

Gas and energy transition



University of Liège – 26 April 2022



Agenda



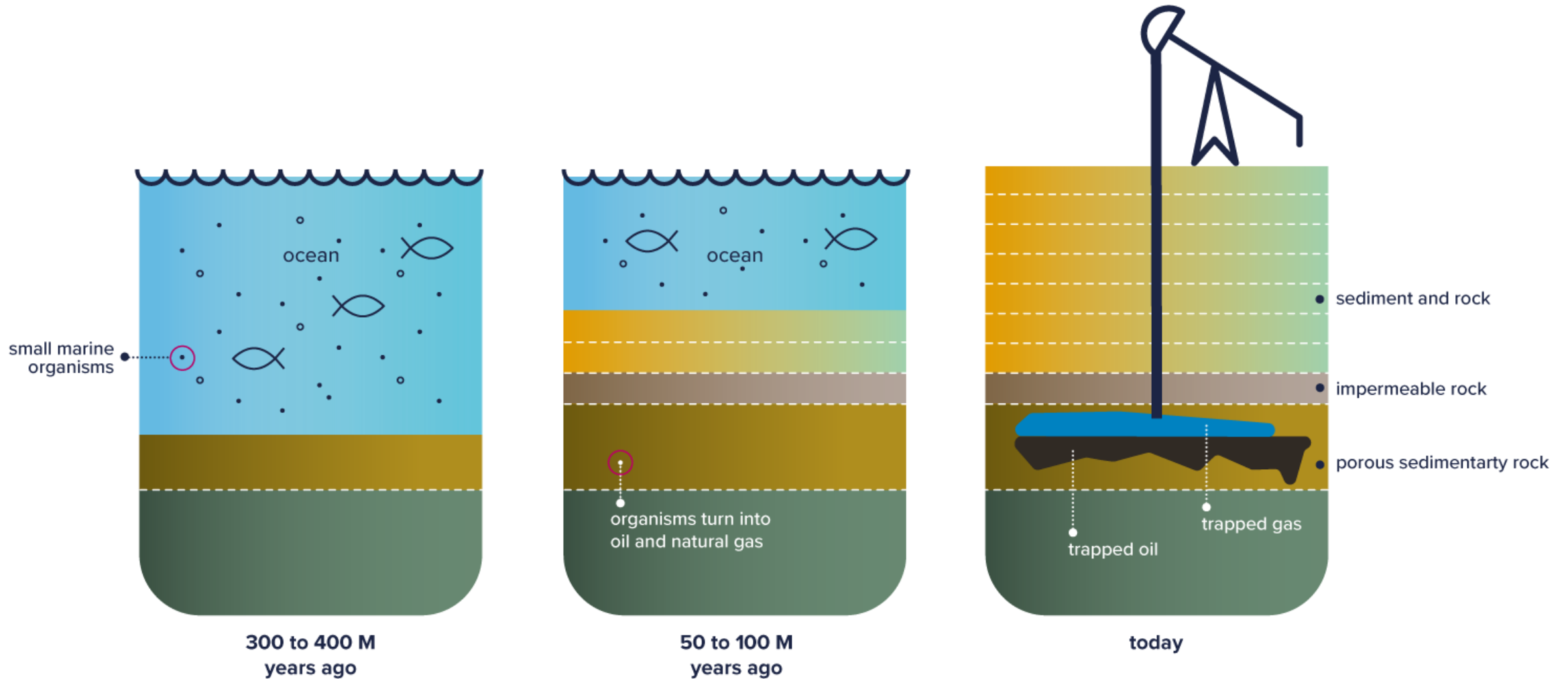
1. Natural gas in a nutshell

2. Fluxys

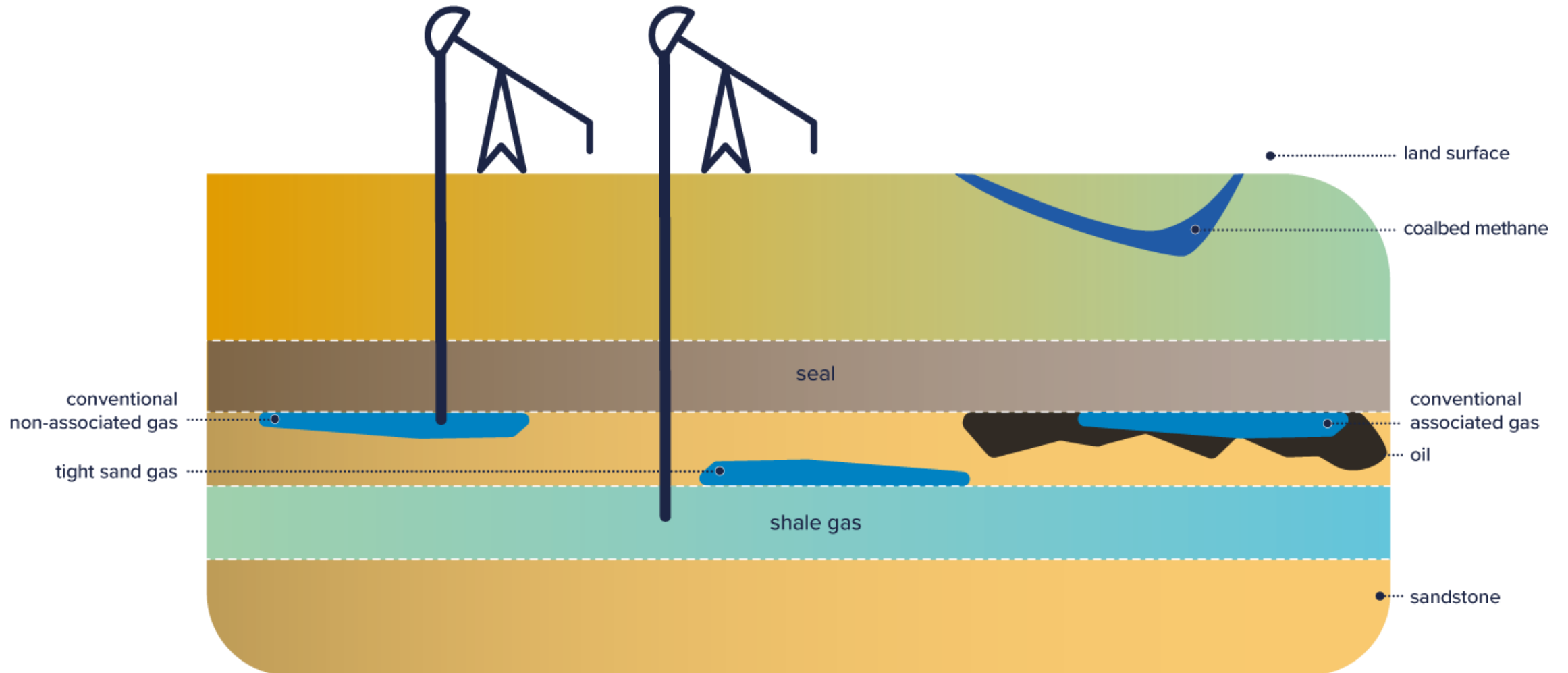
3. Energy transition



Formation of oil and natural gas



Oil and natural gas sources



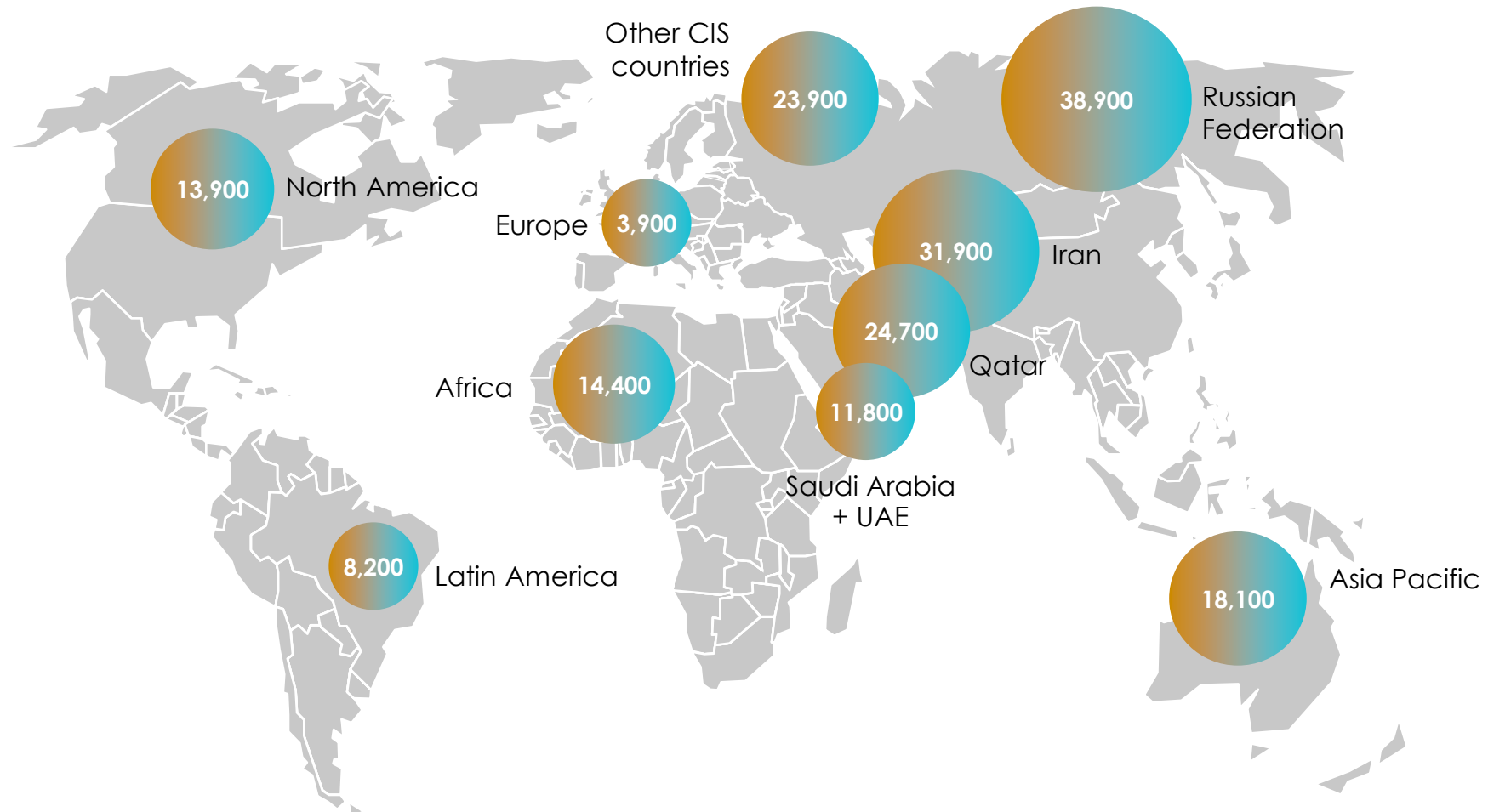
Average Volumetric Composition

GAS COMPONENTS	GRONINGEN (NL) %	EYNATTEN 1 %	LNG %	IZTF (UK) %	ZEEPIPE (NORWAY) %
Methane (CH ₄)	83,903	96,263	93,100	90,642	90,748
Ethane (C ₂ H ₆)	3,718	2,694	6,244	4,787	4,739
Propane (C ₃ H ₈)	0,646	0,138	0,139	1,111	1,123
Butane (C ₄ H ₁₀) (ISO and NORM)	0,228	0,068	0,026	0,338	0,425
Pentane (C ₅ H ₁₂) (ISO and NORM)	0,056	0,008	-	0,075	0,425
Hexane and superior HC (C ₆ +)	0,057	0,005	-	0,046	0,092
C. Dioxyde (CO ₂)	1,375	0,409	-	1,230	1,714
Nitrogen (N ₂)	9,981	0,403	0,491	1,735	1,071
Helium (He)	0,035	0,012	-	0,035	0,013
GAS CHARACTERISTICS	GRONINGEN (NL) kWh/m ³ (n)	EYNATTEN 1 kWh/m ³ (n)	LNG kWh/m ³ (n)	IZTF (UK) kWh/m ³ (n)	ZEEPIPE (NORWAY) kWh/m ³ (n)
GCV	10,321	11,243	11,563	11,447	11,508
WOBBE	12,905	14,811	15,064	14,589	14,617

