ENTSOG Feedback to Call for Evidence on
Legislative initiative on CO_2 Markets and Transportation Infrastructure

ENTSOG welcomes the development of a new legislative initiative for EU CO_2 Markets and Transportation Infrastructure. ENTSOG also supports the EU Grid Package, enabling CO_2 infrastructure alongside CH_4, H2, biogases and electrons. This integrated approach to EU networks addresses investment barriers, noting that delays in infrastructure development could undermine the cost-efficiency of the energy transition.

The revision of the TEN-E regulation could better align with the CCS Directive and support strategic, EU-wide planning for cross-border CO_2 transport and CCS . While early projects may operate independently, EU coordination will be vital to integrate them into a trans-European CO_2 network. ENTSOG, experienced in gas and H2 infrastructure, is well-positioned to support this, especially in supporting PCI/PMI selection for CO_2. The TEN-E regulation includes CO_2 networks as PCI-eligible, supporting CCS by enabling CO_2 transport to storage sites. A revision would integrate CO_2 infrastructure into planning mechanisms such as TYNDP and support PCI/PMI project selection.

Coordinated planning, including building synergies across electricity, gas, H2 and CO_2 networks, enables cost savings, environmental benefits, and system efficiency. There are indications from some areas in the EU that re-using existing assets could support the development of efficient CO_2 infrastructure. Nevertheless, building new pipelines will also be necessary. Network operators bring valuable experience in planning, stakeholder coordination, and technical evaluation, making them well-suited to manage future CO_2 networks.

Investors require stable revenue streams for CO_2 infrastructure. Emitters require long-term offtake guarantees but face short-term volume uncertainty. ETS carbon pricing is insufficient and volatile. EU and national support mechanisms (e.g., CfDs, tax incentives, grants and long-term guarantees) are essential to launch CCUS. Long-term financial certainty is essential. Member States must implement de-risking measures, as done for H2. The ICM Forum WG 'CO_2 Infrastructure' recommends adapting funding to avoid the 'chicken and egg' dilemma. Network operators need guarantees to build appropriately sized infrastructure, and early mover costs should be recovered via guaranteed revenue streams or dedicated funds.

CO_2 can be transported in various forms, and the one chosen depends on the required transport capacity, distance to be covered, possible locations for purification, applicable regulations and possibility to repurpose existing assets and its economic considerations.

Minimum technical and market requirements are needed to ensure safe, harmonised CO_2 transport and storage, including cross-border flows and asset interoperability. As CO_2 transport

resembles regulated gas transmission, EU-wide rules like an Interoperability Network Code are essential to support shared infrastructure and a European CO_2 network linking potential emitters and sinks. In this respect, a full cost recovery to operators and TPA regime should be introduced.

Safe transport of impure CO_2 is possible, but blending streams from diverse emitters must not compromise pipeline integrity. Further research is needed on the physical and chemical behaviour of impure CO_2. Purification must meet the requirements of the next transport mode, and CO_2 quality standards should take into account safety and economic efficiency. A minimum EU-wide standard should apply, with flexibility for Member States to adapt based on national circumstances. Diverging technical specifications should not restrict cross-border flows. EU rules and coordination are key to avoiding market fragmentation.

Safety must be the top priority for CO_2 pipelines, as it is for gas and H2. Gas TSOs, as prudent and experienced operators, have preventive measures in place to preserve pipeline integrity and ensure the high-pressure system safety. Correspondent measures should also be in place for CO_2.

Explanatory note accompanying ENTSOG's feedback to the Call for Evidence on the Legislative initiative on CO_2 Markets and Transportation Infrastructure

ENTSOG submits this explanatory note to provide more details to the Call for Evidence. Please, kindly note that this document reflects current status of thinking based on best available information.

Certain answers and approaches may be refined at later stage (*e.g. expected public consultation on CO_2 Markets and Transportation Infrastructure*). This note status dates as of September 2025.

