

Information Memorandum for CO₂ infrastructure



Fluxys Belgium

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Disclaimer

This document sets forth information regarding the transportation for CO₂ which might be offered as a solution to reduce CO₂-emissions in Belgium by capturing, collecting and transporting them towards their users or storage sites (sequestration). The information contained in this document reflects the point of view of Fluxys at this stage and is publicly disclosed for information purposes only and without any commitment whatsoever from Fluxys. This document should not be considered to give rise to any contractual relationship between Fluxys and any interested party.

1 CO₂ infrastructure, part of the solutions towards decarbonisation

The purpose of this document is to inform the market about Fluxys' ongoing developments of CO₂ infrastructure in Belgium. Fluxys invites parties to work towards the goal of carbon neutrality by participating to the market consultation (RFI – Request for Information), by participating in feasibility studies or by expressing their interest for specific infrastructure proposals.

1.1 Clear target to decarbonize

The **Green Deal for Europe** has set forward strong targets for the reduction in greenhouse-gas emissions to a minimum of -55% by 2030, and to be fully carbon neutral by 2050. As the 2050 projections by the European Commission indicate, a net-zero emissions energy system will probably be based on about 50% carbon-neutral electricity and about 50% carbon-neutral molecules such as hydrogen (H₂), biomethane, synthetic methane and other bio- and e-fuels. This means electrification with green power where possible and clean molecules where it is the greenest, most efficient clean alternative.

Carbon emissions in Belgium originate for almost 40%¹ from industry, either through energy

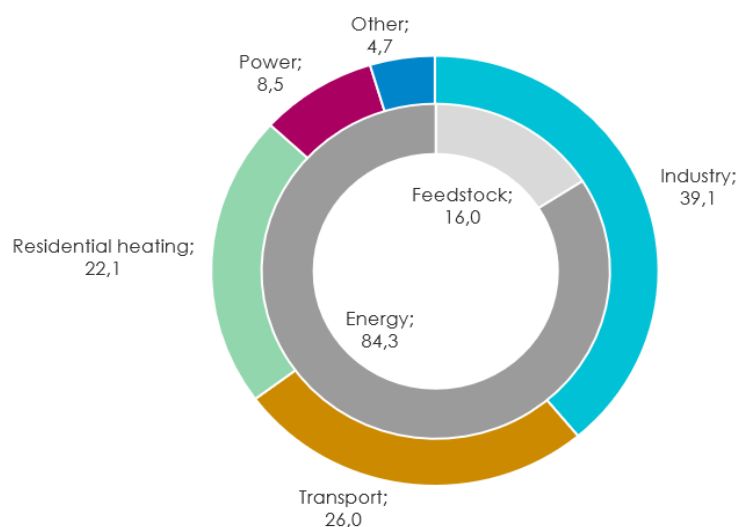


Figure 1 Carbon Emissions Belgium 2019

use or process emissions, and for around 10% from power production (Figure 1).

To limit climate warming below 2 degrees, **carbon capture needs to be deployed at scale where it is the most mature decarbonisation pathway from a cost and technology readiness perspective.** Where carbon emissions (CO₂) can't be avoided, they have to be captured. Some

sectors such as the steel, cement and lime industries generate carbon emissions as these are a by-product of the industrial process itself. Captured carbon can be re-used in products such as polymers or steel, or in the production of e-fuels (such as synthetic methane, methanol and e-kerosene). If carbon re-use is not possible, it has to be stored, for example in empty oil or gas fields. The technology is called carbon capture and utilization/storage (CCUS) and Fluxys has a key role as provider of the infrastructure needed to move captured carbon to where it is re-used or stored.

¹ www.climat.be – www.klimaat.be

Furthermore, **governments are supporting** the transition with different funding opportunities such as the EU Recovery Plan, CEF, Innovation Fund and others. The energy transition as set forward within the Green Deal, together with government support through funding, creates investment opportunities which must be seized now in order to reach the targets of 2030 and of 2050.

1.2 Fluxys Belgium developing the CO₂ network in line with market needs

Fluxys Belgium ('Fluxys') is a fully independent and neutral gas infrastructure company headquartered in Belgium. . In this regard, the Belgian federal energy regulator has certified Fluxys Belgium as a transmission system operator of the natural gas transmission grid, the storage infrastructure and the LNG terminal infrastructure of Zeebrugge, in accordance with the full ownership unbundling model as per the European third package of legislative measures for the gas market. Fluxys is committed to bring the energy transition forward. The Fluxys assets are an essential complement to electricity infrastructure and serve as a cornerstone for secure, sustainable and affordable energy systems.

