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Towards an ambitious Industrial Carbon Management for the EU

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1. Why the EU needs an industrial carbon management strategy

The European Union is committed to achieving economy-wide climate neutrality by 2050 to limit warming to 1.5°C. It is implementing a comprehensive policy framework to reduce emissions by at least 55% by 2030 and the Commission is setting out the EU-27's 2040 ambition1. Achieving these targets and weaning off our reliance on fossil fuels requires decisive climate action across all sectors of the economy. The complete future policy architecture delivering the EU's 2040 ambition remains to be defined. Yet, considering the prevailing emissions of industrial activities in the EU, mitigating and managing carbon emissions in industrial processes – notably in the so-called hard-to-abate sectors where mitigation options are limited – will be crucial2. To decarbonise industry, other solutions such as circularity, resource efficiency, alternative processes and material substitution will be of importance [as underlined in the 2040 Communication], with the re-use of carbon contributing to this paradigm shift.

After the latest reform of the EU ETS, industrial emissions must decline at an accelerated pace to reach the 2030 target[3]. Furthermore, reaching economy-wide climate neutrality by 2050 will require carbon removals to counter-balance residual emissions from hard-to-abate sectors within the EU at the latest by 2050 and to achieve negative emissions thereafter. The exact amount of these residual emissions and the sectors concerned will depend, in part, on technological developments, the degree of circularity and resource efficiency achieved, and the implementation of alternative processes and material substitution.

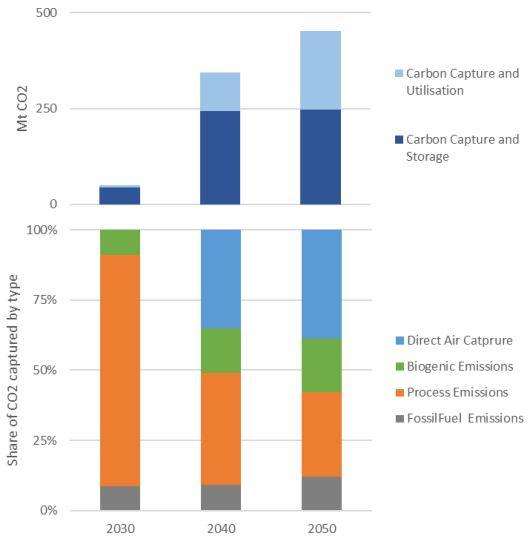
To reach the 2040 ambition [as set out in the 2040 Communication] and climate neutrality by 2050, the EU will need to be ready to capture at least [50] million tonnes of CO2 per year by 2030, [approximately xxx million tonnes] by 2040 and up to 450 million tonnes by 20504 (see figure 1 below). The analysis underpinning [the 2040 Communication] also shows that the power sector is projected to capture by itself more than 100 million tonnes of fossil and biogenic CO2 in 2050, providing carbon neutral or carbon negative dispatchable power, and contributing to the stability of the electricity network. By the same date, most of the remaining emissions from EU industries will have to be captured and stored, in particular from the cement and the chemical sectors. In addition, between 100 and 200 million tonnes of CO_2 will need to be captured directly from the atmosphere as it will play an important role in generating carbon removals but also as a "climate neutral" source of carbon for different applications.

This requires a comprehensive approach to address all aspects of capturing emissions, removing CO_2 from the atmosphere, transporting CO_2 but also using captured CO_2 to replace fossil carbon where carbon is needed. Geological storage remains the main destination for captured CO_2. The phasing out of fossil fuel use in EU transport will also require a significant increase of the use of synthetic fuels produced with captured CO_2. Gradually, the source of this captured CO_2 needs to shift away from fossil fuels and industrial processes towards biobased and air captured CO_2

1 [add reference to 2040 target and links to the 2040 Communication].
2 IPCC, 2022. Climate Change 2022: Mitigation of Climate Change; IEA, 2021. Net Zero Roadmap A Global Pathway to Keep the 1.5 °C Goal in Reach; the analysis conducted by the European Scientific Advisory board on climate change].
3 [Cross reference to the relevant section in the 2040 IA].
4 REF IA 2040.

streams (see figure 1 below). The production of plastics and other chemicals will also transition from a heavy reliance on fossil resources today to more widespread use of sustainable carbon as feedstocks, i.e. carbon from captured CO_2 together with carbon from recycled materials or biomass.

Figure 1: Volume of CO_2 captured for storage and utilisation in the EU (top) and share of the CO_2 captured by origin (down)[5]



The EU will therefore rely on **industrial carbon management (ICM)** to address residual industrial emissions. Industrial carbon management generally covers the capture of CO_2 from a single identifiable source, such as from fossil fuels, industrial processes or biomass, or directly from the air. Where the captured CO_2 is not used directly on-site, it is transported and either used in industrial processes (e.g. for construction products, synthetic fuels, plastics or other chemicals) or permanently stored in geological formations. Such mitigation approaches will become more important as decarbonisation progresses.

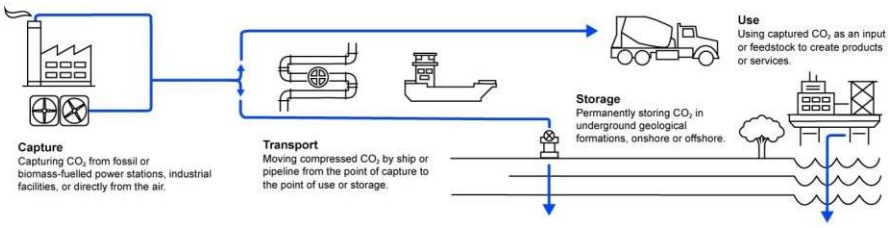
5 Numbers presented in this figure are based on the modelling results of the impact assessment for the establishment of an EU 2040 climate target (SWD (2024) XXX). The volumes of CO2 captured, stored and utilised as well as the shares by origin of the CO2 are scenario dependent, [values from scenario S3 or central values] are reported in this figure. The small increase in the share of captured fossil CO2 for 2050 reflects a broader deployment of CO2 capture power installations in a context where the overall use of fossil fuel in power installation is significantly lower in 2050 than in 2040.

The **industrial carbon management** in the EU in the next decades will be based on three pathways, namely carbon capture for storage (CCS), carbon removals and carbon capture for utilisation (CCU)[6].

- **Capturing CO_2 for storage:** where emissions of fossil, biogenic or atmospheric origin are captured and transported for permanent storage.
- **Removing CO_2 from the atmosphere:** where the permanent storage involves biogenic or atmospheric CO_2 it will result in **removals** from the atmosphere.
- **Capturing CO_2 for utilisation:** where industry uses captured CO_2 to substitute fossil-based carbon in synthetic products or fuels. Initially, using all types of CO_2, the utilisation value chains will over time need to focus on biogenic or atmospheric CO_2 to increase the climate benefit.

