give civil society, scientific experts, and affected communities a meaningful role in scrutinising the assumptions behind sectoral abatement potential.

2. **Setting separate, binding targets for permanent removals**[4], distinct from both emission-reduction goals and LULUCF sequestration, with its own supporting policy and financing architecture. Permanent removal targets should be established well in advance, so that the capacity, infrastructure, and financing needed to meet them can be planned with sufficient time. The EU policymaking process for national climate targets for 2040 should be used to establish separate CDR targets. A distinct permanent removals strategy at the EU level can complement such targets and coordinate further supporting policy for safe and reliable implementation.

3. **Grounding projected removal volumes in transparent and independently verified feasibility assessments**, covering energy and resource use, available geological storage capacity, injection and transport infrastructure, and a conservative pace of technology deployment. The EU Governance Regulation theoretically already sets out the requirements for member states to include feasibility assessments for CDR in their NECPs and LTSs. However, member

[4] For more information on how separate permanent removal targets can and should be set up, read our publication Beyond net: a guide on separate permanent removal targets in the EU

states are not compliant with these provisions. Therefore, the upcoming review of the Governance Regulation must explicitly require extensive feasibility assessments for CDR. A separate section for CDR in the NECP templates can fix this by setting out the timing and quantity of relied-upon CDR, broken down by method and supported by thorough feasibility assessments. Only this way can progress be meaningfully tracked and compared following the 2029 reporting cycle.

4. **Acknowledging the limitations of carbon sequestration in biomass and soils** as a climate solution, while focusing on the protection and restoration of forests and natural lands. The EU must reduce biomass demand by following cascading principles of a circular economy and prioritise measures that strengthen long-term ecosystem resilience over those that aim to maximise short-term carbon sequestration. Ambitious LULUCF targets are needed, and biogenic carbon stocks should be monitored and increased, but carbon sequestration in biomass and soils, which are highly vulnerable to reversal, should never be understood as substitutable with anthropogenic emissions. Negative net-sequestration in the LULUCF pillar should not be allowed to offset emissions under the ESR and ETS. Making the temporary sequestration units accessible to other industries through the CRCF risks delaying genuine decarbonisation.

5. **Clearly separating permanent CDR from CCS and CCU** applied to fossil or unavoidable process emissions, both conceptually and in the design of financing instruments. Subsidy schemes and legal frameworks should not treat removals as a subcategory of carbon capture more broadly, as doing so obscures whether public funds are supporting genuine negative emissions or simply reducing emissions at the source. This can be addressed at the EU level by mandating separate sections in NECPs and LTSs, and at the member state level by addressing fossil carbon capture and CDR in separate strategies and refraining from folding CDR into subsidy schemes for fossil carbon capture.

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Annex

	Germany	Netherlands	Poland	Spain	Sweden
Separate targets for CDR	In progress: the German federal climate action act mandates separate permanent CDR targets, but they are still being developed.	No: The Dutch Climate Act conflates emissions and removals in net targets for 2030 and 2050.	No: Poland generally lacks statutory national climate targets in national legislation, and therefore relies entirely on EU law.	No: The Spanish Climate Change law sets a net-zero target but does not separate the target into gross emission reductions, CDR, and LULUCF.	Partial: Has an indicative separate gross emissions-reduction target at the point of its net-zero goal, but conflates permanent CDR with temporary sequestration and international carbon credits. The Swedish Climate Change Act obliges the government to act on the targets even if they are non-binding.
Dedicated strategy for CDR	In progress: currently developing a separate strategy for CDR: the Long-term Negative Emission Strategy (LNe).	Yes: While the Dutch NECP and LTS do not include significant strategic considerations of CDR, the Dutch Carbon Dioxide Removal Roadmap outlines CDR as supplementary to emission reductions, and analyses different CDR methods and their feasibility.	No: lacks a dedicated, separate strategy for CDR. Poland prioritises advancements in CCS while ignoring the use of carbon capture technologies to procure negative emissions.	No: Spain has not conducted any strategic exercises for permanent CDR, leaning fully onto carbon sequestration in biomass and soils.	Partial: The Swedish climate planning documents frame CDR as a complementary measure and cap their contribution, but they do not include an analysis of hard-to-abate emissions or how expected volumes of CDR will respect ecological and social limits.

	Germany	Netherlands	Poland	Spain	Sweden
Residual emissions definition	No: lacks a statutory definition of residual emissions and an inclusive process to decide on such a definition.	No: has not defined residual emissions, and its CDR roadmap calls upon the EU to do so.	No: does not formally define residual emissions, though it broadly notes that emissions from agriculture and heavy industrial processes cannot be completely avoided with current technology.	Partly: defines residual emissions as the final portion of emissions that cannot be abated and must be absorbed by sinks. However, it does not include an analysis of why these emissions would be impossible to abate.	No: does not define residual emissions and how it would be decided whether emission reduction measures are too costly. But its NECP includes projections based on techno-economic assumptions, illustrating which emissions would remain under envisioned measures.
Residual emissions quantification	Yes: quantifies expected residual emissions at about 5% of 1990 emissions and breaks them down by sectors.	No: fails to quantify the volume of expected residual emissions. The separate Carbon Dioxide Removal Roadmap estimates that its negative-emissions demand is about 4-18% of its 1990 GHG emissions.	No: does not quantify expected residual emissions.	Yes: According to the Spanish NECP, the last 10% of 1990 emissions would be deemed residual - about 29 MtCO2eq in 2050.	Yes: By limiting the gross emission reduction at net-zero to 85% in its Climate Policy Framework, Sweden effectively allows residual emissions to amount to up to 15% of 1990 emissions - about 20 MtCO2eq by 2045, driven by agriculture, heavy industry, domestic transport, and work machinery.

	Germany	Netherlands	Poland	Spain	Sweden
Role of biomass and soils	High risk: despite Germany's LULUCF sector currently being a net emitter, its net-zero strategy relies on large volumes of biogenic sequestration being available to offset emissions in other sectors.	Low risk: Since the Dutch LULUCF sector is currently a net emitter, additional biogenic sequestration is not foreseen to offset emissions in other sectors.	Medium risk: After a sharp decline in net sequestration levels, the Polish LULUCF sector is recovering thanks to aggressive forestry measures. Poland is actively considering net sequestration to offset emissions in other sectors.	High risk: Spain relies entirely on sequestration in biomass and soils (reforestation, wetland restoration) to balance the remaining 10% of emissions by 2050. A lack of effective measures to stabilise the Spanish land sink and rising climate-related effects, e.g., wildfires and desertification, places its LULUCF sink in jeopardy.	High risk: Sweden relies on sequestration in its LULUCF sector to balance emissions at the point of net-zero. The contribution can be 0-15% of 1990 emissions. However, the country's struggle to meet its 2030 LULUCF target shows that the measures implemented were insufficient to sustainably increase net sequestration in the sector.

CARBON MARKET WATCH

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