Fluxys, as neutral operator, is ready to build the open access gas network of the future. **Fluxys' plan is to progressively reconfigure parts of the natural gas network and build new infrastructure in Belgium to develop complementary systems:**

- for transporting methane (in which biomethane and synthetic methane will increasingly replace natural gas),
- for transporting hydrogen (H₂),
- **for transporting carbon (CO₂),**
- for transporting possibly also other molecules needed for the energy transition

The carbon infrastructure will be created by a combination of repurposing and building new infrastructure and will be offered as market demand evolves. As Fluxys makes complementary systems accommodate captured carbon, it unlocks new solutions for the industry in its efforts to achieve sustainable recovery and growth.

1.3 A cooperative commercial process to assess market needs

Together with the market, Fluxys has started a cooperative commercial process beginning 2021:

Market Consultation - Request For Information

Fluxys organised a webinar on January 26th 2021, which was the starting point for a cooperative commercial process to facilitate the development of infrastructure needed for hydrogen and carbon dioxide in Belgium.

Potential users of the future carbon infrastructure were invited to participate at an informative market consultation and to fill out a Request For Information called "RFI". The

information gathered through the RFI gives a clear overview of how market needs develop geographically and over time, and shows interest for CO₂ infrastructure.

Collect & aggregate through interactions with the market

The process of consolidating and aggregating the results gathered through the Request For Information responses was complemented with bilateral exchanges with the participants, which helped Fluxys to deepen its understanding of the market needs and to address technical aspects as well.

Primary conclusions of the market consultation

The market confirmed its interest and the necessity to have access to a CO₂ grid. The CO₂ volumes and timings, as well as the quality and representativeness of the data provides solid ground to move to the next steps towards developing such CO₂ infrastructure:

- Strong signal from the Belgian industry that CO₂ capture, for storage or usage, is part of the solution to reach the Green Deal targets.
- CO₂ volumes for CCUS application exceed 50% of the 40 mtpa industrial CO₂ emissions in Belgium (Figure 2).
- Demand for CO₂ transportation solutions exists as from 2025, and volumes will grow steadily between 2025 and 2030.

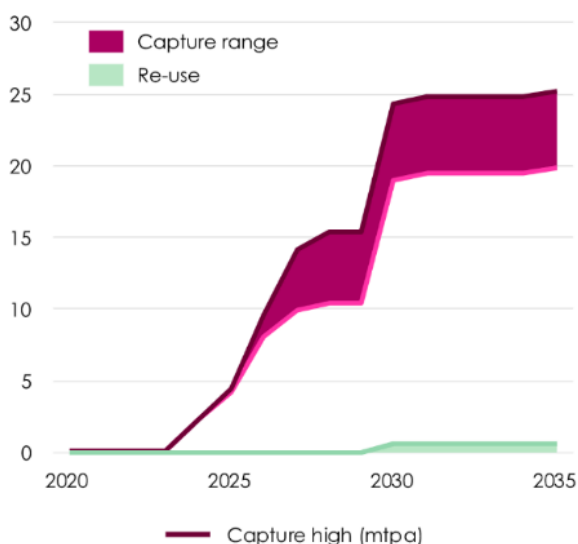


Figure 2 CCSU in Belgium, as indicated in the RFI

As large industrial companies are often in the vicinity of the Fluxys network, repurposing existing infrastructure offers a cost-efficient solution to transport industry's carbon emissions towards their users or storage sites.

It is Fluxys' ambition to have carbon infrastructure operational as from 2025 where industrial activities are dense such as in harbour areas and where CO₂ terminals are being developed. These locations will then drain CO₂ from other areas through a carbon backbone.

Routes of CO₂ transport based on market consultation

Based on the volumes and associated emitter locations introduced during the RFI, Fluxys has worked out multiple **route options towards possible terminal locations** and calculated

an associated tariff for CO₂ transport. The offered routes through pipelines are a competitive transportation solution for CO₂ and help the CCUS projects move forward.

