

# Securing & Greening Energy for Europe: The Role of Terminal Operators

**26 June 2024**

10:30 - 14:30 CET

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The Hotel, Brussels

# Opening of the workshop

## Setting the scene

# Anne-Sophie Corbeau

Global Research Scholar





# AGENDA

GIE STUDY LAUNCH  
26 June 2024

10:30 – 14:30  
The Hotel  
Brussels

10:30 – 10:35 | **Setting the scene** | Welcoming remarks

## **Zooming on the Study and the Decarbonisation Pathways**

10:35 – 11:05 | **Presentation of the Study**

Q&A

11:05 – 11:45 | **Decarbonising Europe via Different Pathways** | Projects

Q&A

11:45 – 12:00 | **European Commission's perspective towards the  
evolutionary role of LNG terminals**

12:00 – 12:20 | Coffee break

## **Terminals Evolution Towards 2050 – Collaboration & Next Steps**

12:20 – 13:30 | **The Role of Terminals in Decarbonising the EU**

Panel Discussion

14:20 – 14:30 | **Concluding remarks & Recommendations**

Luis Parada – GLE President

# Luis Ignacio Parada

GLE President



Zooming on the Study  
**Decarbonisation  
Pathways**

**26 June 2024**

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# Securing and Greening Energy for Europe: The role of Terminal Operators

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**Matthias Janssen**  
Associate Director



**Rogier Roobeek**  
Senior Consultant  
Energy Markets & Strategy





WHEN TRUST MATTERS

# The Contribution of Terminal Operators to Securing and Greening Energy for Europe

Presented by DNV and Frontier Economics

For Gas Infrastructure Europe AISBL

26 June 2024



# Introduction DNV & Frontier Economics

**Rogier Roobeek**  
Senior Consultant  
DNV



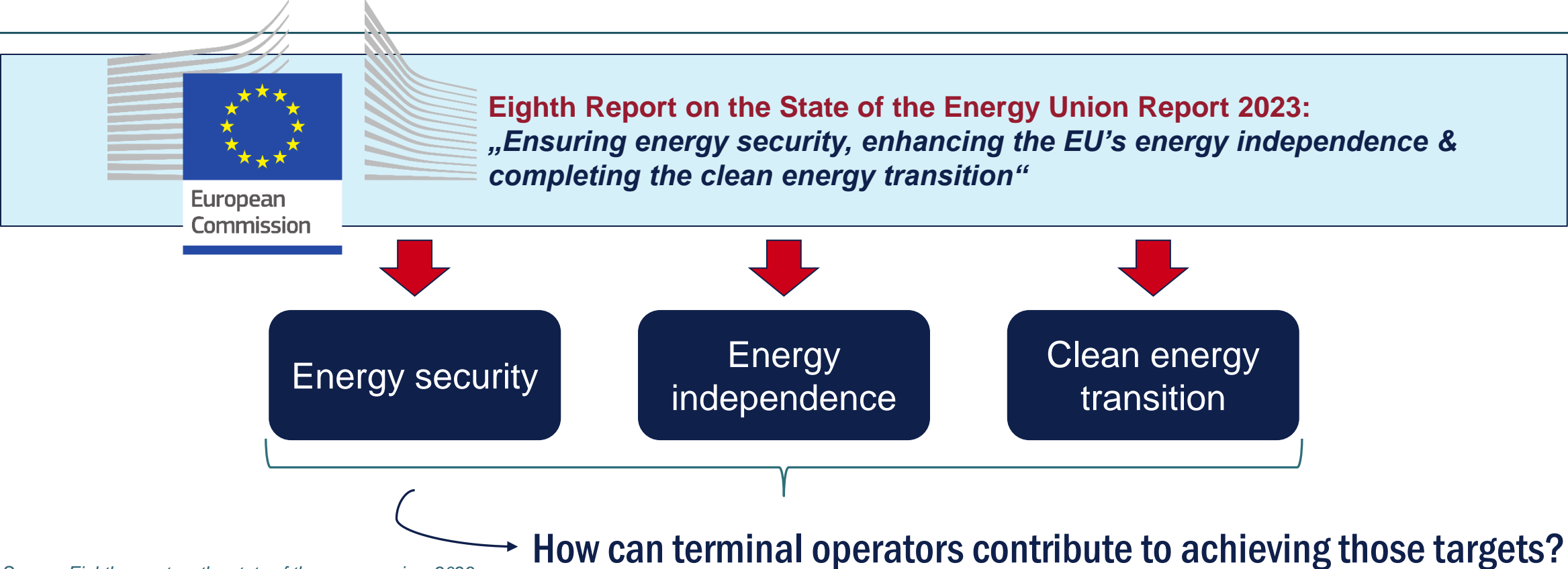
- DNV as a global assurance and risk management company, active in **Energy Advisory**
- Part of DNV's **Energy Markets and Strategy Team**  
Project Manager and subject matter expert on hydrogen
- Background: TU Delft, MSc Industrial Ecology and MSc Sustainable Energy Technologies

**Matthias Janssen**  
Associate Director  
Frontier Economics



- Part of Frontier's **Energy practice** since 2011, located in Cologne
- Supports private and public clients on economic challenges along the **electricity, gas, hydrogen & hydrogen-derivates value chain**
- Background: University of Muenster, PhD in Economics

# Situation: Potential contribution terminal operators



Source: Eighth report on the state of the energy union, 2023

# This study aims to identify the contribution of terminal operators

## Report structure and angles of analysis

### 1. EU gas market

Market requirements and developments for gas imports and infrastructure

### 2. Pathway costs

Calculation of import costs for different energy carrier pathways

**Market focus**

### 3. Terminal benefits

Assessment of terminal suitability for different uses

### 4. Assess pathways

Assessment of individual strengths of end-use pathways for terminals across multiple dimensions

**Terminal focus**

### 5. Policies

Identification of current policy hurdles - and how to address them

**Policy focus**

## Identification of key contributions of terminals

### Valuable volumes

Enabling much needed renewable and low-carbon imports



### Building bridges

Accessing favourable locations for renewables through worldwide sourcing



### Safety net

Providing system resilience to disruptions through diversification of supply and back-up capacity

### Waiting in the wings

Leveraging the value of readily available infrastructure for expanding to new carriers



### Greening gradually

Growing progressively with transition



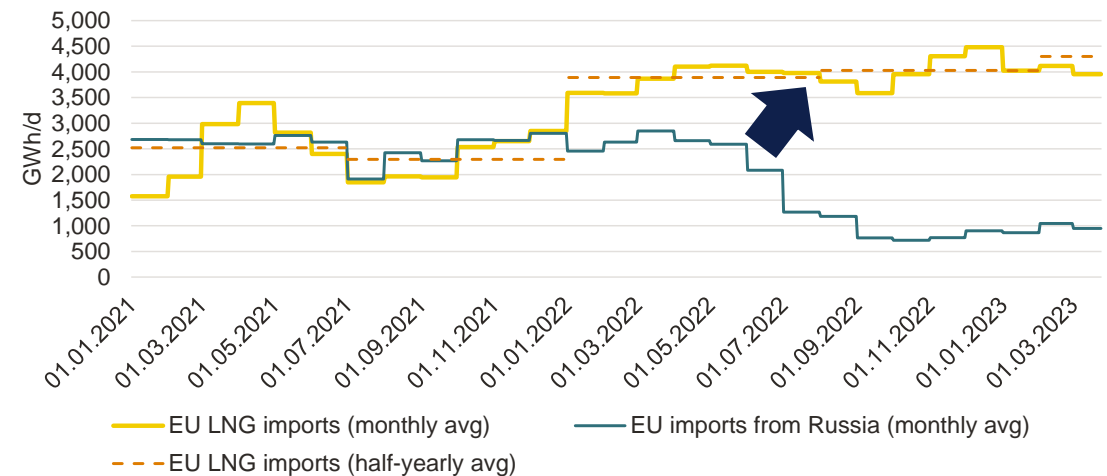
### Fit for many

Allowing different import pathways and various other energy services

# Safety net: Terminals ensure security of supply

- Terminals contribute to the security of supply by providing import capacity with **sourcing flexibility**.
- They provide **resilience to geopolitical** developments and disruptions by enabling energy imports from many countries worldwide, reducing dependence on individual countries or suppliers.
- Recent lessons from the **energy crisis** highlight the importance of terminals, as LNG terminals proved critical in securing energy supplies during a period of abrupt reductions in Russian pipeline gas imports.