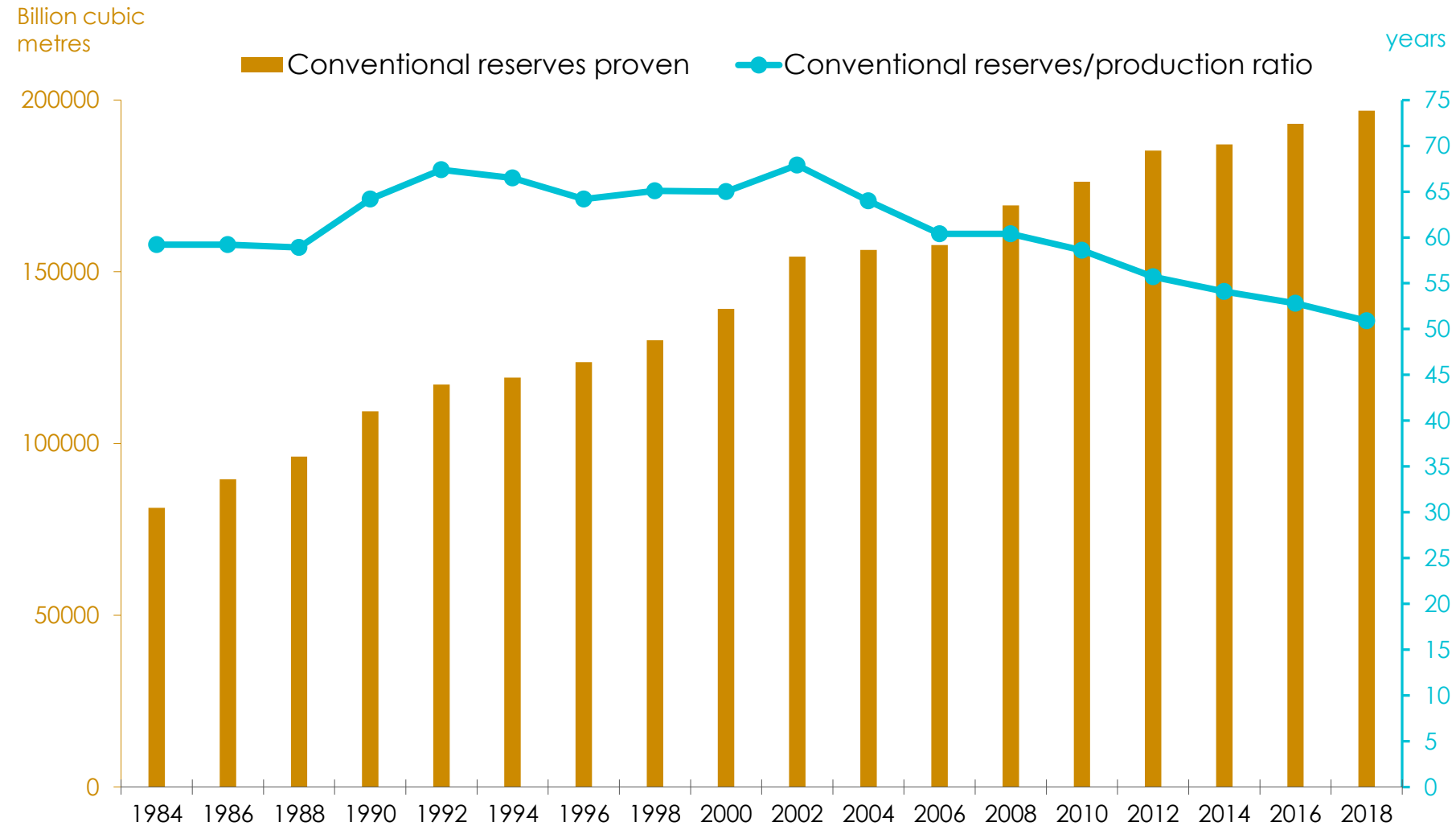


Supply side:

Proved conventional natural gas reserves (bcm)



Natural gas abundantly available

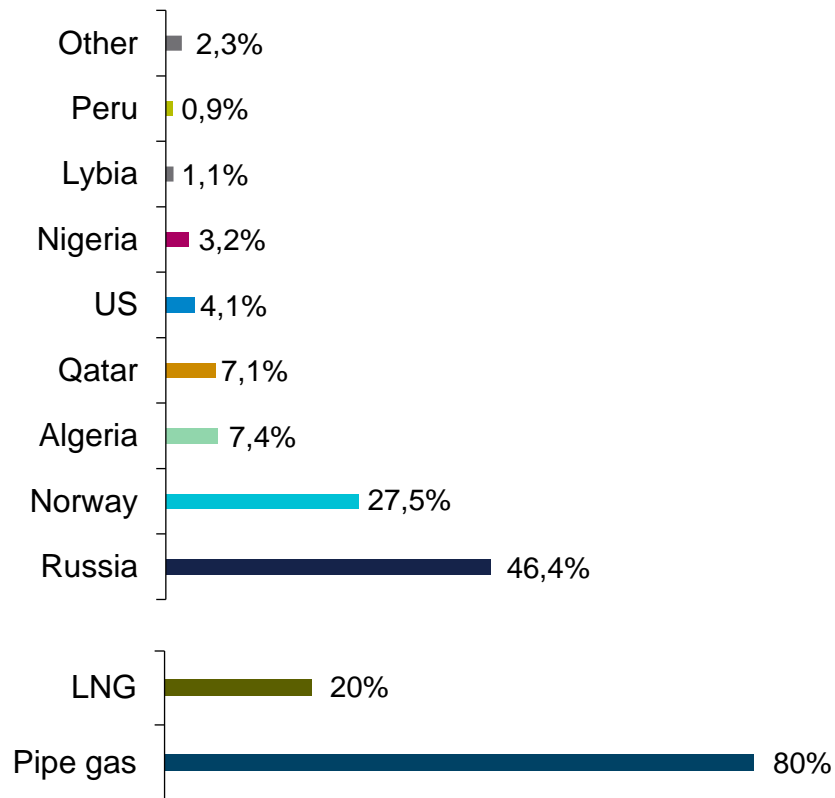


- Conventional natural gas reserves to outlast oil by 20 years
- Total: sufficient reserves to keep up current production rate for 250 years