The **CO2 transport infrastructure**, being it pipelines, ships, but also road and rail transport means, is binding all the pathways together as a key enabler.

Figure 2: Description of the functioning of the CO2 value chains [based on IEA graphic TBC]



This Strategy, therefore, aims at bringing together different policy strands to create an enabling environment to develop and scale-up the industrial carbon management approaches as essential building blocks to achieve climate neutrality, while setting adequate safeguards to ensure their environmental benefits.

2. The state of industrial carbon management solutions in Europe

There are already 20 Member States that include industrial carbon management solutions, namely Carbon Capture and Storage (CCS) and/or Utilisation (CCU), as a necessary element of their pathways towards climate neutrality in their draft National Energy and Climate plans.[7] Furthermore, seven Member States[8] included these technologies in their Recovery and Resilience

[6] This is an oversimplification as there will be industries capturing both for utilisation and storage. Conversion of CO_2 into products can also be integrated with the industrial processes that generate the CO_2 and hence does not need transport. There will also be many more intermediate steps along the value chain for purification, compression, liquefaction, buffering storage, etc.

[7] Germany, Hungary, Lithuania, Portugal (CCS & CCU), Cyprus, Czechia, Denmark, Estonia, Greece, Spain, France, Croatia, Italy, Netherlands, Romania, Sweden, Slovenia, Slovakia (CCS), Finland, Luxembourg (CCU).

[8] Belgium, Croatia, Denmark, Finland, Germany, Greece and Sweden.

Plans. Denmark and the Netherlands already have functioning national subsidy schemes for carbon capture and have accelerated efforts to make CO_2 storage available. Together with Norway, these three countries are pioneering the geological storage of CO_2 on an industrial scale and are seeing increasing commercial interest in both onshore and offshore storage licenses. France, Germany and Austria are currently developing carbon management strategies.

At the EU level, several policy instruments already recognise the importance of industrial carbon management solutions.

Firstly, the EU Emissions Trading System (EU ETS)[9] prices CO_2 emissions and incentivises the capture of CO_2 for permanent storage since 2013. It is a central policy to develop further industrial carbon management solution in the EU and the EEA. It also funds, through the EU Innovation Fund established with the revenues of the EU ETS, small-, medium and large-scale capture projects for storage or utilisation, such as in the cement, chemical and bioenergy sectors. The projects supported by the Innovation Fund so far are expected to capture and store approximately 10 million tonnes of CO_2 per year starting as early as 2027, provided the necessary storage capacity is commercially available.

The EU ETS has recently introduced[10] several changes relevant for industrial carbon management. Firstly, it has broadened the scope of CO_2 transport for storage to include any transport mode[11]. Detailed rules on the monitoring and reporting of emissions from each transport mode will be issued mid-2024, accounting all emissions to ensure that the net CO_2 benefit of the storage is considered[12].

Secondly, it establishes the possibility of not surrendering allowances in respect of emissions of greenhouse gases which are considered to have been permanently captured and utilised[13]. The Commission will establish the requirements for considering that greenhouse gases have become permanently chemically bound in this sense in a delegated act in mid-2024. In this way, permanent CCU and CCS are put on equal footing in the ETS, providing more options to hard- to-abate industries capturing CO_2.

Thirdly, the ETS rules will provide that the use of renewable fuel of non-biological origin (RFNBO) and recycled carbon fuels (RCFs) that have been certified as meeting the minimum criteria set by the Renewable Energy Directive[14], should not be subject to surrendering allowances to avoid double counting of the embedded carbon.

Notably in the aviation and maritime sectors it is expected that renewable synthetic fuels will be of particular importance. The ReFuelEU[15] aviation initiative sets binding targets to Aviation Fuel Suppliers to supply a minimum share of synthetic aviation fuel to EU airports, meeting the

[9] Directive 2003/87/EC.
[10] Directive 2003/87/EC.
[11] Prior to the changes, to benefit from the reduction in surrender obligations under the ETS, the transport could only take place by pipelines.
[12] Including the energy use in the transport and related processes, fugitive emissions and leaks.
[13] The requirements for permanent CCU are established in Article 12(3b) of Directive 2003/87/EC.
[14] Directive (EU) 2018/2001.
[15] Regulation (EU) 2023/2405.

RNFBO quality requirements. Similarly, the FuelEU Maritime Regulation[16] puts in place a special incentive regime to support the uptake of RNFBOs. In addition, the ETS Directive further incentivises these alternative synthetic fuels by using 20 million allowances to be allocated for free to aircraft operators to cover the remaining cost-difference for their deployment.

Furthermore, CO_2 storage is regulated by the CCS Directive, setting out clear permitting rules to ensure the safety and environmental integrity of CO_2 storage and prescribing transparent and non-discriminatory access to the infrastructure.[17]

In relation to State aid for carbon management solutions, the Guidelines on State aid for climate, environmental protection, and energy[18] and the General Block Exemption Regulation[19] include conditions where State aid for CCS and CCU investments is permissible. CCS is also included in the EU sustainable finance taxonomy - a classification system developed to identify and define economic activities that are considered environmentally sustainable.[20]

In 2021, the Commission set out the aspirational 2030 objectives for sustainable carbon to represent at least 20% of the carbon used as feedstock in the EU chemical industry and to remove and permanently store at least 5 million tonnes of CO_2. The environmental integrity of carbon removals will be ensured by an EU certification framework for the certification of carbon removals that is about to be adopted in the EU.[21]

To stimulate the nascent CO_2 market in the EU, the proposed Net Zero Industry Act (NZIA)[22] regulation recognises CCS as a strategic net-zero technology and supports project deployment with accelerated permitting procedures. The proposal [undergoing final negotiation between the co-legislators] also includes a CO2 storage availability target for the EU of 50 million tonnes of annual injection capacity by 2030 and [mandates oil and gas producers]23 to invest in those initial infrastructures, recognising this sector's specific know-how in this field. The regulation also [mandates the EU and Member States to ensure investment in and access to CO2 transport infrastructures]. 24

On 28 November 2023, the Commission adopted the new list of projects of common interest (PCIs) or projects of mutual interest (PMIs)[25] linking the CO_2 transport and storage infrastructure of Member States (and third countries) under the revised TEN-E Regulation[26]. The list includes

[16] Regulation (EU) 2023/1805.
17 See Article 21 Access to transport and storage infrastructure of Directive 2009/31/EC.
18 Communication from the Commission (2022/C 80/01). Guidelines on State aid for climate, environmental protection and energy 2022
19 Regulation 2014/651/EC.
20 Regulation 2020/852/EC.
21 COM/2022/0394 final.
22 COM/2023/161 final.
23 [Pending NZIA agreement – to be expected end 01/2024].
24 [Pending NZIA agreement – to be expected end 01/2024].
[25] https://energy.ec.europa.eu/topics/infrastructure/projects-common-interest/key-cross-border-infrastructure-projects_en .
[26] Regulation (EU) 2022/869.