1. Network Planning

Integrated and coordinated planning

CO_2 infrastructure could be integrated in Ten-Year Network Development Plans (TYNDP) and national Network Development Plans (NDP) reserving specific, well-identified chapters which would however be consistent with other gas infrastructure developments. Onshore and offshore cross-border CO_2 transport planning needs to be aligned and CO_2 offshore development plan volumes would be useful. The following overlapping data points will be helpful for mapping CO_2 infrastructure:

- Existing pipelines available for repurposing.
- Optimal integration of potentially needed new pipelines (co-existence with other assets, harvesting the existing Right-Of-Way)
- CO_2 emitters mapping (locations, volumes)
- Potential CO_2 users
- Blue hydrogen production locations as "bridges" between gas, H2 and CO_2 networks
- Locations for CO_2 capturing
- Expected orders of magnitude
- Usage of geological formations (e.g. depleted field already connected through pipes)

Transport options like shipping could be included in the planning as possible complementary or alternative solutions to CO_2 transmission.

2. **Market**

Stable revenue streams for investors to build business cases are needed. Emitters need long-term CO_2 offtake guarantees but may not be able to give certainty on their emitted CO_2 volumes in the short term. However, transport and storage infrastructure investors also need long-term commitments, taking into account increasing volumes as carbon capture capacity ramps up. Costs which cannot directly be gathered via (initial) users shall be recovered through other guaranteed revenue streams.

Carbon pricing as determined by the ETS is one of the key mechanisms that make investments in industrial decarbonization profitable. However, the impact of this mechanism is currently inadequate for CCUS for two main reasons. Firstly, the price is and will remain for the foreseeable future too low for emitters to be able to take Final Investment Decision (FID) for CCUS projects. Secondly, the price is highly volatile. It has increased fivefold between 2020 and 2023 but has since nearly halved again. This poses a risk factor for CCUS projects, even if the carbon price reaches the level needed to justify such an investment decision. In addition, even if CCUS becomes 'in the market' due to adequate carbon pricing, the ability for Europe's industry to pass on the high additional costs for CCUS will remain unsure in a global, highly competitive market. OPEX & CAPEX based support mechanisms for industry such as well-designed Contracts for Differences (CFDs), tax credits, etc. will therefore be crucial to kickstart industrial CCUS. In addition, to ensure a fair and not discriminatory access to CO2 infrastructures, a third-party access (TPA) principle has to be introduced. The choice between regulated (rTPA) or negotiated TPA (nTPA) could be based on the market structure and other circumstances, such as national CO2 industry development stages and availability of transport/storage assets.

CCUS and its benefits are crucial for the European industry and for preserving its industrial base here, as well as safeguarding European autonomy and independence, thus accelerating EU's energy transition. The removal of free ETS allowances for certain energy intensive sectors covered by the CBAM (steel, iron, cement, fertilizers) creates an incentive for these companies to sign long-term CO_2 transport and storage agreements. But until at least 2034, when all free allowances are phased out, they will not have a sufficient financial incentive to sign such agreements - buying ETS allowances could be cheaper than decarbonising. However, this could be true primarily for a short- to medium-term business outlook, and when the necessary support mechanisms are not effectively implemented. Furthermore, it is today uncertain exactly when the ETS price will cover the cost of the CCS value chain for energy intensive industry that falls within CBAM sectors and will need CCS. There is also an increasing risk of carbon leakage, since CBAM does not yet cover all sectors, nor manufactured products.
Other industries that will need CCS to decarbonise, for example chemicals which do not yet fall within the CBAM and may retain free allowances for an unspecified period, create a further level of uncertainty.