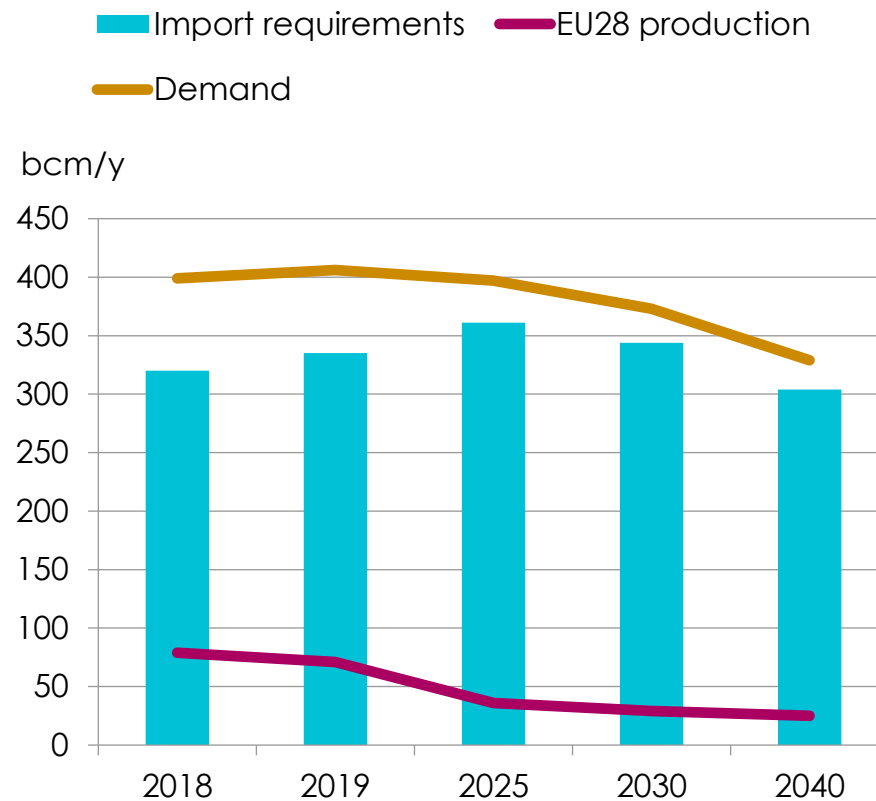


Despite demand outlook: Europe needs additional imports

EU imports: 85% of consumption



Source: BP Statistical Study June 2020 – reference year 2019

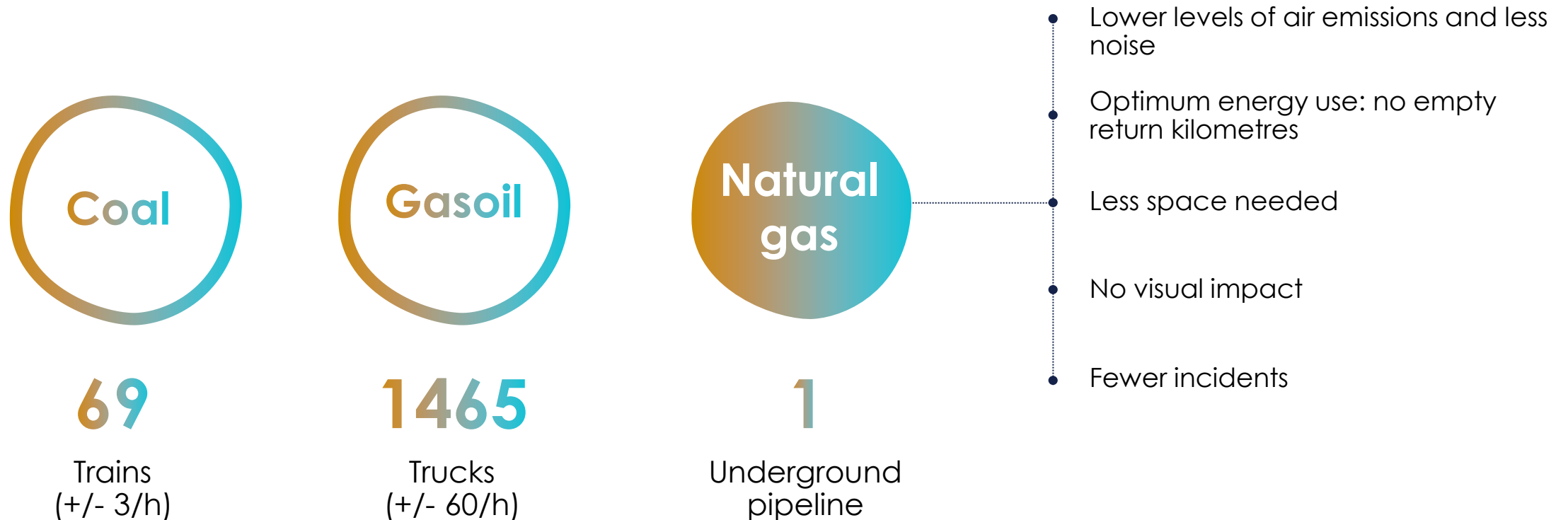


Source: World Energy Outlook 2020

- North Sea fields dwindle
- Dutch L-gas Groningen field: progressive phase-out of exports and production cap



Underground pipeline: most sustainable transport mode



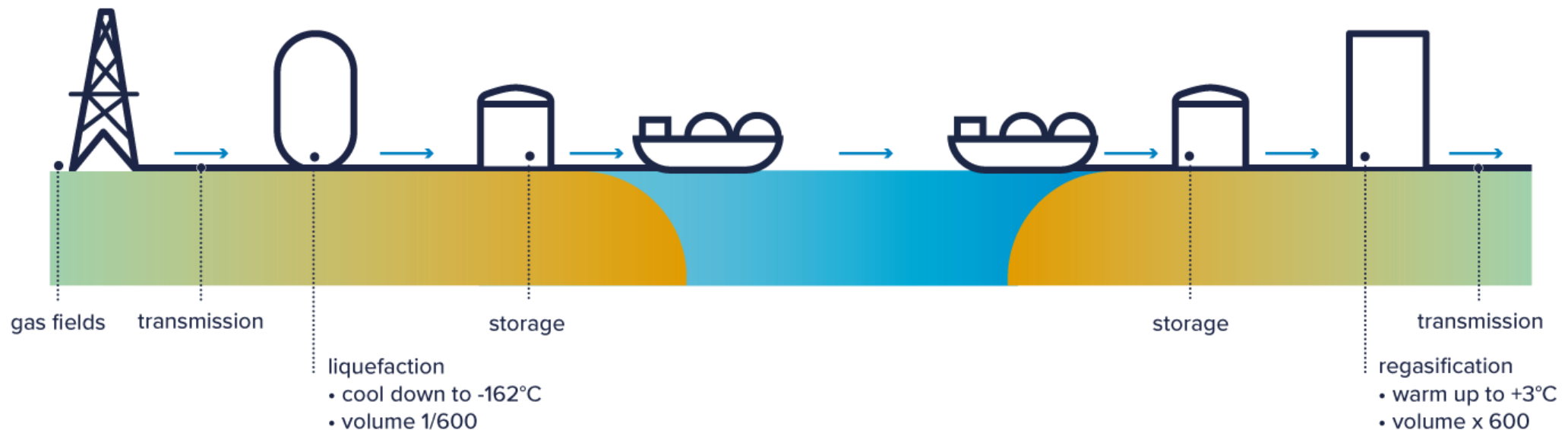
Transported energy per day:
2.3 million GJ/day (pipeline with 20 bcm capacity / year)



From source to end user market: pipelines and LNG chain (liquefied natural gas)