14 CO_2 transport projects with an overall planned capacity of 42 to 103 Mtpa of CO_2 and a possibility to reach up to four onshore storage sites and eight or more offshore locations.

A dedicated stakeholder dialogue platform, the CCUS Forum, has been put in place since 2021. The Commission established different working groups under the CCUS Forum, focusing on key issues of relevance to the development of the ICM market: infrastructure (incl. an expert group on CO_2 specifications/standards), public perception and industrial partnerships. Through an inclusive and bottom-up approach, these working groups have delivered several reports informing the public and the Commission on carbon management topics and guiding the work on the ICM Strategy[27]. The Commission intends to continue these working groups to support the action points related to this ICM Strategy. At the last CCUS Forum Plenary meeting, the Commission announced the following three action points as key priorities for 2024: 1) establish a knowledge-sharing platform, 2) work with our standardisation bodies on CO_2 stream composition standards, and 3) launch a pilot project creating a CCUS Observatory that will monitor, report and verify the CO_2 captured from cement and waste-to-energy plants.

However, the experience of the first projects that plan to capture, use or store CO_2 in the EEA reveal a number of **challenges** to the emerging industrial carbon management system in Europe. They include difficulties to build a business case and a lack of a comprehensive regulatory environment along the entire value chain, notably for industrial carbon removals and for certain CO_2 use applications. The first actors that are building the carbon value chains also face CO_2-specific cross-value chain risks, such as liability for leaks or the temporary unavailability of transport or storage infrastructures. These projects suffer from insufficient co-ordination and planning, especially where they cross borders. Capture and storage of CO_2 in general still needs to be recognised by governments across the EU as a legitimate and necessary option to decarbonise.

3. A European approach to industrial carbon management

A European approach is needed to establish a European single market for industrial carbon management as a key building block towards a climate-neutral economy in 2050. This includes more ambitious and well-coordinated policies at national level, as well as strategic infrastructure planning at the EU level, underpinned by close co-operation between the EU and national administrations but also businesses, civil society and research communities.

To achieve this, the Commission sees the deployment at scale of carbon value chains in Europe advance in stages.

The strategic EU objective towards 2030 is to secure the deployment of CO_2 storage capacity of at least 50 million tonnes per year[28] together with related transport infrastructure consisting of pipelines but also ships, trains and trucks, depending on business case. In a 2030-time horizon, Member States can support Net-Zero Strategic Projects that combine capture, transport and storage to deliver on this target. First CO_2 infrastructure hubs are expected to emerge, serving

[27] https://energy.ec.europa.eu/topics/oil-gas-and-coal/carbon-capture-storage-and-utilisation/ccus-forum-and-working-groups_en#the-working-groups.
[28] COM(2023) 161 final.

CO_2 capture projects supported by national and EU funding programmes, for which many rely on cross-border CO_2 transport. Investments in these hubs will be facilitated by the implementation of EU-wide CO_2 transport infrastructure interoperability rules that include minimum CO_2 quality standards to ensure it can flow freely across the EU/EEA.

By 2040, a number of regional carbon value chains should become economically viable to meet EU climate objectives, as CO_2 will become a tradable commodity for storage or use. These will rely on an EU-wide transport and storage infrastructure with pipelines as the dominant transport means on land. It allows for cross-border transport of captured CO_2 either for storage or for use, based on a regulatory environment that guarantees non-discriminatory access to competitive services of transport and storage. Capturing CO_2 emissions in hard-to-abate sectors progressively becomes the norm and all relevant remaining sources of industrial process emissions are captured. The capture of biogenic and atmospheric CO_2 should gradually reach levels comparable to the capture of fossil CO_2 and eventually go beyond.

Delivering on this vision of a well-functioning market for CO_2 requires a coherent policy framework that provides regulatory certainty and incentives for investments into carbon capture, storage, use and industrial carbon removals as key technologies to achieve climate neutrality, and underpin efficient infrastructure investments in transport and storage infrastructures.

4. A policy framework for the deployment of industrial carbon management solutions

The capture of CO_2 emissions, whether from fossil, biogenic or atmospheric origin, is the common starting point for all industrial carbon management pathways: CCS, carbon removals and CCU. Without capture, there is no industrial carbon management. In addition, regardless of whether CO_2 is captured for permanent storage or for re-use, CO_2 transport infrastructure is needed for enabling the establishment of the different pathways and the creation of a single market for CO_2 in Europe. Furthermore, coordination within and between the pathways of industrial carbon management is crucial to establish a sound business case and will give more certainty for investors.

4.1 Deploying transport infrastructure for a single CO_2 market

Transport of CO_2 is already today a commercial activity. However, the volumes moved are very small in comparison to what the future of industrial carbon management requires.

Emitters capturing CO_2 but also utilisation companies and storage sites operators should be able to rely on a functioning cross-border, open-access CO_2 transport network. While all CO_2 transport modes are covered under the EU ETS and thus their environmental integrity is safeguarded, the investment in and operation of such infrastructures is not regulated at EU level yet.

To build a market catering for the needs of the developing CCS, CCU and industrial carbon removals, significant investment will be needed. According to the study of the Commission's Joint Research Centre (JRC)[29] using the Commission modelling figures for 2040 Climate target,

29 REF.

the CO_2 transport infrastructure could span for up to [XYZ] km and its deployment could already cost up to EUR [XYZ] by 2030 rising to [XYZ] km and EUR [XYZ] in 2040. Several challenges need to be overcome to mobilise investment and deploy such an extensive transport network.

While pipelines are in many cases the preferred transport option, initial capital costs of building them remain high. Uncertainty regarding future CO_2 volumes, complicated coordination across the value chains, long permitting procedures, and the lack of a business case, constitute significant barriers for investors to move ahead with the projects.

In the EEA, the CCS Directive requires that CO_2 streams entering the storage sites consist overwhelmingly of CO_2 and that no waste or other matter may be added. The Directive also sets a requirement to limit incidental and added substances on a site-specific basis and defined in the relevant storage permit. However, large-scale cross-border transport infrastructure will require handling CO_2 streams from different sources, captured with different technologies and using different transport means and potential different storage sites creating interoperability issues.