2 Transporting CO₂ in a reliable and efficient way

Gas infrastructure provides **huge capacities** (Figure 3) to transport molecules in a **reliable** and **continuous way**. Gas infrastructure has a reduced CO₂ emission footprint and is very **competitive** in comparison to alternatives. It avoids additional traffic on waterways or busy highways, with lower levels of air emissions and less noise. Pipelines require less space and have no visual impact and fewer incidents.

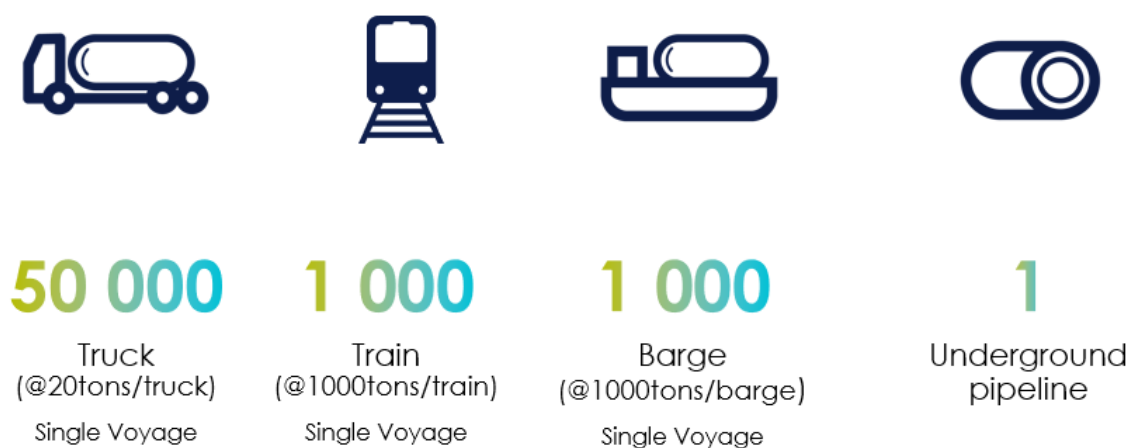


Figure 3 Comparison of the capacity needed to transport 1 MTPA CO₂

If all CO₂ volumes as communicated in the RFI would be transported via road or waterway, this would represent a net increase of almost 11%² of the total freight transport (2020) by road or of 16%³ of the total freight transport (2020) by inland waterway shipping in Belgium.

Pipeline transport of CO₂ is a sustainable way and furthermore avoids the need of a dedicated liquefaction plant at every emitter (since trucks, trains and barges transport CO₂ under its liquid form).

² <https://statbel.fgov.be/nl/themas/mobiliteit/vervoer/goederenvervoer-over-de-weg#news>

³ <https://statbel.fgov.be/nl/nieuws/lichte-stijging-van-de-binnenscheepvaart-2020>

3 Fluxys Belgium contributing across the CO₂ value chain

To transport the CO₂ from the emitters towards the sequestration or utilization sites, several steps are needed (Figure 4):