## LNG import crucial for security of supply



# Valuable volumes & Building bridges: Clear need for imports of renewable and low-carbon energy



1. The characteristics of a maritime import terminal allow for **dynamic access to the most favourable locations worldwide for renewables.**
2. The need for **renewable and low-carbon energy** imports is evident in EU policy (REPowerEU 10 Mt import target) and all considered studies.
3. Need for hydrogen (derivatives) imports via ship to meet an expected increasing demand, as per various energy transition scenarios.
4. To enhance **supply diversity, supply flexibility**, access to international supply, and increasing competition and liquidity on European markets.
5. **Complementing European production and pipeline imports.**
6. Creating a more **competitive & more liquid European market** (hydrogen & its derivative incl. ammonia).

## EU hydrogen demand outlook

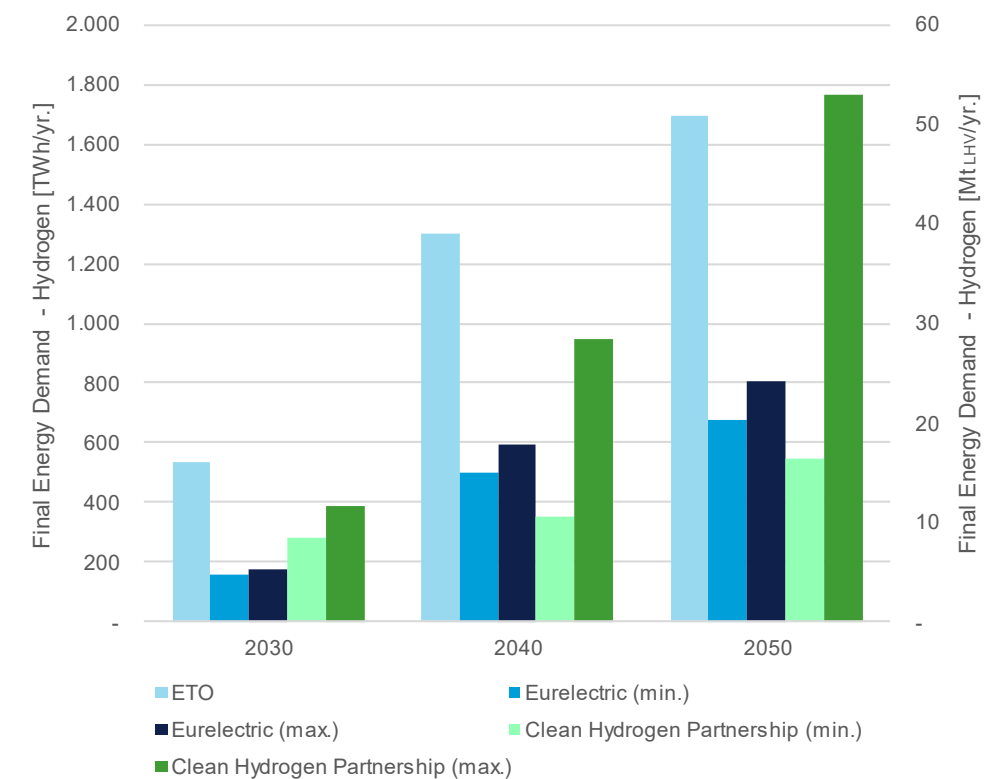


Figure: Development of final hydrogen demand.

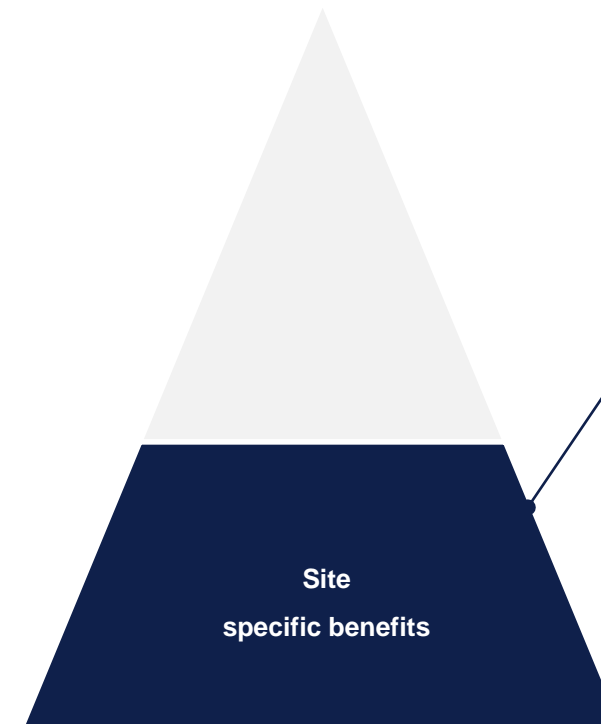
Sources:  
 DNV. (2023). *Energy Transition Outlook 2023*. DNV.  
 Eurelectric. (2023). *Decarbonisation Speedways—Final report*. Eurelectric.  
 Clean Hydrogen Joint Undertaking. (2023). *Study on hydrogen in ports and industrial coastal areas. Report 1*. Publications Office of the EU



# Waiting in the wings: Terminals bring unique site- and terminal specific benefits (1/2)

## Site specific benefits of existing terminals

- **Terminal sites and existing infrastructure have high value**, including deep docks, space for further processing of hydrogen carriers, and access to connecting infrastructure.
- Other benefits include the **storage potential of the terminals and synergies with cryogenic energy** in processes such as CO2 liquefaction.



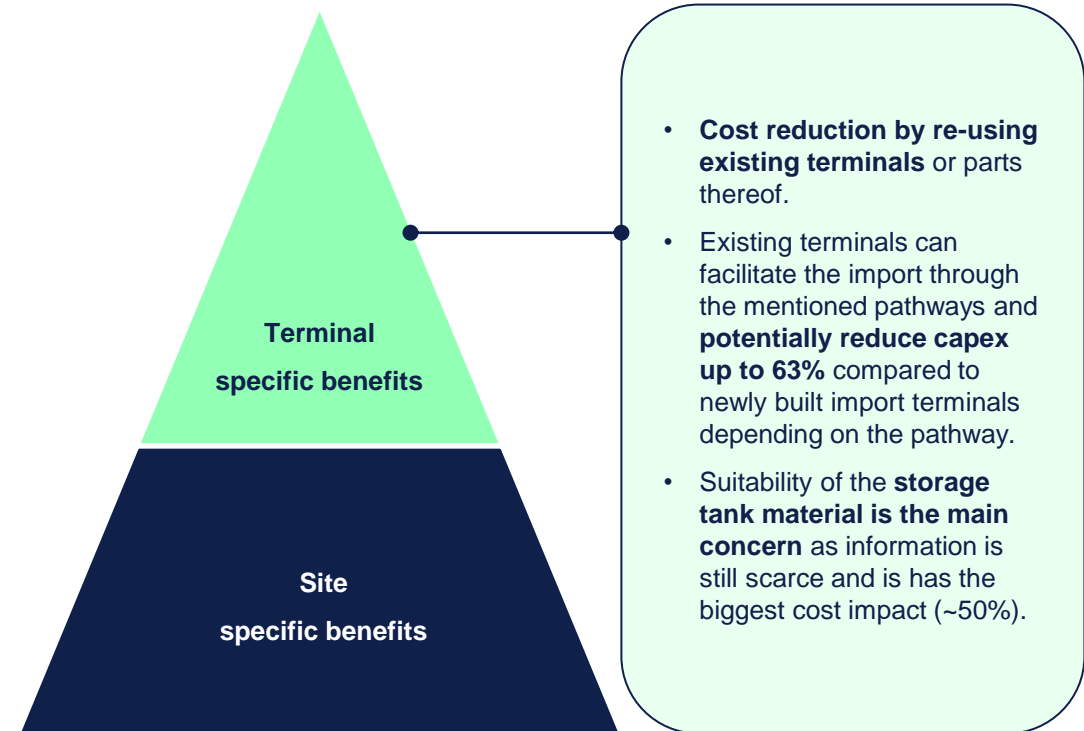
- **Availability of a site** that is specifically intended for import of energy with **access to infrastructure**.
- **Storage potential to support a stable energy supply chain**.
- **Space for energy import and further processing of carriers**.
- **Synergies with cryogenic energy and heat**.
- **Upper-tier Seveso establishments**.