Going forward, minimum CO_2 stream quality standards will be needed to avoid market fragmentation[30]. The standardisation will look to address issues such as composition, purity, pressure and temperature. This would also support a fair market by creating a balance between cost effectiveness and risks, as different CO_2 purity levels come with different cost.

Capture installations located away from industrial hubs and storage sites as well as small emitters lacking sufficient CO_2 volumes to interest transport operators might be excluded from the market altogether which could mean significant difficulties to decarbonise. Catering to their needs, dedicated solutions would be needed to increase their negotiating power with network operators.

Transport infrastructure for industrial carbon management is required for the establishment of a single market for CO_2. This means the development of a non-discriminatory, open-access, transparent, multimodal, cross-border CO_2 transport and storage infrastructure. Considering the potential size of such market and analytical work[31], **a dedicated regulatory package will likely be necessary to optimise its development**.

Such regulatory framework would ensure a degree of harmonisation across Europe, and possibly beyond, underpinned by local conditions and rules. It will consider how to facilitate coordination across the value chain, including with contract and price transparency and timely permitting. When preparing such a framework, the Commission will consider what measures are needed and when, to limit the risk of overregulating and stifling an emerging market.

To optimise the benefits of capital spent on infrastructure, **interaction between the electricity, gas and hydrogen sectors** and the need for future spare capacity will have to be considered based on coordination **and network planning** across the EU. Such planning should be based on a participatory approach known from electricity and gas sectors, where relevant stakeholders provide input through consultation. The existing CCUS Forum will provide input for this work

30 REF to CCUS Forum WG paper -TBC].

[31] ENTEC https://energy.ec.europa.eu/publications/eu-regulation-development-market-co2-transport-and-storage_en.

with the JRC underpinning the process with its work on pan-European CO_2 transport infrastructure development[32]. In the medium-term, the Commission would reflect on the need to establish a dedicated body representing transport and storage network operators. If established, such a body could provide an overview of existing infrastructure and outlook for its development needs, as well as the actual demand-supply situation.

The planning will need to factor in the interaction between the electricity, gas and hydrogen sectors, to ensure system integration and promote flexibility and resilience in the EU energy system. It will have to optimise investment across sectors and guide **the mapping of the potential repurposing and re-use of existing infrastructure for CO_2 streams**. This could reduce overall network costs and deployment times.[33] It will have to consider several regulatory issues, including permitting, licensing, and decommissioning. There are also issues with removing gas infrastructure as regulated assets (Gas Directive). National decommissioning obligations and international agreements might be also affected. The timing of future availability of gas transport infrastructure and depleted oil and gas fields for CO_2 storage will also have to be considered.

Considering the success of battery and hydrogen Important Projects of Common European Interest (IPCEI), **it is evident that close co-operation with Member States and companies willing to move fast brings good results on complex**, **cross-border, integrated projects that are important due to their contribution to EU objectives**.

The Commission will:

- *Initiate preparatory work in view of a possible future CO_2 transport regulatory package. It will consider issues including market and cost structure, cross-border integration and planning, technical harmonisation and investment incentives for new infrastructure, third-party access, competent regulatory authorities and tariff regulation for transport assets, as well as ownership models.*
- *Propose EU-wide CO_2 transport infrastructure planning mechanism in cooperation with Member States and the CCUS Forum stakeholder platform.*
- *Develop the emissions accounting rules in the context of the EU ETS to enable transport of CO_2 by any means.*
- *Work with CEN and CENELEC to issue a standardisation mandate to establish minimum standards for CO_2 streams in transport and storage infrastructure to be used in a network code.*
- *Assess to what extent re-use/repurposing of existing hydrocarbon transport infrastructure*

32 Reference to the JRC study.

33 The costs of repurposing hydrocarbon pipelines for CO_2 transport are estimated to be between 1-10% of the costs of building new pipelines. Original source: Benton C. and Silton B. for ADL Ventures. Repurposing Natural Gas Lines: The CO_2 Opportunity. Available at: https://adlventures.com/repurposing-natural-gas-lines-the-co2-opportunity/.

for CO_2 transport would be possible, and if so, what regulatory changes would be necessary.

- *Will encourage Member States to establish an Important Project of Common European Interest for CO_2 transport and storage infrastructure projects and assist in its creation if needed.*

4.2 Capturing and storing CO_2 emissions instead of releasing to the atmosphere

Carbon capture and storage includes applications where the CO2 is captured and permanently stored. According to the [Reference to 2040 IA], it is expected to be deployed at large scale. As most other carbon management value chains, it starts with capturing hard-to-abate industrial CO_2 emissions instead of releasing them to the atmosphere. The ETS carbon price provides incentives to deploy CO_2 capture of fossil fuel and industrial process emissions for permanent storage applications that thus avoid CO_2 emissions to the atmosphere from EU ETS installations, notably in the context of a steadily decreasing emissions cap setting a strong price expectation for carbon in the EU.

Since 2013, the EU ETS has provided industrial installations with an incentive to invest in geologically storing captured CO_2. Every tonne of CO_2 stored safely in compliance with the CCS Directive means one emission allowance saved, constituting a tangible incentive, especially considering the carbon price. Proper accounting of the net CO_2 benefit is ensured by the ETS Directive, considering energy use of the processes, fugitive emissions and leaks, while permanently environmentally safe geological storage is guaranteed under the CCS Directive.

In addition, corporate strategies are reviewing options to transform production processes within the EU into net-zero emission operations that will allow industrial operators to bring low- or zero-carbon end products to the market. Industrial sectors whose process emissions are hard-to- abate (e.g. cement) increasingly develop investment plans to capture CO_2, to either reuse it to produce fuels/chemicals (CCU), or permanently store it (CCS). Industry stakeholders expect that, by 2030, up to 80 million tonnes of CO_2 can be captured per year[34].

Such investment decisions depend on the development of markets for low- or zero-carbon end products as well as the availability of a full CO_2 value chain with capture, transport, utilisation or storage services being offered at competitive prices. The Commission will therefore explore the possibility to establish an **EU CO_2 aggregation platform** that supports CO_2 capture companies to procure CO_2 value chain services and allows for matching supply and demand**.** This platform would also allow establishing contracting and procurement transparency and provide transport and storage providers with infrastructure planning information. This is in particular relevant for

[34] According to needs calculation by CCUS Forum stakeholder CCUS Forum coalition (industry, NGOs); no Final Investment Decisions (FID) taken – pending availability of storage sites.

capture companies with less bargaining power, for example because of lower volumes of captured CO_2. such as from waste-to-energy plants[35] or of less continuous CO_2 capture.