3. De-Risking and Public Funding Mechanisms for Ramp-up Phase

To enable TSOs to invest in CO_2 grids (which will require very important investments that will need to be amortized over a long period and require many years to be in place, especially in case of new pipelines) they will need an appropriate level of financial certainty to raise and invest the necessary funds. Transport and storage infrastructure investors need long term offtake commitments or other forms of guarantees.
Thus, at present, there is a lack of clarity when EU industry will have sufficient incentive to sign long-term CO_2 transport and storage agreements. However, to build the grids needed for these companies to decarbonize, which will be needed towards the end of this decade and onwards, investment needs to start today.
This represents a major barrier to investment in CO_2 grids by TSOs. If action is not taken by the EU and Member States to resolve this, there is every chance that no 'fit-for-purpose' CO_2 grid will be in place by the time that it is needed by EU industry to decarbonize. Energy intensive companies will not sign transport and storage agreements until the mid-2030s, when they are fully exposed to the ETS, and until this happens, TSOs will not have the financial guarantees necessary to raise the capital to build the grid.
In order to bridge this gap, and enable the TSOs to progressively build the CO_2 grid (which will need to be designed on a cautious 'no-regrets' basis - for example using a TYNDP approach - to ensure that the size and location is 'fit-for-purpose'), initial start-up de-risking measures will need to be put into place by the EU/Member States. This situation is parallel to that which is taking place regarding the development of the EU's hydrogen grid, which shares the same mutual dependency financing problem.

One of key findings and recommendations stemming from the report of the ICM Forum WG CO_2 Infrastructure states that : "*All relevant EU and national funding programmes should be adapted to maximise their potential to fund CO_2 infrastructure projects and to avoid 'chicken and egg' challenges along the value chain*".

Potential transportation system operators for their parts cannot compensate for this lack of business cases and are facing a severe default risk, which impede financing via capital markets. Existing support schemes like CfD cannot make up for this risk, covering the whole lifetime of CO_2-pipelines (estimated > 30 years). Therefore, additional instruments for risk mitigation and initial funding are required. It has to be addressed how to best provide guarantees to transport and storage operators to build infrastructure with an optimal size (i.e. to stimulate initial overcapacity). This shall take into account future higher utilisation rates.

Costs which cannot directly be gathered via (initial) users shall be recovered through other guaranteed revenues streams for early mover projects e.g. also via the set-up of dedicated Funds backed by the overall energy system or by a Member state(s).
Three potential mechanisms have been identified in relation to the development of the EU's hydrogen grid, which will also need to be applied for CO_2:

- Contracts for difference (CfDs), where Member States guarantee to energy intensive industry to cover any difference between their cost of decarbonization (including the CO2 transport and storage costs) and an agreed minimum carbon price over a defined period. Where the ETS cost equals or exceeds this price, no payment is required. This enables such companies to sign long-term CO_2 transport and storage agreements with network investors at an earlier stage, providing sufficient guarantees to enable TSOs to finance the grid.

- State grants to finance the initial development stage of the grid, which has occurred for example in Belgium and the Netherlands regarding hydrogen.

- State guarantees that a TSOs' investment in an agreed grid will be financially viable over their defined lifetime, as has been in Germany regarding hydrogen.

- Economic regulation ensuring the full cost recovery for CO2 infrastructure operators (examples already introduced in UK and under definition in other context such as France and Italy).

Such de-risking mechanisms will be needed if the EU is to have a fit-for-purpose CO_2 grid in place within a time-frame compatible with its decarbonization objectives.
It is important that the EC takes the lead in underlining the importance that such mechanisms are rapidly put in place. Grants under the CEF will be important, and there are solid grounds to justify the EC's reasoning should it replicate its successful actions under the Hydrogen Bank to equally kick-start the decarbonisation of energy intensive industry using a similar mechanism for carbon contracts for differences.

4. Technical Aspects and Standards

As a general principle, a set of minimum requirements to ensure a safe and harmonised CO_2 storage and transport, including cross-border flows or usability of interconnected assets will be required.
As example, the hydrogen and decarbonised gas package recently adopted has established the processes to solve possible restrictions to cross-border flows due to gas or hydrogen quality differences at interconnection points between Member States (respectively Article 21 and

Article 55 of the Regulation). These kinds of provisions could be in place for CO_2 to solve possible restrictions to CO_2 flows withing regions due to quality differences.
Additionally, as CO_2 transportation activities are similar to regulated natural gas transmission activities, EU-wide rules like the Interoperability Network Code (INT NC) should be put in place. Distinct options on how to set up operational rules may arise for CO_2 cross-border flows with different operators. As such, a common EU-wide set of rules would therefore be key to support the operation of shared infrastructure and a European-wide network linking potential emitters and sinks. Such a Network Code should cover principles on the following topics:

- The establishment of Interconnection agreements and rules on how should adjacent operators coordinate flows at their borders.
- A harmonised units system.
- CO_2 quality parameters - coordination between adjacent MSs will be needed for cross-border issues related to CO_2 quality differences.
- Data Exchange.