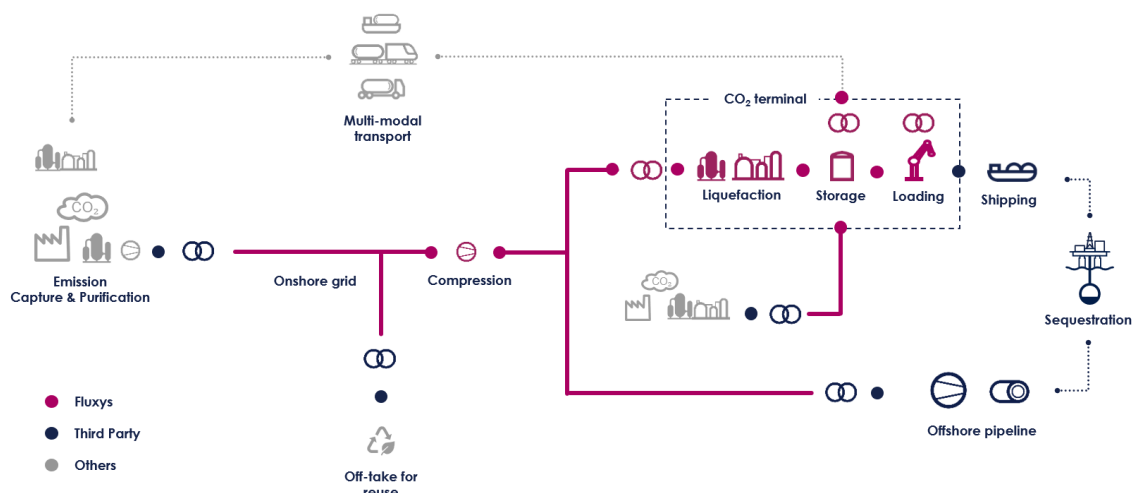


Figure 4 Fluxys across the CO₂ value chain

Capture and purification is done at the **customers'** premises. The used technology will depend on customers' specific needs and processes in order to reach CO₂ specifications fit for transportation including compression up to the minimum required entry pressure.

Transportation through pipelines is offered by Fluxys to bridge the distance from the emitter towards the export terminals or CO₂ users through its partially repurposed network.

In addition to transportation, Fluxys is developing **CO₂ terminals** in which CO₂ will be **liquefied**. The liquid CO₂ is then temporarily **stored** in buffer tanks before being loaded on ships to transport the liquefied CO₂ to the sequestration sites

The **sequestration** of CO₂ and the associated **shipping logistics** with seagoing vessels will be offered by **third parties**.

However, in order to unburden the industry with the coordination of CO₂ transport towards the sequestration sites and let it focus on its core activities, **Fluxys** proposes **to facilitate the logistical chain** from the moment the CO₂ leaves the industrial emitters' plant until it reaches its reuse destination or the sequestration site. To that end Fluxys may act as a facilitator integrating the shipping and sequestration services of the CCUS value chain. Acting as an aggregator of CO₂ volumes allows the different emitters to benefit from the economy of scale for their CO₂ projects.

4 Fluxys Belgium proposing CO₂ transport routes as from the emitter

4.1 Exit Points

The mainland can be connected to the offshore sequestration sites by offshore pipeline or terminals with shipping connections. In Belgium, several CO₂ exit points projects are being developed. Fluxys promotes the following exit points:

- Antwerp@C: an open access CO₂ terminalling infrastructure including liquefaction facilities that will collect captured CO₂ from industrial emitters within the Antwerp port region and possibly from emitters from the hinterland.
- Ghent Carbon Hub: an open access CO₂ terminalling infrastructure including liquefaction and multimodal connections that will collect and transfer captured CO₂ from industrial emitters within the Ghent port area and possibly from emitters from the hinterland.
- Zeebrugge: it is the most suitable location for the development of a connection of the Belgian CO₂ network with an offshore CO₂ pipeline to transport the CO₂ directly and continuously towards sequestration sites in the North Sea (UK, Norway, ...).
- Gaseous pipeline interconnections with the Netherlands in Poppel, Antwerp or Ghent

Other terminal or pipeline export locations always remain possible, as well as border connection points to import CO₂ from for instance France and Germany, and to transport it through Belgium towards the Belgian CO₂ exit locations. The above mentioned exit terminals or onshore & offshore pipelines are well connectable with a CO₂ pipeline grid which is collecting CO₂ in gaseous phase all over Belgium and even beyond, at an attractive tariff and in a reliable and safe manner, with reduced CO₂ footprint.

4.2 Proposed CO₂ Routes

Fluxys has made some simulations to offer a competitive solution to bridge the distance between emitters and potential exit points while taking the actual natural gas grid into consideration with the aim of maximum repurposing. The proposed routes take following into account:

- High density locations of CO₂ emitters in Belgium (Source: climat.be / klimaat.be)
- The data of the RFI market consultation organised by Fluxys in 2021
- The existing high pressure natural gas grid of Fluxys and the potential of repurposing pipelines over time for usage of CO₂ transport
- Potential exit locations, both terminal and pipelines, towards sequestration sites
- The potential future demand for CO₂ in usage applications (CCU) both in Belgium and abroad

Routes options are presented in Figure 5.