Carbon capture and storage requires not only that the carbon is captured, but also that it is permanently stored. Developing storage sites in line with the NZIA target will need support from and dialogue with permitting authorities. The latest Implementation Report of the CCS Directive[36] shows that only four Member States have processes in place that allow storage permit applicants to engage with the competent authorities during the preparatory phase – a crucial facilitation for the strategic net-zero projects contributing to the 2030 target. Two thirds of EU Member States allow CO_2 storage on their territories, and half of them have engaged in discussions about cross-border cooperation in view of ensuring CO_2 flows towards planned storage sites in the EEA. However, the potential storage capacities that are reported by Member States[37] only reach half of the CO_2 storage demand already identified by Member States, showing the need for further economic incentives to identify and build more storage capacity.

The business case for developing critical CO_2 storage infrastructure reaches beyond the immediate industrial emissions reduction's agenda in the next decades and includes the potential to contribute to economy wide negative emissions after 2050. At an initial stage, storage sites and related capture and transport infrastructures should be recognised and supported by Member States as **Net Zero Strategic Projects** under NZIA. This would allow Member States to support regional carbon management value chain clusters, by pooling initial capture volumes to de-risk storage site investments. To lower the upfront costs, Member States can consider aggregating financial security required from CO_2 storage operators in the form of levies per volume of CO_2 stored[38].

However, given the increasing storage needs post-2030 and to ensure that the relevant CO_2 transport and storage infrastructure capacities are dimensioned for the growing needs of industrial capture and storage post 2030, the **ambition is to increase the annual CO_2 injections capacity to allow at least [200] Million tonnes of CO_2 per year to be stored geologically in 2040 in the European Economic Area**. This requires the EU to identify and develop its potential CO2 storage capacity.

The Commission will therefore kickstart work on establishing an EU-wide **Investment atlas of potential CO_2 storage sites**. To that effect, the Commission will put together a digital inventory of the underground storage of CO_2 building on the work of the European geological surveys[39]. Each potential storage site will be labelled according to its 'storage readiness level' and public

[35] According to CEWEP, the European waste-to-energy sector has the potential to deliver net carbon savings of up to 75 MT of CO2e every year by applying CCUS technologies.
[36] As of [add cut off date]; see Report on Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide, COM/2023/657 final.
[37] In their draft National Energy and Climate plans as of [cut-off date for SWD].
38 In line with Art. 19 of Directive 2009/31/EC Member States can decide relevant arrangements. [See also the revised Commission Guidance Document 4 on the Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide on Financial Security and Financial Mechanism – TBC & new link to be added].
[39] Including the European CO2 Storage Atlas developed in 2020 by the CO2 Storage Potential in Europe Project (CO2StoP project), https://setis.ec.europa.eu/european-co2-storage-database_en.

data will be associated with it to speed up work on the identification and appraisal of storage sites.

Geological services in the EEA should be resourced and able to aggregate all existing subsoil knowledge, including, where available, technical information such as well samples, geophysical behaviour, and seismic data from hydrocarbon production sites and early CO_2 storage sites. On the basis of the atlas, investors will be able to identify potential storage opportunities as part of CO2 value chains. In addition, CO_2 storage permitting procedures need to be well defined, made transparent and be comparable across the Union. On the basis of the strategic sites that will make up the first 50 million tonnes of annual storage capacity by 2030, the Commission will **develop guidelines for CO_2 storage permitting** balancing site-specific flexibility with investment predictability **to facilitate and speed up CO_2 storage roll-out.**

The Commission will:

- *Support Member States in the deployment of recognised Net-Zero Strategic Projects for Industrial Carbon Management, including for addressing CO_2-specific cross-value-chain liability risks for operators.*
- *Develop, with Member States, a dedicated voluntary demand assessment and demand aggregation platform for CO_2 transport or storage services, with the aim to match CO_2 supplier with storage operators and establishing contracting and procurement transparency.*
- *Develop in cooperation with geological services of the EEA an Investment Atlas of potential CO_2 storage sites based on common Storage Readiness Level format.*
- *Develop, with Member States, step-by-step guidance for permitting processes for Net-Zero Strategic Projects for CO_2 storage under Directive 2009/31/EC Directive, notably regarding:*
  - *the transfer of responsibility from operators back to the competent authorities and the corresponding Financial Security and Financial Mechanism requirements; and*
  - *the transparency about permitting requirements and risk-based approaches to facilitate Final Investment Decisions (FIDs) of storage operators.*
- *In cooperation with Member States, consider developing guidelines on "incidental associated substances from the source, capture or injection process" that can be accepted by storage operators.*

Member States should:

- *Ensure that they have transparent processes in place for storage permit applicants to engage with the competent authorities during the preparatory phase.*
- *Support the development and deployment of cooperative Net Zero Strategic Projects under NZIA that establish full carbon capture, transport and storage value chains,*

including across borders.

- *Enable their geological services to contribute existing and generate new data to contribute to an EU-wide Investment Atlas of potential CO_2 storage sites.*

4.3 Removing CO_2 from the atmosphere

The industrial carbon removals value chains are key to achieving the carbon neutrality objective of the EU Climate Law.

To reach net zero economy-wide greenhouse gas (GHG) emissions by 2050, the EU will need carbon removals to balance out about 400 $MtCO_2e$ to 500 $MtCO_2e$ of residual emissions in hard-to-abate sectors such as agriculture, aviation and some industries. Nature-based solutions will play an essential role in this but will not be sufficient. Industrial carbon removals will also be a necessary tool to achieve this goal.

Industrial carbon removals are based on the CCS technology, capturing CO_2 directly from the atmosphere or capturing biogenic CO_2 from power plants or industries emitting, storing it permanently. The capture and storage of biogenic and atmospheric CO_2 is currently incentivised only by the EU ETS Innovation Fund and not by the EU compliance carbon market price since the EU ETS does not recognise negative emissions. Investment decisions for this type of activities often rely on state subsidy or voluntary carbon markets.

Today industrial carbon removals are not covered by the ETS Directive nor the Effort Sharing or the LULUCF regulations. The role of industrial carbon removals in achieving the EU climate objectives needs yet to be clarified. The Commission will therefore consider how best to incentivise industrial carbon removals in existing EU legislation or through new instruments.

As carbon removals will be instrumental in achieving the 2040 objective and climate neutrality by 2050, the Commission will also consider the benefits of setting specific objectives for carbon removals, in line with what will be proposed as **an overall net 2040 GHG emission reduction objective.**

Furthermore, the Commission has already **been mandated by the co-legislators to assess, by 2026, if and how the CO_2 that is removed from the atmosphere and safely and permanently stored could be accounted for and covered by emissions trading**[40] without offsetting emission reductions and while ensuring environmental integrity, especially regarding the use of sustainably sourced biomass for BioCCS.