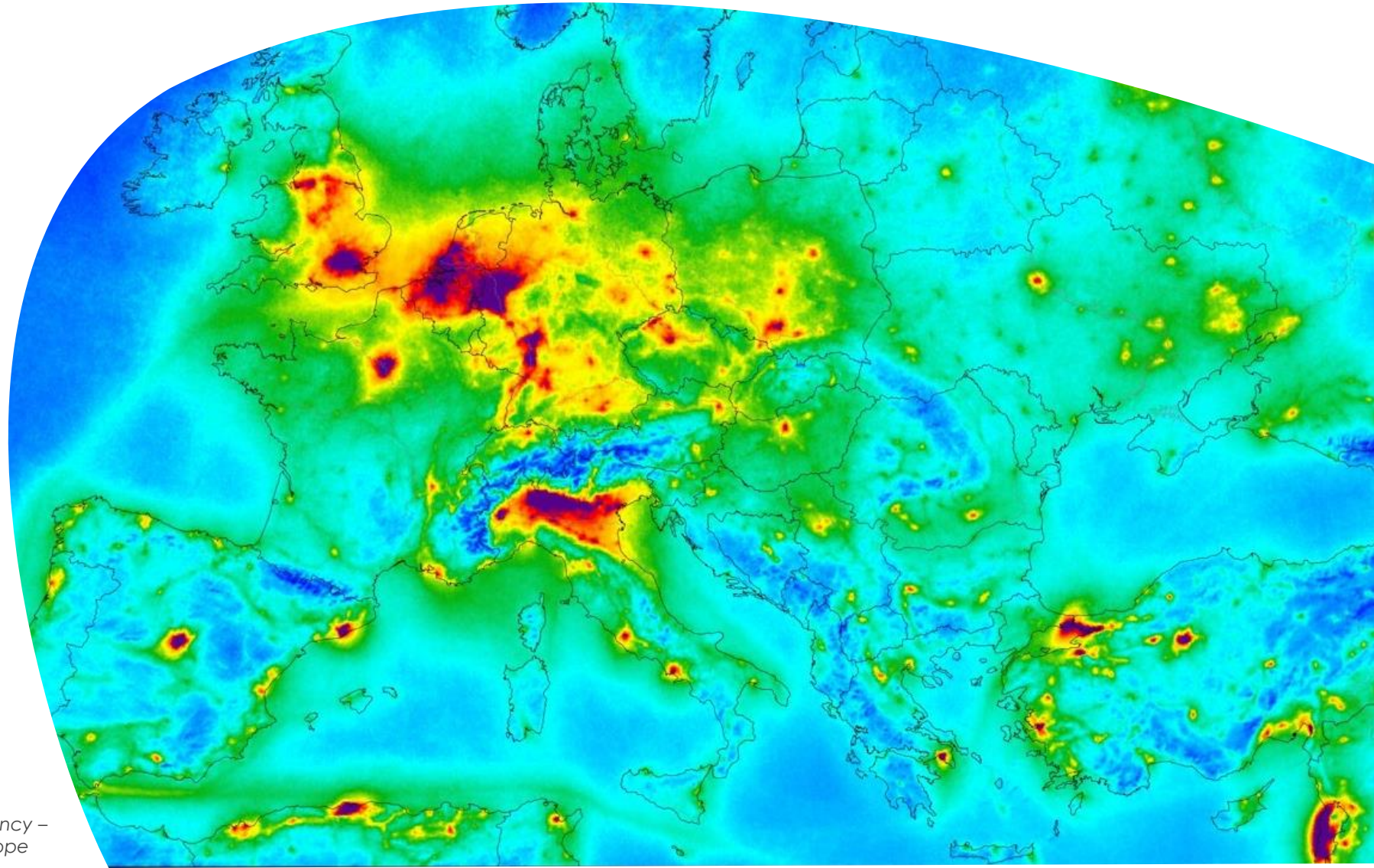
Why LNG?

- LNG offers competitive advantage over pipe gas for transmission over longer distances
- Easy diversification of sources
- Easy flexibility in destination markets



Europe's challenge: address climate change and harmful emissions

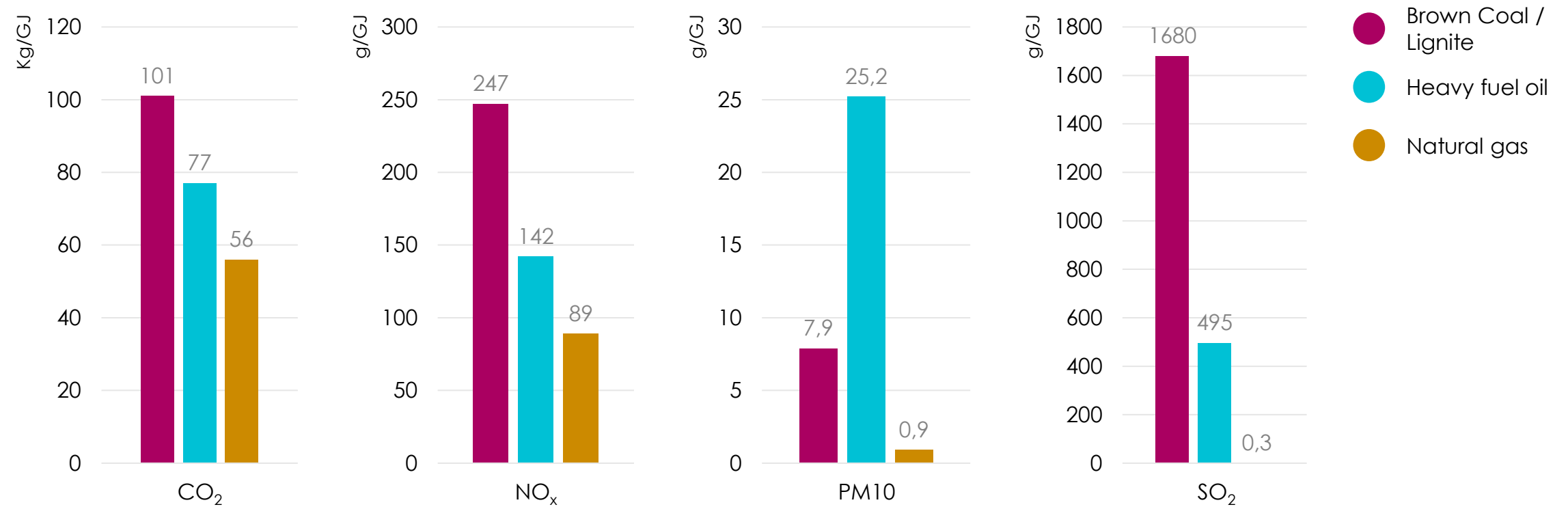
- Limit climate change below 2°C
- **Attack the invisible killer:** premature deaths in EU28 from air pollution (PM, NO₂ & O₃) amounts to 400,000 in 2019