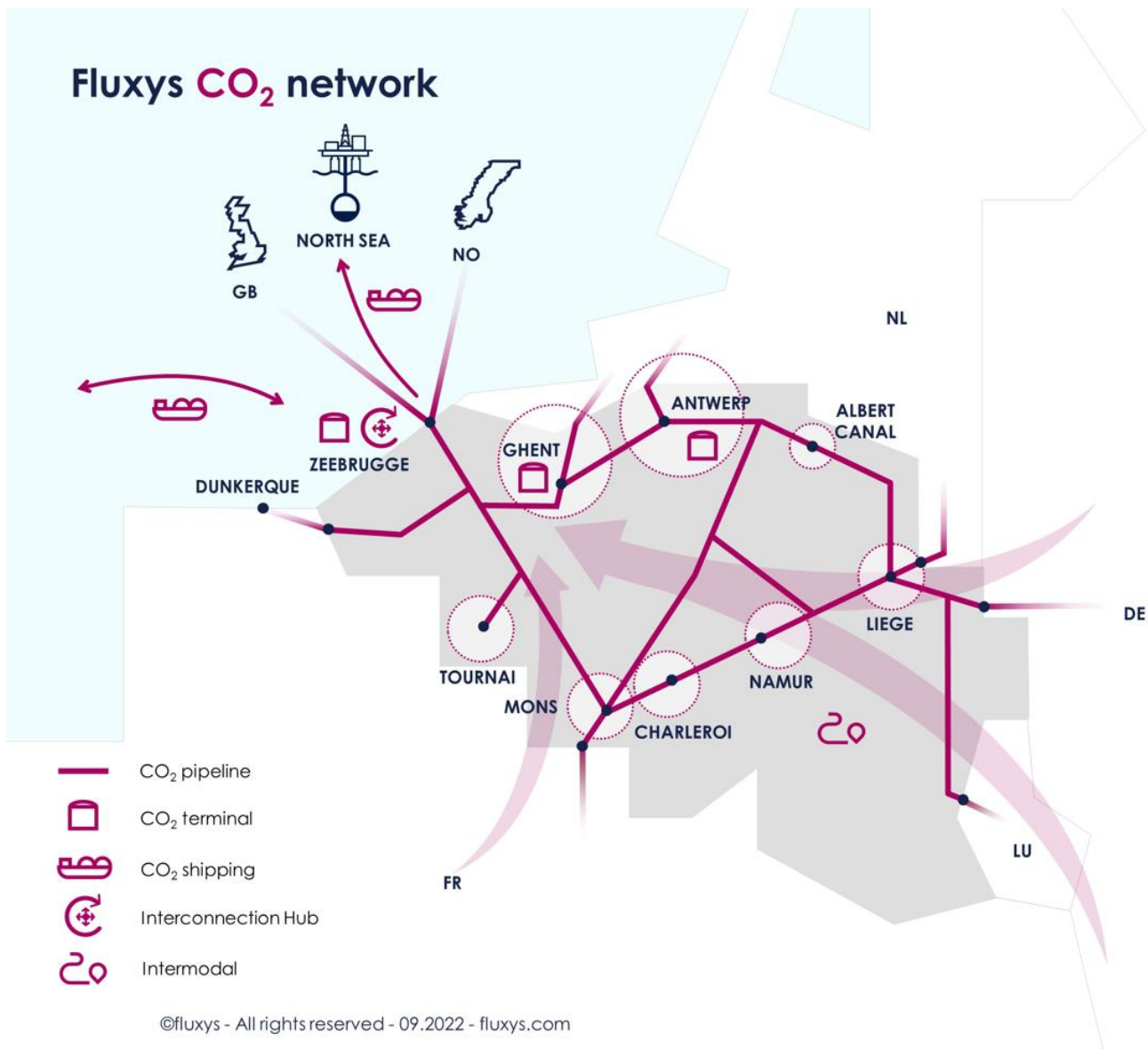


Figure 5 CO₂ routes in Belgium based on 5 pillars

The potential interconnection of these routes to foreign entry points (DE, FR) has been foreseen to offer CO₂ transport infrastructure solutions for emitters located outside the Belgian frontiers.

5 Commercial services

5.1 Key Principles

In order to ensure that the CO₂ infrastructure is developed on a fair basis, Fluxys applies the following principles to its commercial model:

- **Unbundling** of transportation & terminalling services and commodity, and acting as pure infrastructure company,

- **Non-discriminatory open access to the network** to ensure a level playing field for participation in the emerging CO₂ market,
- **Cost-effectiveness** pursued to the maximum extent based on Fluxys' operational pipeline and terminal expertise and with optimal reuse of existing natural gas network for the development of CO₂ network.