This could be done either via the full integration of industrial carbon removals in the EU ETS (one single market where the generation of industrial removals to comply with surrender obligations is allowed without restrictions) or by creating a separate compliance mechanism for such removals, connected directly or indirectly to the EU ETS. In this context, the role of

[40] See Article 30 of Directive 2003/87/EC (link).

Member States in developing industrial carbon removals should also be considered. As a result, this would create price-based incentives for the generation of industrial carbon removals.

Initially, one of the main challenges would be to address the significant current difference between the prevailing carbon price and the cost of removing CO_2 through industrial solutions. Whereas costs for some BioCCS installations may not be much higher than for capture and permanent storage of fossil fuel and process CO_2 emissions, for other types of removals such as DACCS the costs are now ranging from € 550 to €900 per tonne of CO_2.

The integration in the EU ETS pricing system alone might thus be insufficient to incentivise such industrial removals, as compared to other types of emission reductions. At an early stage of deployment, additional support will be required to accelerate technological learning and reduce costs further.

At the same time, it will be important to accelerate research, development and demonstration to advance novel carbon removal technologies and lower their costs. With different removal technologies at different stages of maturity, tailored programmes will need to be set up for their development.

The Commission will use **its existing instruments to support industrial carbon removal technologies**. Specifically, Horizon Europe will focus on stepping up the research to improve the efficiency and feasibility of removal technologies, notably the direct air capture technologies as well as on their commercialisation and scale-up to market with the support of the European Innovation Council. The ETS Innovation Fund will continue to support clean technologies that will help scaling up carbon removals.

The Commission will:

- *Assess the establishment of overall objectives for carbon removals in line with the 2040 climate ambition and the achievement of climate neutrality by 2050 and negative emissions thereafter.*
- *Develop policy options and support mechanisms for industrial carbon removals, including if and how to account for them in the EU ETS.*
- *Boost EU research, innovation and early-of-a-kind demonstration for novel industrial technologies to remove CO_2 with resources under Horizon Europe and the ETS Innovation Fund.*

4.4 Using captured CO_2 as a resource to replace fossil fuels in industrial production

Capturing CO_2 and recycling it in the production of advanced synthetic fuels, chemicals, polymers, proteins or minerals is another aspect of an industrial carbon management value chain, which also contributes to the circular economic model. Yet, the benefits of these CO2 utilisation technologies and their capacity to provide an alternative source of carbon to replace fossil carbon in sectors of the EU economy that are carbon dependent are not fully recognised.

Existing support to some use of captured CO_2 in products is covered in regulation[41]. The deployment of CCU fuels when they replace fossil fuels in key sectors is encouraged, with safeguards in place to ensure that they provide the required minimum greenhouse gas emission savings.

The ETS Directive provides a maximum of 20 million allowances from 2024 until 2030 to be allocated for free to aircraft operators to cover the remaining cost-difference for the deployment of renewable fuels of non-biological origin and sustainable alternative fuels[42], and ReFuelEU aviation also requires, from 2030, renewable fuels of non-biological origin that cover also synthetic fuels produced with renewable energy through CCU. The use of such CCU fuels will also be recognized in the EU ETS to avoid the double counting of the embodied carbon emissions.

The 2023 revision of the EU ETS Directive acknowledges the permanence of the carbon storage in certain types of products and a delegated act is in preparation to define the conditions under which this permanence can be recognised. Consistent with the EU ETS framework, the EU carbon removal certification framework will give the possibility to certify carbon removals generated by industrial activities storing atmospheric or biogenic carbon in products in a manner preventing the carbon to be re-emitted to the atmosphere.

However, additional measures are necessary to recognise the climate benefit of the use of sustainable carbon from captured CO_2 rather than fossil carbon for other applications. In the chemical industry, captured CO_2 could be used as feedstock, e.g. in the manufacturing of polymers, plastics, solvents, paints, detergents, cosmetics, and pharmaceuticals. The annual carbon demand for the chemical sector alone is currently estimated around 125 million tonnes, or about 450 million tonnes CO_2 equivalent, more than 90% of which is supplied with fossil carbon.[43] Given that the chemical production could potentially double at global level by 2050[43], it is crucial to promote sustainable carbon cycles and incentivise the use of sustainable sources of recycled, biobased and captured CO_2 to significantly decrease the reliance of the chemical industry on fossil feedstocks. Consideration needs to be given that certain uses of carbon-based fuels, such as in aviation and maritime, do not allow for carbon recycling. Accordingly, there may be a need to focus on the use of sustainable sources of carbon in those sectors or to extend the possibility to use fossil-based carbon for the production of renewable and low-carbon fuels.

To play a significant role in the EU economy, CCU requires a framework that can track the source, transport and use of several hundred million tonnes of CO2. It should ensure environmental integrity, including by establishing liabilities for CO2 leakage, **and create a price incentive that matches exactly the climate benefit that a solution brings along the carbon management value chain**.

To provide such an efficient and effective incentive, the framework needs to build on a robust accounting system that gives every actor in the value chain a clear and direct incentive for its action that is not dependent on the actions of other upstream or downstream actors. Among the

41 Directive (EU) 2018/2001 and Commission Delegated Regulation (EU) 2023/1185
42 Article 3c(6) of Directive 2003/87/EC.
43 To be added.

range of issues for the July 2026 review of the EU ETS, it will assess whether the accounting in the EU ETS ensures that all emissions are accounted, and double counting is effectively avoided when CO_2 captured is used in products that are not considered as permanent in an ETS context. It will consider whether the CO_2 potentially released from non-permanent CCU products and fuels should be accounted at the actual point of emission to the atmosphere ('downstream accounting') or when the CO_2 has been initially captured ('upstream accounting'). The 2026 review of the EU ETS will also assess the feasibility of including municipal waste incineration installations in the EU ETS, including with a view to their inclusion from 2028, and of including other waste management processes, in particular landfills. The recognition of non-permanent CCU as pathway to reduce surrender obligations would be facilitated if these sectors were included in the EU ETS, as it could allow pricing emissions downstream because the majority of end-of-life emissions would be covered by the ETS.

Building on the EU ambition set out in the Sustainable Carbon Cycles Communication[44] to achieve 20% of the carbon used in the chemical and plastic products originating from sustainable non-fossil sources by 2030, clear objectives should be set in relevant legislation to encourage the chemical industry to develop production routes substituting fossil carbon with sustainable carbon.

The achievement of these objectives will require support for innovative technologies that capture CO_2 from the atmosphere or from industrial waste streams and turns it from a pollutant into a valuable resource that can be converted with renewable energy to all sorts of sustainable products, including fuels, chemicals, mineral materials or proteins.