Source: European Space Agency –
nitrogen oxide levels over Europe

Natural gas

Fossil fuel of choice from an environmental point of view



Source:
European Environment Agency - EMEP/EEA air pollutant emission inventory guidebook 2016
Public electricity and heat production - dry bottom boiler

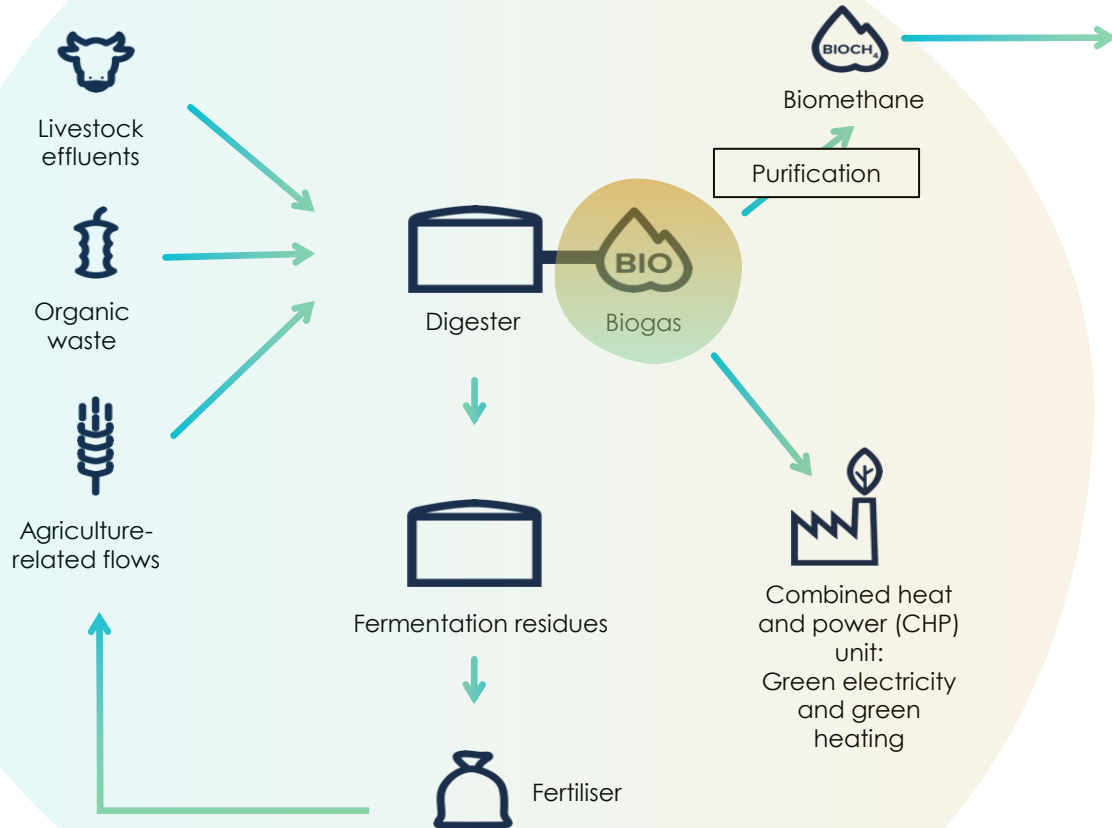


Specific advantages for power generation

Gas-fired power generation ideal for replacing coal-fired power generation and back-up of choice for power generation from renewables with variable output



Biomethane: carbon neutral and circular



Biomethane composition similar to natural gas: 100% compatible for injecting into the existing system

- Biomethane: **additional production of renewable energy in Belgium**, supplementing green electricity from solar and wind energy
- Contributes to the **circular economy** and creates **employment** in agricultural regions – jobs that can't just be moved elsewhere
- Currently 5 biomethane facilities in Belgium and an investment decision expected for several other projects of this type
- **Considerable generation potential** in Belgium: 15 TWh or 6-8% of current natural gas consumption (ValBiom study in 2019)
- **Excellent import potential** thanks to the strong interconnection of the Fluxys Belgium system – generation potential in Europe of 1,000 TWh/year



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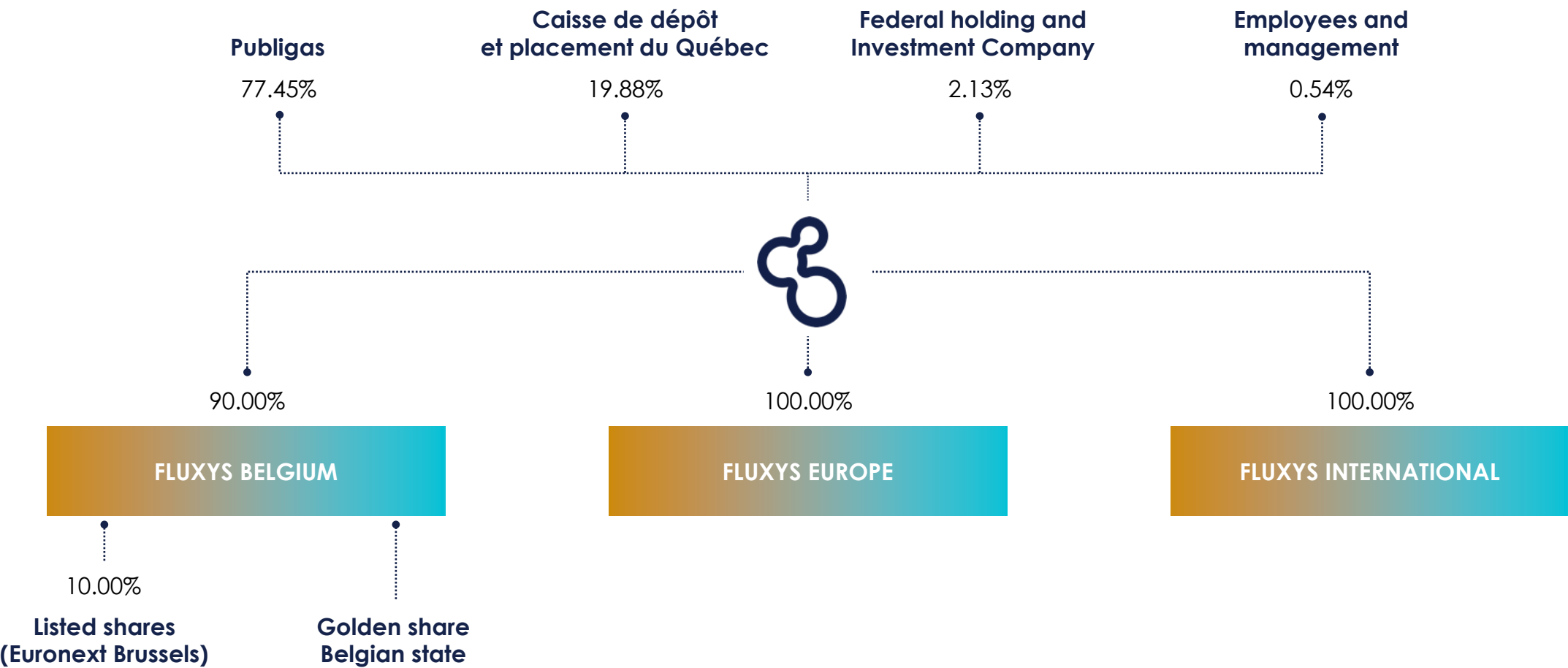
Who we are?