Source: DNV

# Waiting in the wings: Terminals bring unique site- and terminal specific benefits (2/2)

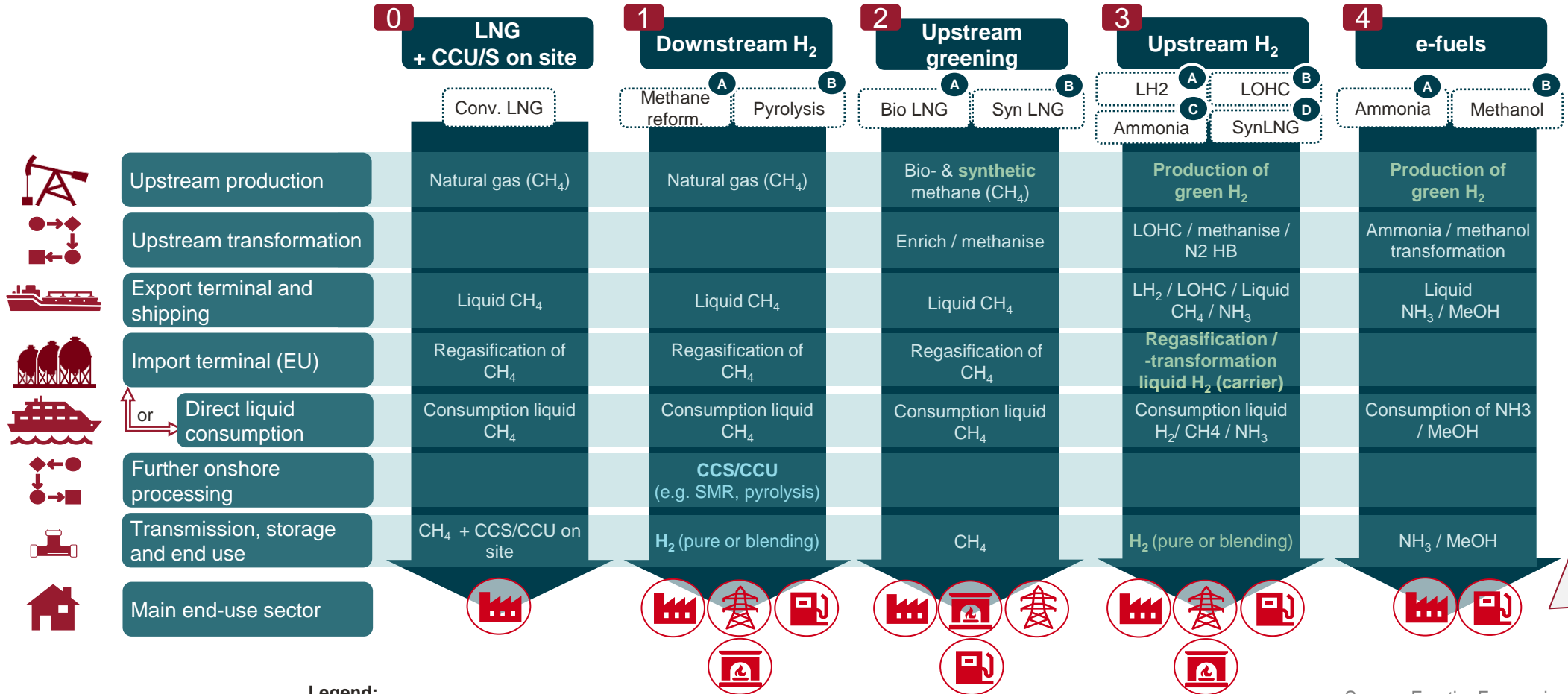
## Terminal specific benefits of existing terminals

- **Readily available** to import methane carriers (e.g. biomethane) at any time and can be expanded or repurposed to import other carriers relatively quickly and at lower cost than greenfield infrastructure development.
- This flexibility accelerates emission reductions, especially for industrial clusters, and supports the development of a hydrogen-based infrastructure (**possibly even before the development of the hydrogen backbone**).



Source: DNV

# Fit for many: Terminals acting as import points do not prescribe to a singular carrier pathway



Moreover, terminals are also fit for carrying out **non-import activities** (e.g. as carbon hubs)

For our more thorough analysis, we have selected **seven pathways** that we consider for our **multi-dimensional strength assessment** in the following.

Legend:  
 Green hydrogen  
 Blue/turquoise hydrogen

Source: Frontier Economics



# Fit for many: Different carrier pathways have different strengths - there is **no “silver bullet” pathway**

“Upstream greening” pathways (2A & 2B) with CH4 in end-use **do not require technical adjustments** of infrastructure & end-use facilities  
 → Existing LNG terminals can **accelerate greening** of energy supply right away

Pathways with **upstream conventional LNG (0 & 1A)** rely on **established value chains outside Europe** – there is no reliance on the timely ramp-up of new value chain overseas for pathways to become viable.  
 → **Market uncertainty is limited** to CO2 capture market

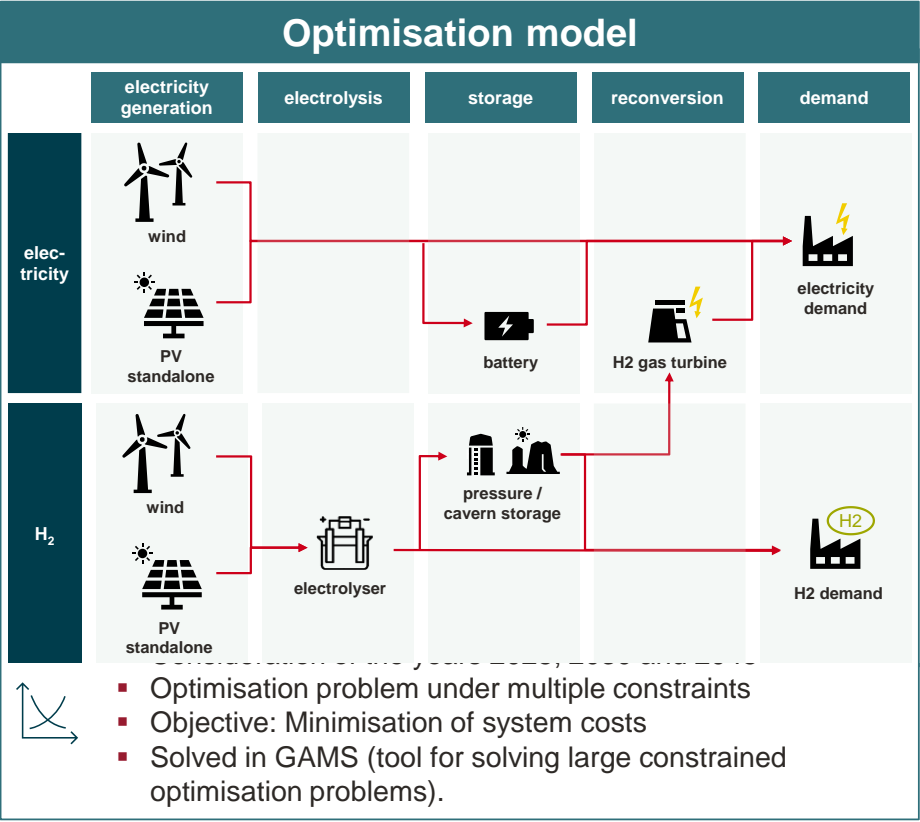
“Upstream and downstream H2” pathways (3A, 3B & 3D) are considered “greenest” pathways due to wide acceptance of the green carrier characteristics  
 → Well-suited for **emission reduction and hydrogen ramp-up**

	Suitability to meet EU targets	Energy costs	Infrastructure requirement	End use suitability	Technological maturity	Other value chain elements	Environmental implications
<b>Pathway 0:</b> LNG → CH4+CCUS	Yellow	Green	Yellow	Green	Yellow	Green	Yellow
<b>Pathway 1A:</b> LNG → H2(+CCUS)	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Yellow
<b>Pathway 2A:</b> BioLNG* → CH4	Yellow	White	Green	Green	Green	Yellow	Green
<b>Pathway 2B:</b> SynLNG → CH4	Yellow	Yellow	Green	Green	Yellow	Yellow	Yellow
<b>Pathway 3A:</b> LH2 → H2	Green	Yellow	Yellow	Yellow	Red	Yellow	Green
<b>Pathway 3C:</b> SynAmmonia → H2	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Green
<b>Pathway 3D:</b> SynLNG → H2	Green	Red	Yellow	Yellow	Yellow	Yellow	Yellow