Such support should be available for any level of technological readiness. It should rely on the Horizon Europe programme for exploratory research, the European Innovation Council for CCU applications that have already achieved a certain level of maturity and the ETS Innovation Fund for pre-commercial projects with potential for scale-up.

The Commission will:

- *Consider options for higher uptake of sustainable carbon as a resource in industrial sectors [GROW to complement];*
- *Establish a coherent framework for the accounting of all industrial carbon management activities that accurately reflects the climate benefits along their value chains.*

5. Investing and funding the clean carbon transition

Fit-for-purpose regulation covering all elements of the value chain is needed to create regulatory certainty for investors and underpin the business case. The investments from the industry to meet the Net Zero Industry Act target of 50 million tonnes of annual CO_2 storage capacity by 2030 is

[44] COM(2021) 800 Final (link).

estimated at approximately €3bn, depending on the locations[45]. Moreover, a JRC paper[46] estimates that the investment cost in transport infrastructure associated with the NZIA amounts to approximately €10bn. This compares to estimations that a theoretical market potential of captured CO_2 in the EU of between 360 and 790 million tonnes of CO_2 could lead to a potential total economic value of the future CO_2 value chain in the EU between €45bn and €100bn, contributing to the creation of up to 170.000 net-zero jobs[47].

First-of-a-kind CCS projects are costly and final investment decisions in the sector depend i.a. on the ability to combine public and private finance. Today bridging grant funding mechanisms, including but not limited to the ETS Innovation Fund, are necessary to get large-scale deployment of CO_2 capture capacity to long-term profitability. Co-ordination between such projects and other stakeholders, in particular energy transport operators is needed to facilitate concerted FIDs.

To bring first innovative large-scale projects to market and reduce the costs for the next wave, the ETS Innovation Fund has been the Union's main funding instrument to support the decarbonisation of industrial processes. The support from the EU ETS Directive through this avenue to date for 28 large- and small-scale CCS and CCU projects amounts to almost EUR 3.3 billion in grants. CEF Energy is the key EU support mechanism for the development of cross-border energy and transport infrastructure projects. So far, CEF has granted around 290 million euros to CO_2 PCIs.

Direct subsidies are not the only mode of support. To close the gap between the carbon price and the cost of Industrial Carbon Management projects, several Member States have implemented 'Carbon Contract for Difference' (CCfD) where subsidies cover the difference between a carbon reference price and an agreed 'strike price' representing the project's true costs[48]. This method of support provides a predictable revenue stream for project developers and is a good solution to de-risk investment.

To move beyond initial stage with large-scale Net Zero Strategic Projects, the incentive of the EU ETS will be key to make CCS projects commercially viable, considering the cost of capture, transport and storage of CO_2 on the one hand and the price of emitting the same amount of CO_2 on the other hand.

According to the JRC, the capture costs from point sources can range between 13€/t and 103 €/t of CO_2 depending on the industry, capture technology and CO_2 concentration.[49] A report prepared by the CCUS Forum estimates a funding shortfall for the currently announced CCS

[45] SWD(2023) 68 final, Staff Working Document "Investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity".
46 Ref.
47 SWD(2023) 219 final, Staff Working Document for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act).
48 [Ref needed].
[49] JRC CETO CCS 2023 report: https://setis.ec.europa.eu/carbon-capture-utilisation-and-storage-european-union-0_en.

projects amounting to a cumulative €10bn by 2030[50]. However, beyond 2030 and despite increasing investment needs, the report expects that a path towards a commercially viable market will begin, where investors could earn a competitive return on invested capital based on the ETS carbon price.

This process can be accelerated in the single market with joint support mechanisms that enable countries of the EEA to use their national budget resources to award support to projects located on their territory while relying on an EU-wide auction mechanism to identify the most competitive projects. Such a first competitive bidding mechanism is being pioneered under the ETS Innovation Fund's pilot auction for renewable hydrogen production in the EU[51]. To participate in such joint support mechanisms, interested countries must follow the State aid notification process.

The Commission will

- *Develop and launch jointly with Member States a cross-border CO_2 transport infrastructure call under CEF funding for IPCEI and PCI/PMI. To start the process as soon as possible, use the existing CCUS Forum platform to ensure good coordination, set the timing, monitor progress and keep the pace of the project. Consider establishing a dedicated high-level platform to work beyond 2030;*

- *Assess whether certain CO_2 capture installations, such as in cement or lime production, are mature enough to move from project-based grant support, to market-based funding mechanism such as competitive bidding auctions as a service under the EU ETS' Innovation Fund.*

- *Looking forward, assess investment needs for future public funding for industrial carbon management [in view of the further development of the Innovation Fund, the CEF and Horizon Europe]*

6. Public awareness

As the industrial carbon management infrastructure projects are necessary for getting to net-zero and will need public funding at least in the initial deployment phase, **it is essential that Member States stimulate and support an inclusive, scientifically informed, and transparent debate on all the industrial carbon management technologies**. The engagement of public authorities and project developers should take place before, during and after the policymaking and project implementation. To avoid one-way dissemination of information, it is essential to **involve all stakeholders proactively**.

[50] A Vision for Carbon Capture, Utilisation and Storage in the EU prepared for the European Union's CCUS Forum by the CCUS Vision Working Group, April 2023.
[51] https://climate.ec.europa.eu/eu-action/eu-funding-climate-action/innovation-fund/competitive-bidding_en#overview.

Based on their identified decarbonisation pathways, **Member States should engage all the relevant stakeholders working towards national industrial carbon management strategies**. In addition to stimulating a national debate on industrial carbon management in the context of climate targets, such discussions should also present the economic rationale behind supporting the technology and its application, the resulting opportunities but also costs, safety concerns and risks, and regulatory actions addressing these.

The Commission will use the **CCUS Forum** and other Commission fora including the **European Sustainable Energy Week to stimulate public debate and increase public awareness** on Industrial Carbon Management. It will also **support public debate** at national and local levels with data and experience from projects it supports, including under the Innovation Fund and the Trans-European Energy Networks.

The **Knowledge Sharing Network** established to enhance the deployment of EU-funded projects will include a component of public awareness. Its objective will be to share lessons learned on public engagement and best practice between project developers, local and national authorities.

The Commission will monitor public opinion on industrial carbon management, including through **Eurobarometer surveys,** and will encourage Member States to measure public awareness at national level. EU research funding programmes on carbon management will include topics **on public perception**.