5.2 Overview of services

To help the industry tackle the complexity along the CO₂ value chain, Fluxys is willing to play a key role over the different sections of this chain by offering the possibility to move captured carbon from the emitter towards where it is re-used or stored. Therefore, Fluxys intends not only to offer commercial services in transmission and terminalling of CO₂, but also to facilitate the export shipping or pipeline and sequestration.

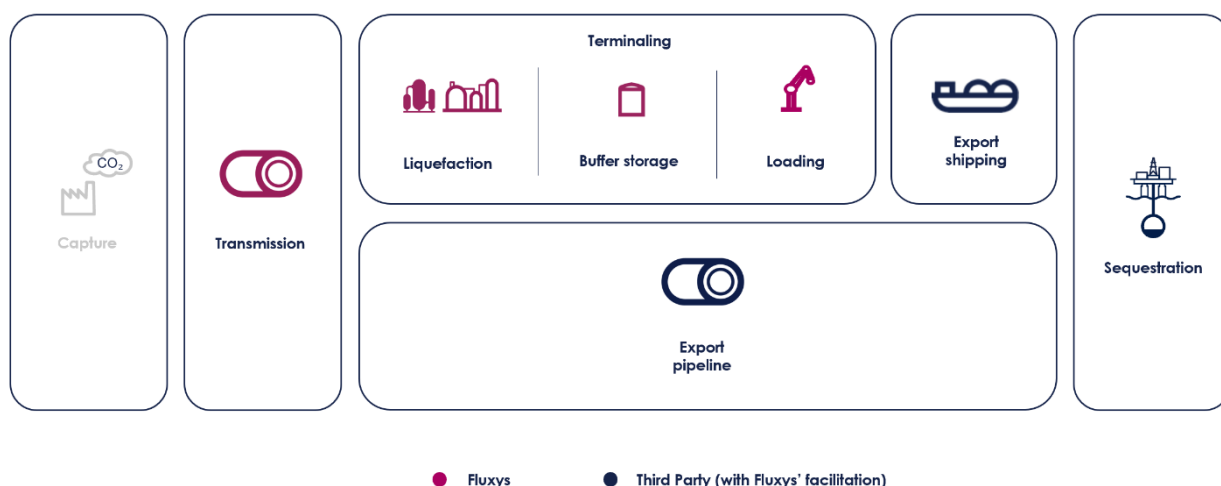


Figure 6 Fluxys' services overview

5.3 Transmission

The services for transmission of CO₂ will be capacity services with long-term subscriptions based on the following principles:

- CO₂ can be continuously injected at any time within the network, within the subscribed capacity,
- The injected CO₂ in the network is taken into custody, transported and then redelivered back to the custody of the customer at the designated exit point,
- The same quantity of CO₂ injected into the network is redelivered exiting the network,
- The CO₂ inflow into the network and outflow from the network is metered in accordance with good industrial practice,
- A balance between CO₂ inflow & outflow is required for a reliable operation of the network,

- The transport services are capacity services offered with ship-or-pay charges, which are not dependent on the actual use ,
- The quality of the injected and redelivered CO₂ must comply with agreed harmonized quality specifications,
- Minimum and maximum pressure and temperature requirements at the injection point are respected in order to guarantee reliable and optimal operation for all users of the network.

Building on these basic principles, Fluxys will establish a transmission tariff for a specific route in a manner to reflect the cost for building and operating the relevant transportation infrastructure based on following principles:

- The tariff will be an annual tariff, assuming a flat injection profile over the year,
- The tariff is distance based for transport between clusters with higher tariffs for higher distances,
- The tariff within a specific cluster is in principle independent of the distance between injection point and exit point within that cluster,
- The tariff within a cluster is specific to that cluster and the associated infrastructure, and can be different between clusters.

All emitters in the same geographical area ("cluster") transporting CO₂ to the same exit point would therefore be subject to the same tariff to transport CO₂ to another cluster in which the exit point(s) are located.