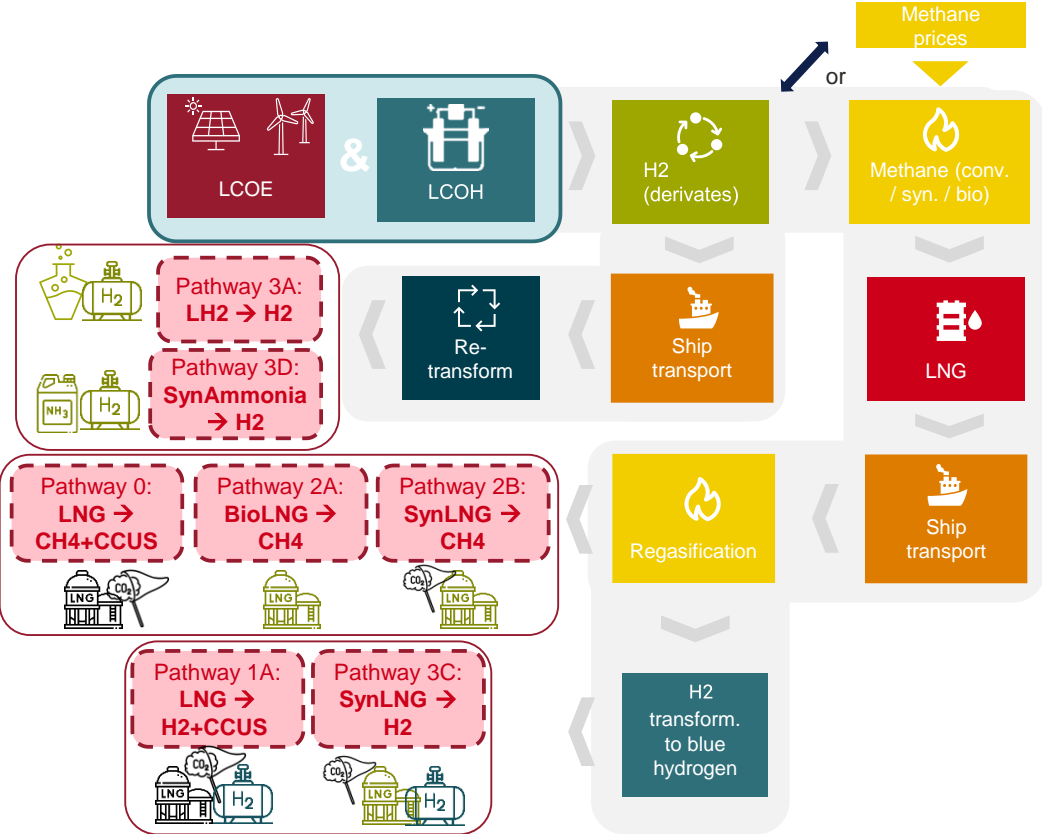
**Legend:**  
 - Overall positive assessment of pathway specifics  
 - Mixed factors identified in the assessment of pathway specifics  
 - Challenges identified in the assessment of pathway specifics

# Fit for many: We apply a twofold approach to estimate import costs for 2040 for different pathways

## LCOH modelling (for SynLNG/H2 paths)



## Cost-based assessment of pathway



Source: Frontier Economics

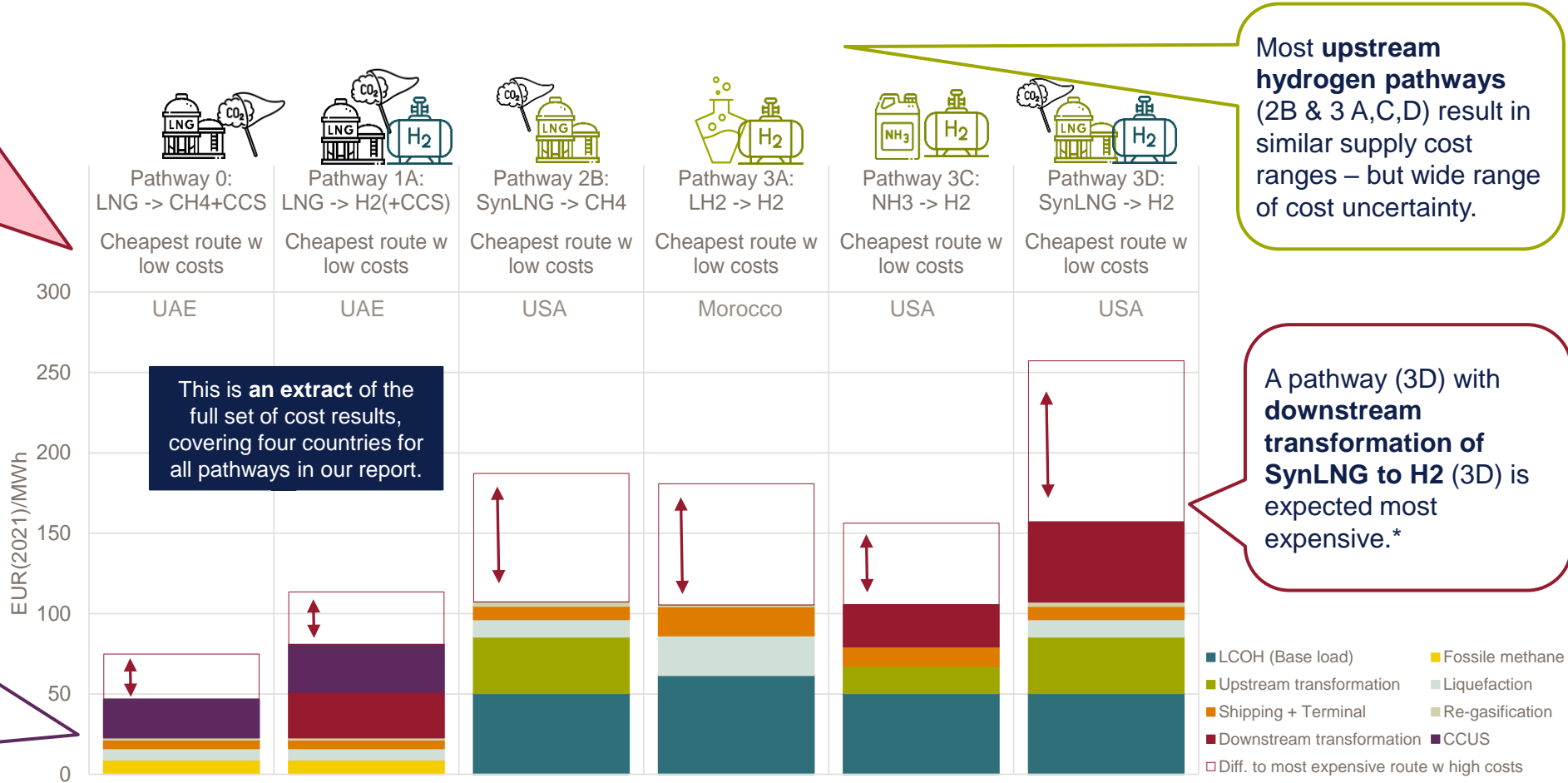
# Fit for many: 2040-cost estimates show **wide range of uncertainty** around developments of cost drivers

For estimating costs, we differentiate:

- By **optimistic / pessimistic** cost assumptions,
- By **sourcing country**.

This chart shows the highest and lowest resulting cost bounds.

Pathways relying on **conventional LNG with CCS** come with lowest lower-bound import costs, however with uncertainty around natural gas prices and carbon capture costs.



Transformation losses are counted towards the associated technology.  
 \* The efficiency losses incurred in the transformation of SynLNG to H2 are more costly than the same process for fossil LNG due to higher underlying costs for the commodity.

Source: Frontier Economics

# Greening gradually: Terminals enable a smooth green transition across regions, times and activities



The existing terminal environment is granular and dispersed across Europe, and therefore allows for a diverse and gradual planning process for its green transition / its repurposing (no “all at once” investment).



The European PCIs demonstrate the variability of terminal operation (in terms of import carriers and activities), featuring NH3, LH2 and CO2 projects across Europe.

It is a key strength of terminals that they are not a uniform technology per se, but instead can accommodate different energy carriers and can serve different purposes/activities (e.g. act as carbon hubs), and therefore provide innate operational flexibility.

Transition across terminals will vary in terms of...

- i.) **timing**
- ii.) **carriers used & activities carried out**

... depending on local needs and plans.