The Commission will

- *work with Member States to elaborate operating conditions for CO_2 transport and storage projects that can reward local communities for hosting them.*
- *work with Member States to increase knowledge on industrial carbon management.*

7. Research and innovation

Research and innovation investments lead to significant cost reductions. Stakeholders highlight a clear potential for innovation to drive efficiency and cost reductions and enhance integration. The Commission will continue to invest in R&I for all industrial carbon management technologies, including new solutions, to increase the availability of technologies on the market (such as DAC), as well meeting mid- and long-term targets.

Pre-normative research based on open data can contribute to standardisation. For example, a complete picture for physical and chemical behaviour of impure CO_2 is not available. Fundamental research will therefore be needed, and concepts for tracking or monitoring of all relevant impurities must be developed. In cases such as this, access to readily available and open data is necessary for research to support components for standardisation and help to avoid overly strict limitations.

As a growing number of CCUS projects are on track to become operational before 2030, there is a great value in aggregating these industrial-scale projects into a knowledge sharing platform to facilitate the collection and sharing of information and best practices on and between CCUS projects in the EU. The ETS Innovation Fund has already started this work with the projects that have received grant. The focus of the knowledge sharing currently is on lessons learned on how to reach final investment decisions, including matching capture and storage volumes, permitting and addressing inter-value chain risks. In the future, knowledge sharing will encompass capture technologies, transport and storage infrastructure, storage site characteristics, regulatory aspects, needs for standards, access to funding, and stakeholder management. The platform will be open to all projects that are ready to share information and cooperate without disclosing commercially sensitive information and in full respect of single market competition rules.

The lessons learnt from the industrial projects should feed back into national and European programmes for research and innovation to close knowledge gaps and accelerate the development of new technologies.

The Commission will:

- *support a new collaboration and knowledge sharing platform for industrial CCUS projects.*
- *continue to invest in R&I for all industrial carbon management technologies, including pre-normative research to contribute to standardisation.*

8. Cross-border and international co-operation

The successful deployment of scalable industrial carbon management systems will be also important for our global partners, and indeed critical for meeting the goals of the Paris Agreement. The business opportunities for EU industries are thus on a global level. Cooperation with other frontrunner countries aimed at having them price carbon and reducing costs of the value chains will also provide opportunities to speed up the GHG emission reductions world-wide.

For Member States of the European Economic Area (EEA), the implemented EU legal framework serves as the relevant "arrangement" between the Parties in the meaning of Art. 6(2) of the international 1996 Protocol to the Convention on the Prevention of Maritime Pollution by Dumping of Waste and Other Matter, 1972 ("London protocol"). Accordingly, any operator of CO_2 transport networks and/or CO_2 storage sites enjoys the full benefit of the EU existing legal framework to import, or export captured CO_2 within the EEA. Any international cross-border transfers of CO_2 for storage in third countries that follows the same logic of storing anthropogenic CO_2 in permanently secured and environmentally safe storage sites could be welcome, provided that the storage is not used for enhanced hydrocarbon recovery and to the extent that this leads to an overall reduction of emissions.

For the time being the only way of extending such benefits would be to operate storage sites under an ETS that is linked with the EEA ETS – by agreement pursuant to Article 25 of Directive 2003/87/EC – and under a framework that offers legal safeguards equivalent to those of the EU's CCS Directive. A potential future recognition of third country storage sites in countries without a linked ETS, would also depend on equivalent conditions for ensuring permanently secure and environmentally safe geological storage of captured CO_2.

The Paris Agreement requires parties to measure and report progress towards their GHG emissions reduction targets, and to account for their nationally determined contribution. This includes the reporting of carbon removals by sinks and other carbon management activities. In this context, emissions and removals must be counted and claimed only once and by one party, thus avoiding double counting.

The reporting of industrial carbon management activities in GHG inventories is a key topics that needs to be addressed. Particular attention should be given to international value chains where the CO_2 is captured, transported, stored or used in different countries.

This includes imported CCU-based fuels used in the EU as well as international carbon removal value chains, for instance in the case of BioCCS or DACCS activities. The role of the IPCC in providing clear guidelines and methodologies to properly report all type of CCS, CCU and industrial carbon removal activities in UNFCC GHG inventories is essential.

Moreover, international collaboration beyond the EU borders will be necessary to maximise the potential of industrial carbon management in mitigating CO_2 emissions on a global scale. In particular, developing a common understanding on how to ensure the permanent storage of CO_2 away from the atmosphere geologically or in durable products could help accelerating and scaling up projects, and making them more economically viable and efficient.

The EU should contribute to international exchanges and workshops with industry, academia, and government on industrial carbon management, to enable EU companies to operate on third countries' markets. While ensuring that third country markets remain open for the access of EU industry and technologies, notably public procurement markets, the EU should also avoid creating strong dependences on third-party key technologies.

The G7 confirmed that the immediate, sustained, and rapid reduction of GHG emissions remains a key priority. However, for achieving net zero targets, the deployment of carbon removal processes with robust social and environmental safeguards, such as strengthening natural sinks, BioCCS and DACCS, have an essential role to play in counterbalancing residual emissions from sectors that are unlikely to achieve full decarbonization. The G7 also recognized that "*CCU/carbon recycling and that CCS can be an important part of a broad portfolio of decarbonization solutions to achieve net-zero emissions by 2050*".

The Commission will work to ensure:

- *Acceleration of international cooperation to promote harmonization of reporting and accounting of carbon management activities, to ensure they are appropriately accounted*

within the UNFCCC transparency framework.

- *that international carbon pricing frameworks focus on the necessary emissions cuts while providing for removals to address emissions in the hard to abate sectors*

9. Conclusions

To reach climate neutrality by 2050 and to provide industry with all means to reach the 2040 ambition [as set out in the 2040 Communication], the EU needs to develop a common and comprehensive policy framework that address all aspects of an industrial carbon management.

The technological solutions to capture CO_2 are available, but need to be deployed at industrial scale, both in industry but also to start removing CO_2 from the atmosphere.

Theoretical geological storage possibilities have been mapped in many Member States, but these sites now need be turned into bankable CO_2 storage capacities. This requires not only investments, but also a broad public understanding that storing CO_2 underground can be a reliable climate solution and a profitable business case. It also requires CO_2 transport infrastructure to be put in place.

Captured CO_2 is a valuable commodity. Its use should be boosted in manufacturing processes in particular for chemicals and plastics that today rely on crude oil and natural gas.

To establish an ambitious industrial carbon management in the EU, support is needed for projects that deploy these technologies and share knowledge. Member States and the Commission need to work together to develop and put in place the necessary policy framework that will increase certainty for investors, while engaging local communities in areas where geological CO_2 storage possibilities could be used as a decarbonisation solution. The conditions for any such solutions will be to produce real and quantifiable environmental benefits.