5.4 CO₂ Terminalling

The services for terminalling of CO₂ will be capacity services with long-term subscriptions based on the following principles:

- CO₂ can be continuously injected within the terminal at any time, within the subscribed capacity,
- The CO₂ liquefaction train will only operate when a minimum aggregated inflow of CO₂ by all emitters is injected within the terminal,
- Injected gaseous CO₂ will result in a liquefied CO₂ inventory for each emitter,
- The storage capacity can be time-shared with some or all emitters or remain individual,
- An annual schedule will determine the moments in time at which an emitter is planning (individual storage) or obliged (shared storage) to lift its CO₂,
- The annual schedule will be based on the capacity of each emitter,
- The emitter will have the freedom to make own arrangements for lifting and shipping to the sink, or to use facilitation by Fluxys,
- Inflow into the terminal and outflow through loading on the vessel will be metered in accordance with good industrial practice,
- In the event of delay in lifting of liquid CO₂ inventory, storage capacity rights may be exceeded and the terminal operator could curtail or stop injections to avoid a tank top to guarantee safe and reliable operations.

Terminalling tariffs will differ from terminal to terminal depending amongst others on storage sizing and availability of subsidies.

5.5 Facilitation of Pipeline export (onshore/offshore), Shipping and Sequestration

The facilitation or aggregation service is a service that enables the transportation of CO₂ over the whole CO₂ value chain, as from the moment the CO₂ leaves the customers premises and is injected within the transmission network, until it's final sequestration site. A facilitation or aggregation service is only offered together with transmission and/or terminalling services. The terms and conditions of the respective services with third parties will be passed back to back to the requesting customer.

6 Launching an Open Season to confirm requirements and start building the CO₂ network

An open season is a call for subscriptions allowing transparent and non-discriminatory allocation of access capacity to infrastructures.

To guarantee an efficient development of the CO₂ network and terminalling infrastructures, Fluxys proposes to join forces and to unite the Fluxys' RFI participants and new interested parties through an Open Season based methodology consisting of 3 steps: non-binding Expression of Interest, Bilateral Iterations and Binding Commitment.

Based on market demand and maturity level Fluxys will develop specific infrastructure proposals and address the market, ensuring a level playing field. With growing market maturity in different regions, several Open Seasons will hence be triggered for separate geographical proposals.

A schematic representation of this Open Season process is depicted below.



6.1 Non-binding Expression of Interest

All market players are first invited to participate in the Expression of Interest phase, where they confirm their interest in the proposed CO₂ infrastructure and are interested to exchange on a basic proposal of contractual terms and cost coverage principles. This is a non-binding phase, but a prerequisite to ensure participation through the Binding Commitment.

Following data is requested from the interested parties:

- expected operations start date
- expected date when binding commitment is possible/required
- locations of entry or exit to the CO₂ network
- hourly capacities (peak) and yearly volumes of CO₂ injected in and withdrawn from the CO₂ network or terminal
- load factor and daily/seasonal usage profile
- potential future increases on capacities (peak) and yearly volumes

Above shared information will be treated as confidential in accordance with the Expression of Interest provisions.

A link to the participation form, to enter into Expression of Interest, is available within every specific proposal document and on the Fluxys website. The closure date for the participation (for every specific proposal) will be published on Fluxys' website in due time with a prior notice period.

6.2 Bilateral iterations

In the 2nd step Fluxys engages in further discussions with parties having submitted the Expression of Interest in order to finetune and align

- the technical design
- the service offering
- the terms and conditions

The necessary dimensioning of the infrastructure and the according capacity, the timing and phases, the offered services and the terms and conditions will be further elaborated based on mutual input during this phase.

6.3 Binding commitment

Finally, based on the final output of the previous phase, a binding commitment is taken for a specific technical design with associated timing for start of operations and terms and conditions. This binding commitment is the final step towards building the proposed infrastructure.

Binding commitments obtained in 2022 could in principle result in a commissioning phase prior to mid-2026.

7 Specific infrastructure proposals

Fluxys will publish specific infrastructure proposals (“Information Memorandum Proposal for CO₂ infrastructure: *Name*”) in addition to this document in order to announce the study or development of specific infrastructure with increased maturity. Publication will be triggered according to evolution of market needs and maturity. In those Information Memorandum Proposals you will find a detailed routing proposal of CO₂ pipelines or terminalling infrastructure reflecting actual and potential future demand.

Fluxys invites all potential users of the CO₂ infrastructure to participate to the Open Seasons.

Interested parties can also share additional CO₂ infrastructure needs via info.hydrogen-carbon-transport@fluxys.com or via the Request For Information in order to trigger specific development of new proposals.

Shaping together a bright energy future!