Source: Frontier Economics

# Policy recommendations (1/2)



## (Hybrid) terminal regulation

### Regulators need to recognise the diverse range of services / options that existing terminals can provide

- Recognise the **manifold role of terminals** in regulation: Multi-molecules/asset sites and hybrid operation, energy service hubs (not import only).
- Appropriate and timely implementation of new EU rules – **cooperation between LSOs and legislators/regulators is essential.**
- Creating **investment security** and a **level playing field** for market participants.



## Policy environment for terminals

### Alignment of regulations, licensing and permitting and support measures

- **Align and coordinate** national and EU legislation to facilitate transformation pathways. **Speed up, harmonise and facilitate project licensing** and **(hybrid) permitting.**
- Activate measures to **kickstart immature technologies** (pilot projects, R&D, etc.) and ensure **regulatory readiness** for market ramp-up.

# Policy recommendations (2/2)



## Upstream supply value chain / policy

### International coordination, standardisation and certification schemes are essential

- Develop **strategic partnerships** and **cooperation** between the EU and exporting countries.
- Consider **imports of renewable and low-carbon energy** in the **EU framework** (H2Global and European H2 Bank).
- **Standards, certifications, GOs, etc.** → e.g. **Union Data Base implementation** is a hurdle at the moment.



## Downstream markets / policy

### Ensure downstream market regulation is compatible with (hybrid) terminals

- An **overly narrow policy focus** might hinder appropriate market development (e.g. CO2 market)
- Imports should **not be limited to injection into H2 grid** in the short to mid-term (e.g. option for blending, local uses, other needs).
- Ensure **appropriate end-use planning** to facilitate the ease of transition.

# Thank you.

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Q & A STUDY PRESENTATION

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**Matthias Janssen**  
Associate Director



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Senior Consultant  
Energy Markets & Strategy





# **Decarbonising Europe via different Pathways**

Project Presentations

# Olivier Heurtin

CEO



# D'ARTAGNAN PROJECT

## CO<sub>2</sub> Export Terminal 1,5 MTPA from 2028

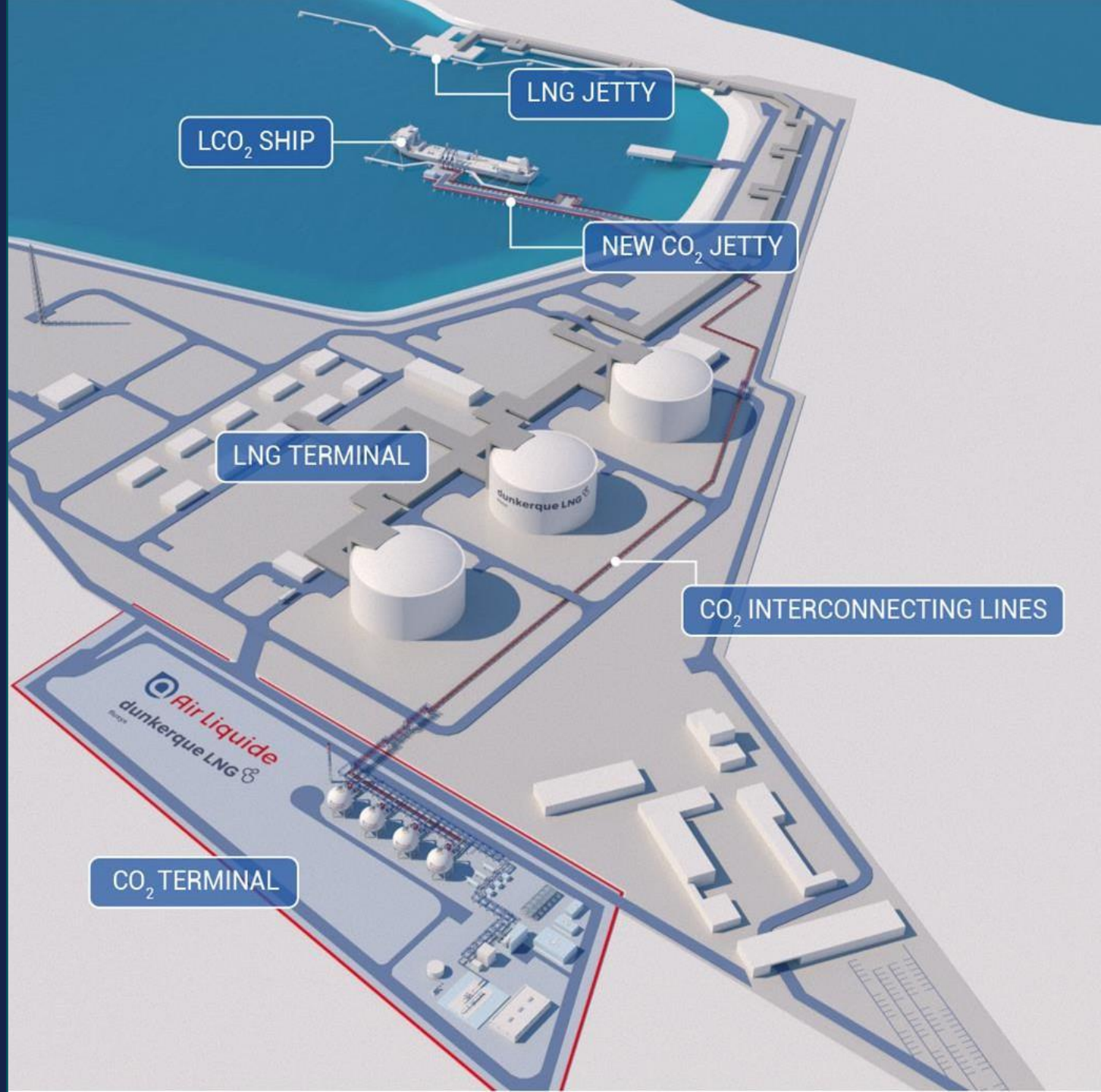
Partnership between Dunkerque LNG and Air Liquide

Anchor Customers Equiom and Lhoist

First CCS project in France to receive CEF funding



Co-funded by  
the European Union







“

**Shaping together a bright energy future**

# Laurent Hamou

Head of European  
and Institutional Affairs



**elengy**



# Elengy and LCO2 Terminaling



Elengy

June 2024

Une société de  **ENGIE**



# Elengy in the CCUS Chain

**Elengy is a subsidiary of GRTgaz** (French TSO) within the ENGIE Group

**50+ years of expertise** and among **leaders** in LNG services in Europe

**+ 400 employees**

Regulated entity that fulfils a public service mission with a duty of **transparency, independence** and **non-discrimination**

**Elengy** participates in the emergence of **CCUS chains** and develops **CO2 Hubs** projects in **Fos-sur-Mer** and **St Nazaire** based on

- Its know-how in LNG **cryogenics** and port operator
- **Existing facilities**, which can be mutualized and benefit from energy synergies (refrigeration recovery)
- Recognized **operator expertise** (performance and safety)
- Adapted and reproducible **commercial know-how**

Elengy at the service of **decarbonisation** with the first projects possible before **2030**