Where nTPA is the chosen approach for any given piece of infrastructure, it should be up to the involved parties to agree on interoperability rules whilst complying with a set of minimum requirements.

Standards
Circumstances in different Member States or regions are distinct and may need to be addressed differently to present the most effective and efficient solutions.
For the transport of CO_2, a minimum quality standardisation should be given to be complied with by Member States. Beyond that, MSs could be given the option to adapt the CO_2 requirements to their own circumstances as considered relevant and existing national standards for CO_2 composition[1] should remain an option. The type, number, or location of CO_2 emitters will be different from Member State to Member State. This will impact the CO_2 quality transported in each region. Additionally, pipelines which could be repurposed may also present different characteristics due to a diversity of original designs. In any case, diverging technical specifications, including CO_2 quality parameters should not be a cause to restrict CO_2 cross-border flows and EU rules as mentioned above would solve issues raised. It should be noted that Member States' coordination should be key to avoid market fragmentation.
It would be useful to have harmonised standards and technical specifications in place, e.g., for the design of pipelines, valves, and other parts of the value chain. However, assessment of these standardisation requirements is needed.

[1] Example Germany: CO_2 composition in dense phase according to DVGW C260

Some base-line standards will need to be agreed to facilitate the development of regional grids and eventually a possible EU network, in order to prevent barriers and reduce costs. A similar exercise such as the one developed by the European Clean Hydrogen Alliance (ECHA) may be needed to map standardisation needs for CO_2 – looking into what standards might be missing. The current ISO TC 265 has issued voluntary standards for CO_2 capture, transportation, and geological storage, and may be a relevant starting point.
Additionally, in CEN, a Technical Committee TC 474 has been established to develop the EU standardization framework for CO2[2]. One of the goals of the group is to develop a EN standard on CO_2 quality based on the German standard DVGW G 260 (A): Quality of Carbon Dioxide and Carbon Dioxide Streams.

Safety & CO_2 leaks

Safety should be a number one priority for the transportation of CO_2 by pipelines, just as safety is the highest priority in the transportation of natural gas and hydrogen. Specificities like CO_2 being heavier than air require application of distinct measures in case of a potential leak. Gas TSOs as prudent and experienced operators have preventive measures in place to preserve pipelines integrity and ensure the high-pressure system safety. Corresponding measures should also be in place for CO_2. Additionally, TSOs continuously monitor their systems for potential leaks in an efficient manner that could be put in place also for CO_2.

Cross-border cooperation

In the gas system, TSOs exchange information and coordinate actions related to their activities. Similarly, for CO_2 transport, there will be the need to cooperate regionally to ensure the development of the network as well as its safety and availability, depending on the maturity of the system. However, a careful approach may be needed not to burden the initial steps of development of CO_2 systems with too strict requisites.

In summary, it is essential to build preparedness in regulation, markets, and processes, so as to avoid blocking CCUS, which constitutes a vital piece towards the achievement of environmental targets in Europe and in the World

[2] https://www.cencenelec.eu/news-and-events/news/2024/brief-news/2023-02-20-ccus/

Editorial notes

> **The European Network of Transmission System Operators for Gas (ENTSOG)** was founded in line with Regulation (EC) 715/2009 and has played a key role in facilitating integration of the European gas markets, ensuring technical interoperability and providing security of supply by gas infrastructure planning. Looking forward, ENTSOG is contributing to the net-zero decarbonisation by 2050, in particular, by the integration of renewable and low carbon gases via future-proof gas transmission pipelines, in line with the EU energy and climate goals. More information on ENTSOG can be found on our website – www.entsog.eu or contact info@entsog.eu.