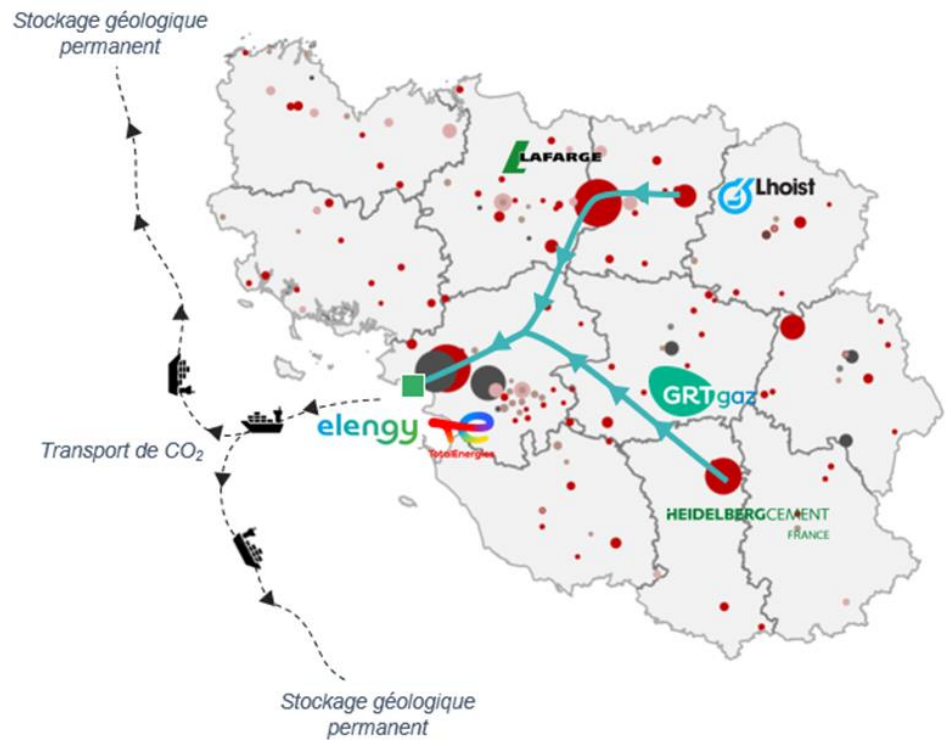
**Terminal méthanier Elengy**



**Terminal d'export de CO2**



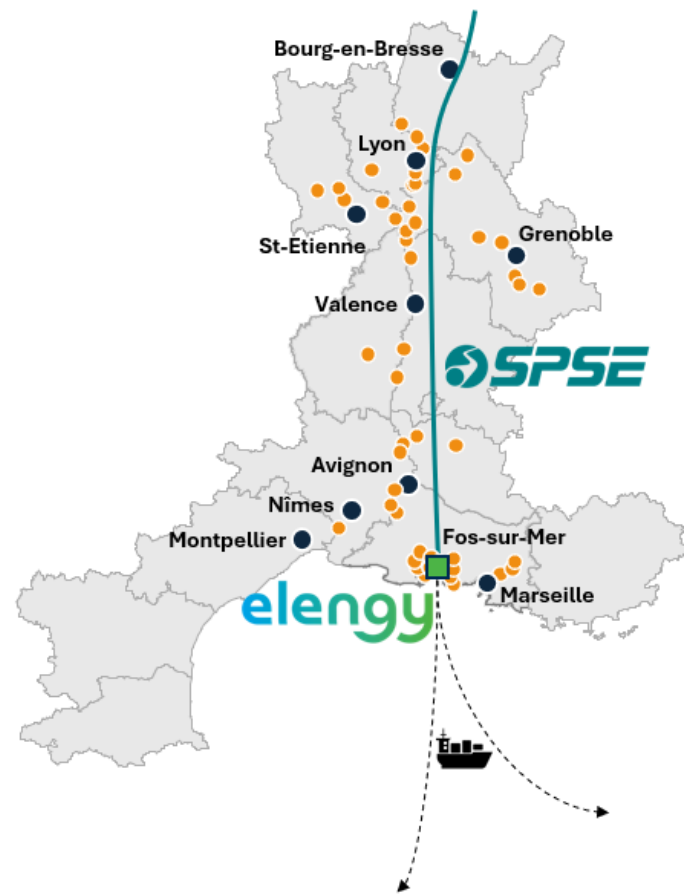
# Our projects



**GOCO2 (Grand Ouest CO2)**

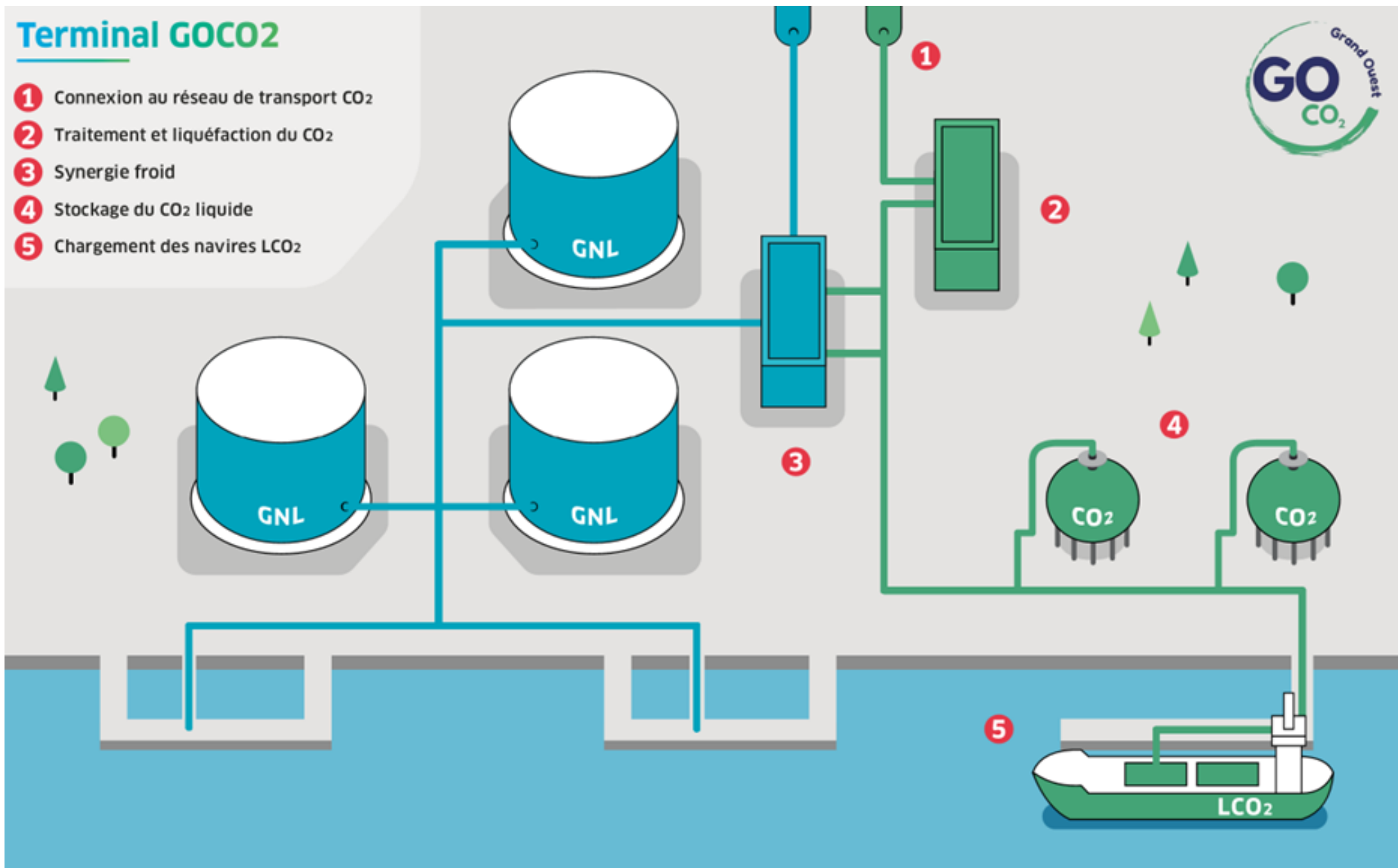


**Rhône CO2**

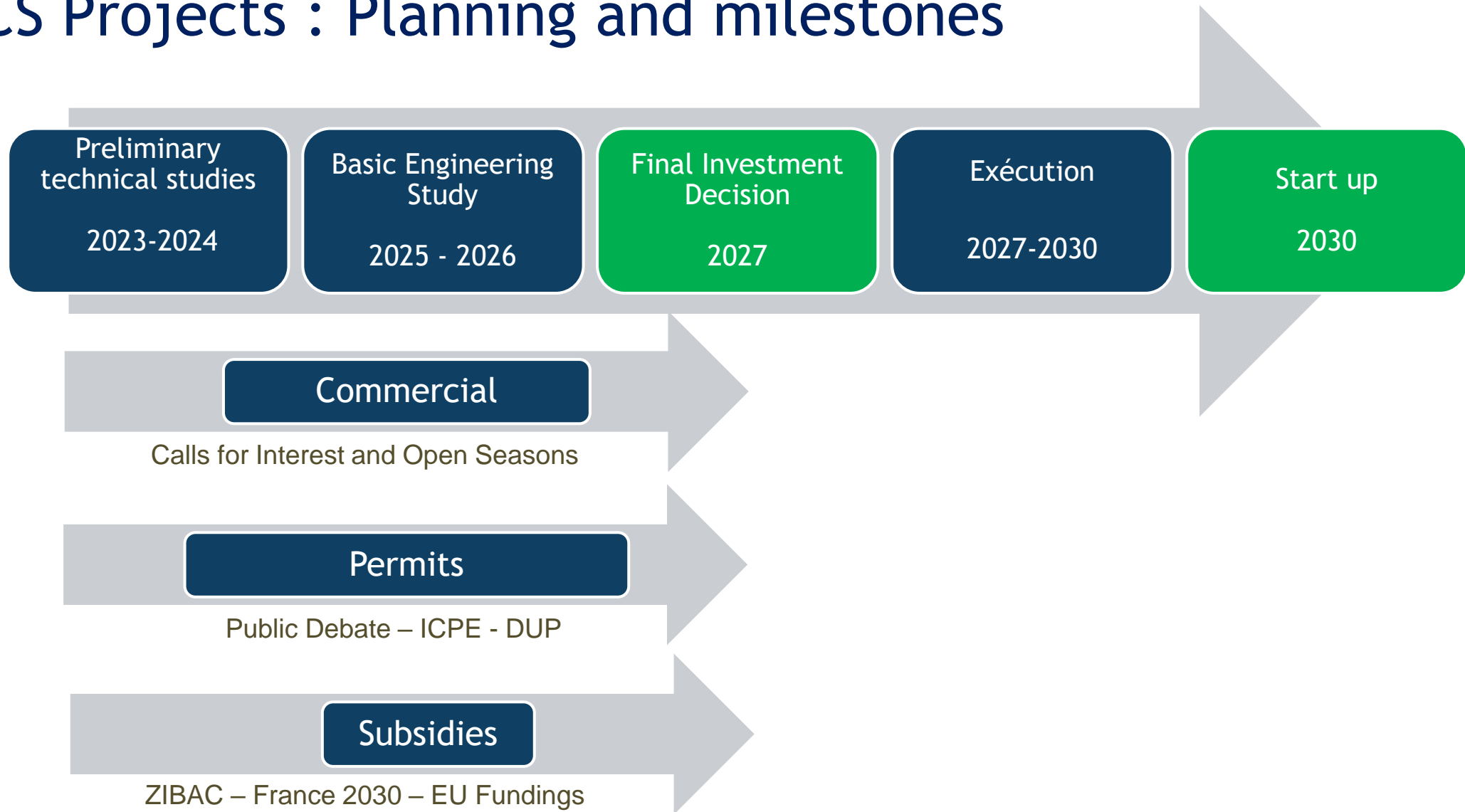


## Terminal GOCO2

- 1 Connexion au réseau de transport CO<sub>2</sub>
- 2 Traitement et liquéfaction du CO<sub>2</sub>
- 3 Synergie froid
- 4 Stockage du CO<sub>2</sub> liquide
- 5 Chargement des navires LCO<sub>2</sub>



# CCS Projects : Planning and milestones



## CCS Projects : outlook

**These projects are required to maintain industrial activity in Europe such as cement.**

**Support (e.g. CCFD) is needed to accelerate the calendar.**

## Claudio R. Suarez

Gas Assets  
General Manager



Claudio Rodríguez  
Gas Assets General Manager

# The Enagas vision for reinforcing EU SoS from “multi-molecule” plants



26<sup>th</sup> June 2024

# The Enagas LNG portfolio strengths



Largest **storage capacity of molecules in cryogenic state** in the EU.

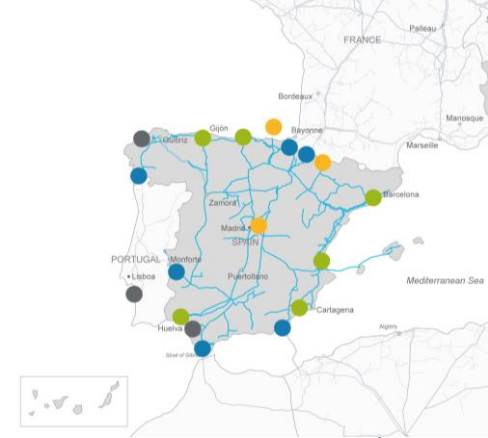
Greater experience **in adapting and making logistics more flexible**. Starting in 2014 through the CORE LNG Hive project and completed in 2023 with the commissioning of El Musel terminal as a logistics platform.

Greatest experience in the development of **projects to make use of the cold** from the LNG terminals (E4E):

- ✓ **Barcelona LNG terminal:** industrial cold supply to Mercabarna and the Port.
- ✓ **Huelva LNG terminal:** cold supply for the agri-food sector.

First **EU certification for the conversion of LNG tanks into NH3**.

Plan to certify our terminals for **the availability of bio-LNG** through "*Equivalence liquefaction*" (Target date: end 2024). **First step for the multimolecule terminal**





# Spanish H2 system strengths

- Largest **competitive H2 production capacity** in the EU
- **"Call for Interest"** has allowed us to **identify NH3 and CO2 hubs**

## Ammonia (NH<sub>3</sub>) Results

Interest in producing more than **5 Mt/y** of ammonia involving a consumption of approx. 0.9 Mt/y of hydrogen

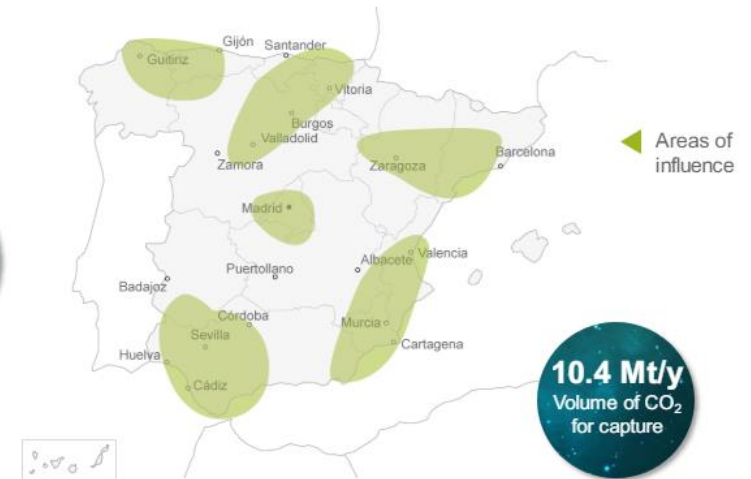
**41 companies** interested in the use of infrastructure for the transport of around 4 Mt/y of ammonia



## CO<sub>2</sub> Results

**37 companies** interested in CO<sub>2</sub> capture

**53 companies** interested in infrastructure



- Spain has a **high level of bunkering activity:**



- ✓ Three Spanish ports rank among the top 10 in Europe in terms of **LNG container vessels**. With the **third largest port volume in the European Union**.
- ✓ The ports of **Barcelona and the Canary Islands lead** the European ports in terms of **cruise ships**.

# An uncertain market in need of hybrid flexibility

There is much uncertainty regarding the use of these new molecules, so...

... **HYBRID FLEXIBILITY** is required, and Enagás is moving towards this through its terminals, such as multimolecule terminals, thanks to having:

Figure 1: Mapping most recent fuel mix scenarios: Hydrogen (H2)-fuels scenarios versus Biofuels scenarios.



- Space
- Berth
- Storage
- Cold
- Geostrategy



The adaptation of terminals presents **competitive advantages** which can make the **development of port hinterland hubs**, **Large Scale Green Corridors** and **Small Scale Green fuel supply chains**.



# Scaling from innovation and advanced management of knowledge

## 1. Hydrogen Technology Observatory

Hydrogen Technology Observatory as **a catalyst for the exchange of technical knowledge in the hydrogen value chain** and to promote technological advances that accelerate the deployment of this vector.

### Main functions of the Observatory

1

Monitor the state of the art of the technologies

2

Identify future trends and anticipate the technological evolution of the sector

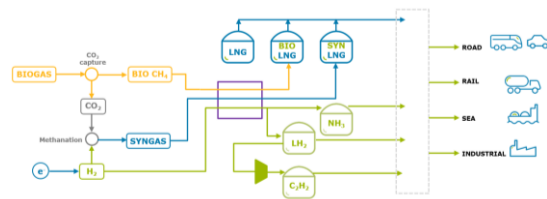
3

Share best practices related to technology and innovation in this field in order to promote their implementation

## 2. Cátedra de Universidad de Oviedo

Collaboration framework for the **adaptation of the "El Musel" LNG terminal to a multi-molecule plant (e-terminal)** in the context of the energy transition.

### Energy vectors to be studied



- CO2 storage for export and/or use
- H2
- BioLNG
- SNG (Synthetic Methane)
- LOHC (Methanol, Cyclohexane-Benzene, etc.)
- NH3
- E-fuels

## 3. NHyRA (pre-Normative Research on Hydrogen Releases Assessment)

The project will carry out **an assessment of H2 emissions along its value chain**, as due to the lack of validated data currently available, the impact of H2 processes on climate change is unknown.



## 4. HyStoreNew

**Liquid Organic Hydrogen Carrier Research** (LOHCs to H2). Detailed study of the possibility of using organic liquids as an alternative for the storage and transport of hydrogen obtained from renewable sources.

### Goals

- **Prediction of the enthalpies** of hydrogenation and dehydrogenation reactions.
- Selection of **processes** and preliminary evaluation of their **economic viability**.
- Design of a process diagram: **hydrogenation** reaction and **dehydrogenation** reaction

Thank you



# Stefaan Adriaens

## Commercial Manager



# Reality check pathways around Gate (Rotterdam)

- LH<sub>2</sub> by H<sub>2</sub>Sines-consortium discontinued
- Blue Hydrogen:
  - under construction of CO<sub>2</sub> pipeline/CCS(Porthos) combining with existing H<sub>2</sub> and CH<sub>4</sub> pipelines in existing H<sub>2</sub>-plants
  - Various other project ideas a.o. with new nat/int H<sub>2</sub> network (HNS) and nat/int CO<sub>2</sub> (Aramis/CO<sub>2</sub>nect) options, even re-exporting CO<sub>2</sub> through cold recovery.
- Import of (green) NH<sub>3</sub> at various locations (1 under construction). Main topic: splitter
- BioLNG: operational at Gate.
- Gaseous H<sub>2</sub> under discussion



# Reality check pathways around EET (Eemshaven)

- Launched a market consultation on the combination of:
  - LNG
  - Carbon capture
  - Hydrogen carriers like ammonia
- Connected to international H<sub>2</sub>-network and H<sub>2</sub>-storage (planned)
- Also other initiatives around carbon capture



In collaboration with the **Ministerie van Economische Zaken en Klimaat**, Gasunie and **Vopak** are investigating the possibilities of extending the operation of the EemsEnergyTerminal in Eemshaven. In doing so, we hope to strengthen energy security in the Netherlands. In addition to LNG, the research also focuses on the possibilities for a future, rapid transition to a green energy system, in which hydrogen and CO<sub>2</sub> capture and storage play a central role. That is why a market consultation is taking place into the interest in and possibilities for hydrogen and CCS. Read more in the press release <https://lnkd.in/gjwZBKK4> #energie #energietransitie #eet #lng #waterstof #ccs



# Q&A

Decarbonising Europe via different pathways





# European Commission's perspective

Towards the evolutive role of  
LNG terminals

## Tatiana Marquez Uriarte

Member of Cabinet  
of the Commissioner for Energy



# Coffee break

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12:00 – 12:20



# Terminals Evolution Towards 2050

## Collaboration & Next Steps

**26 June 2024**

10:30 - 14:30 CET

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The Hotel, Brussels

# The Role of Terminals in Decarbonising the EU

Panel Discussion

# Anne-Sophie Corbeau

Global Research Scholar

MODERATOR



Center on  
Global Energy  
Policy

PANEL DISCUSSION  
**The Role of Terminals  
in Decarbonising the EU**

MODERATOR



**Csilla Bartók**



**Harmen Dekker**



**Joop Hazenberg**



**Emile Herben**



**Huibert van Rossum**



## Csilla Bartók

Acting Head of Department  
Gas, Hydrogen & Retail





# Harmen Dekker

CEO



# Joop Hazenberg

EU Director



## Emile Herben

Director Product Management



Yara Clean Ammonia

# Huibert van Rossum

Chair Energy Transition Network



# Q&A

## The Role of Terminals in Decarbonising the EU

# Concluding Remarks & Recommendations

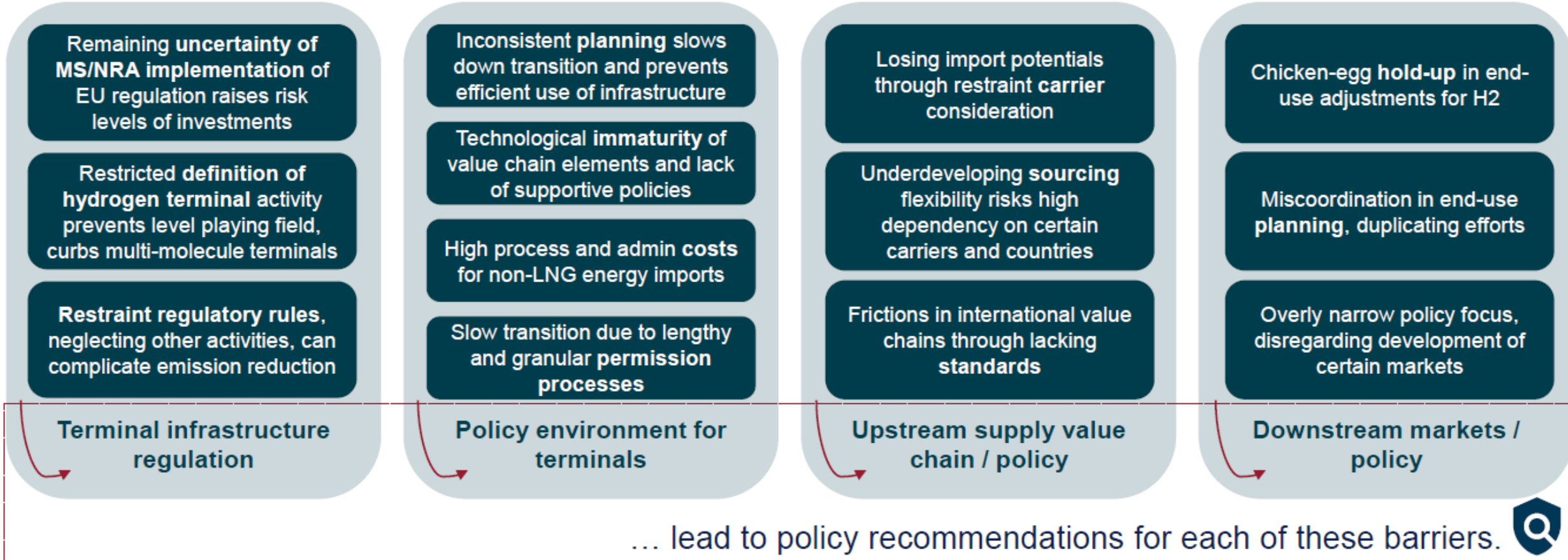
# Luis Ignacio Parada

GLE President



# Policy recommendations to enable the decarbonisation of EU's terminals

## Barriers and threats identified





# Policy recommendations to enable the decarbonisation of EU's terminals

## Hybrid terminal regulation



### Regulators need to recognise the diverse range of services/options that existing terminals can provide

- Multi-molecule terminals, new services, repurposing and new installations, development of new markets, new emission reduction pathways
- Appropriate implementation of new EU rules - **cooperation between LSOs and legislators/regulators is essential**
  - create a sound investment environment + a level playing field across EU
  - acknowledge the different pathways that terminals will choose, and the synergies offered by hybrid terminals

## Policy Regulatory environment



### Alignment of regulations, licensing and permitting and support measures

- **Align and coordinate** national and EU legislation to facilitate the transformation pathways
- Speed up, harmonise and facilitate **project licensing and permitting**
- Agile "**hybrid permitting**" → allowing for multiple molecules to co-exist at the same terminal.
- Activate measures across the value chain resulting in cost reduction of required technologies (pilot projects, R&D, innovation funding, etc.)

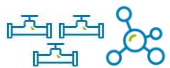
## Policies upstream



### International coordination, standardisation and certification schemes are essential

- Develop strategic **partnerships and cooperation between the EU and exporting countries.**
- Consider **imports of renewable and low-carbon energy** in the EU framework → covered by mechanisms such as H2Global and EU H2 Bank
- **Standards, Certifications, GOs, etc.** → **Union Data Base implementation** is a massive issue at the moment

## Policies downstream



### Ensure downstream market regulation is compatible with hybrid terminals.

- Terminals need **visibility on the decarbonization developments downstream.**
- Imports not limited only to injection into an H<sub>2</sub> grid.
- **Stimulate demand downstream** and consider regulatory developments for all future markets (e.g. CO<sub>2</sub> market...).



# Thank you for your attention.

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