4 facts about Fluxys

- 1 Fully independent energy infrastructure partner headquartered in Belgium
- 2 Strong European presence with associated companies across Europe and offices in Singapore & Brazil
- 3 A growing group of 1 300 employees
- 4 Purpose-driven company committed to building a greener energy future for the generations to come



Our shareholder structure



What we do?

We are a midstream energy infrastructure company, we are not involved in any energy production

Terminalling



29 bcm/y of
LNG regasification capacity
with terminals in Belgium,
France and Greece

Transmission

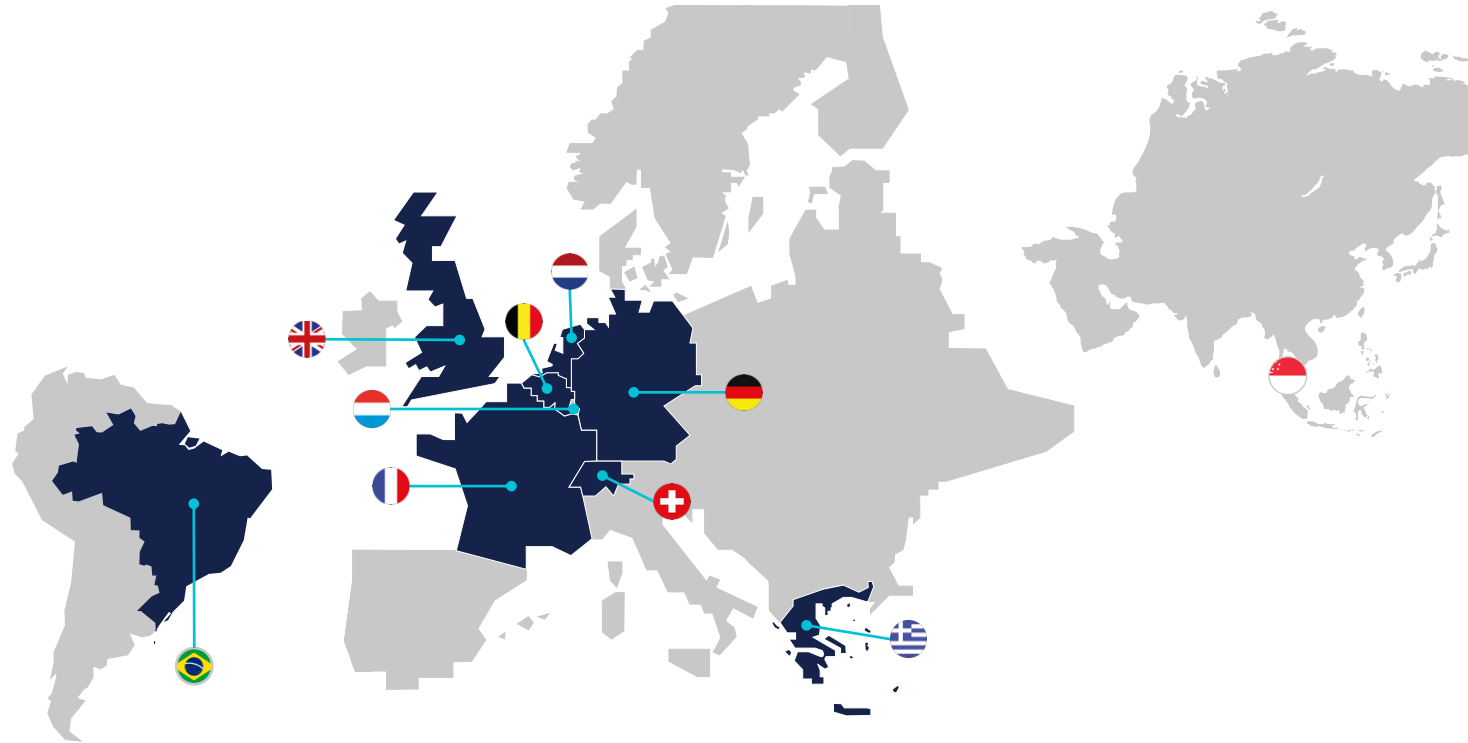


12,000 km
gas pipelines in operation

Storage

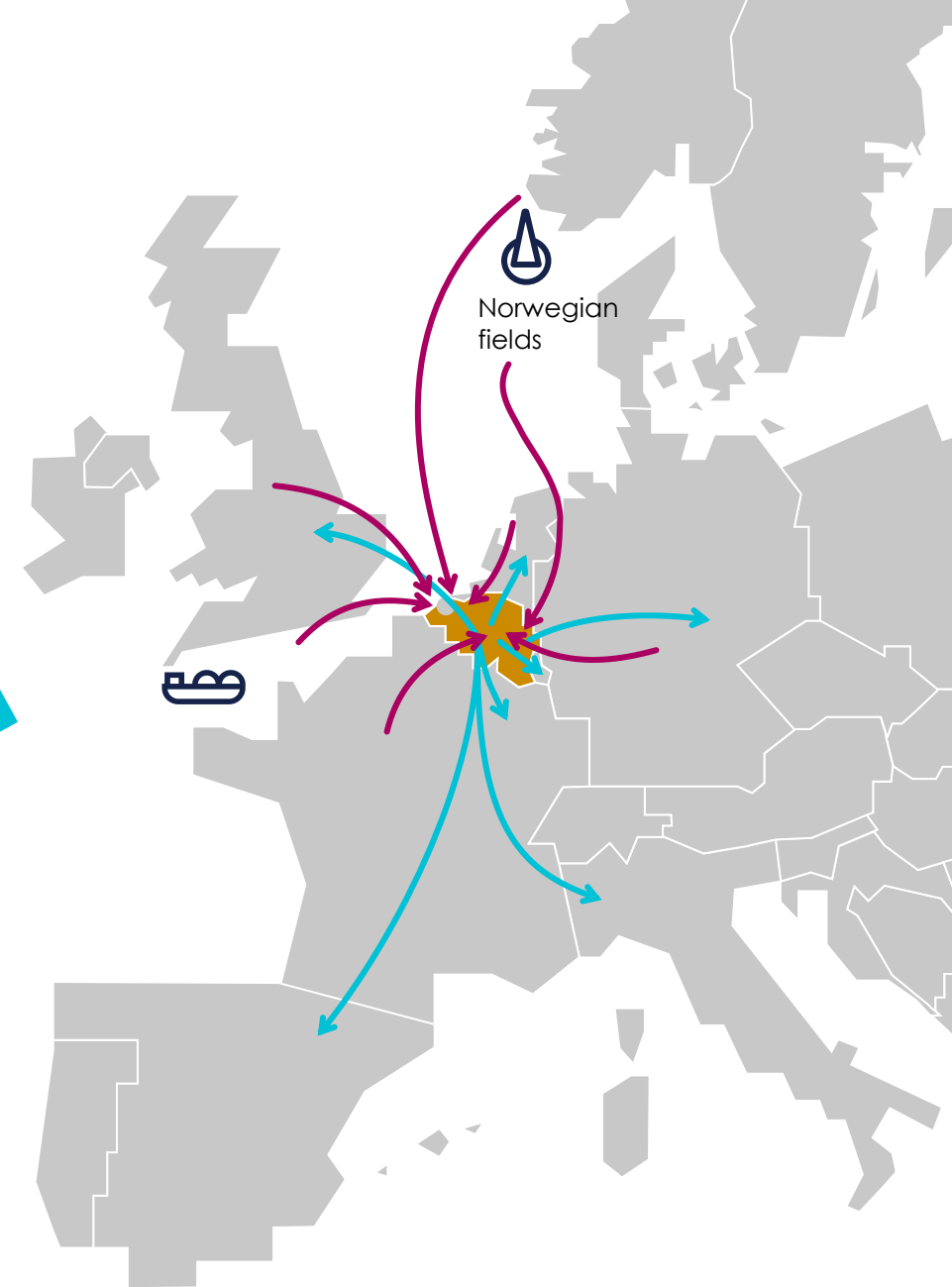
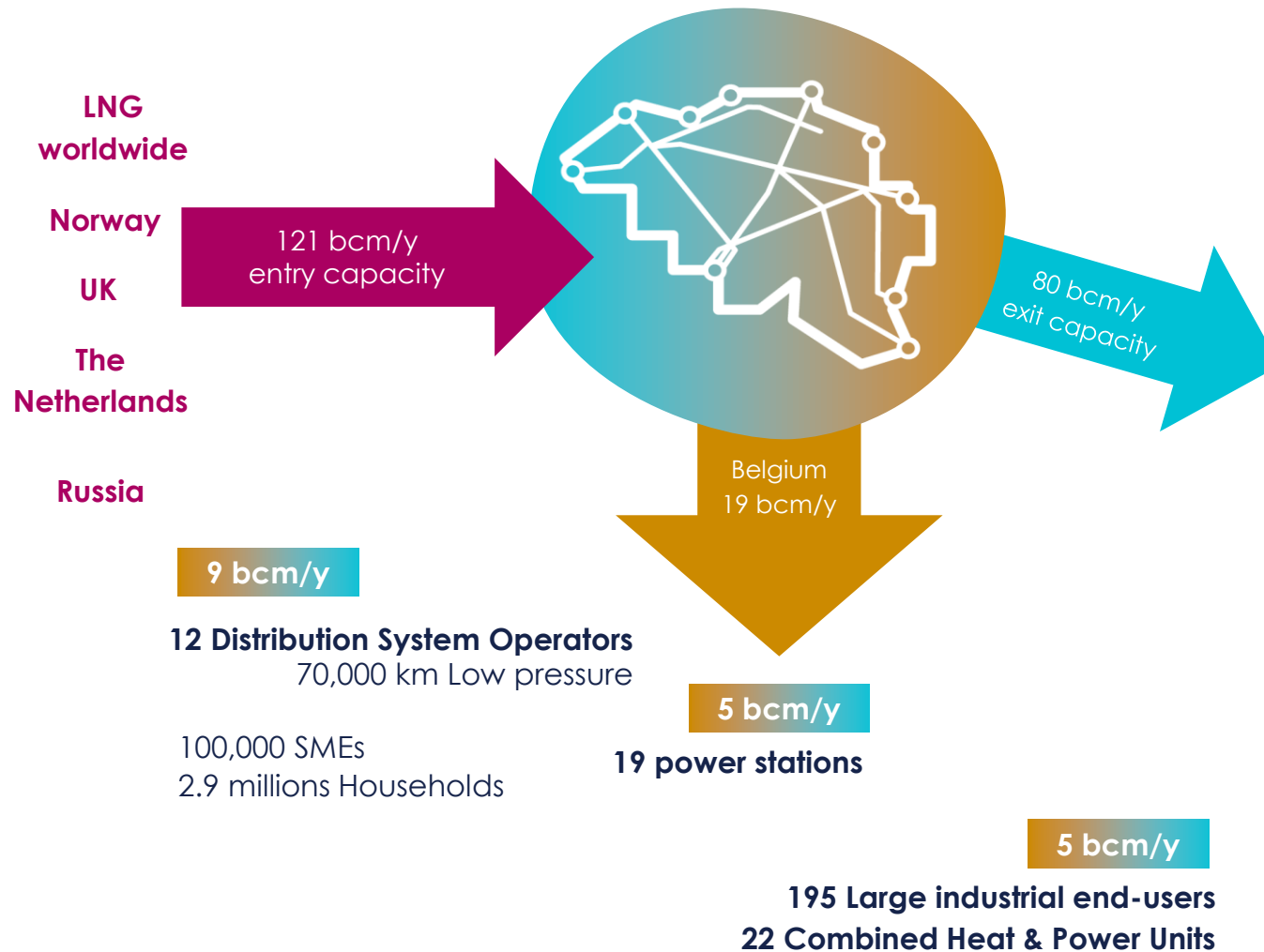


700 mcm
underground
gas storage
in Belgium



Where does our energy come from ?

Fluxys Belgium network developed key transit role



Our strategy

En route for a green tomorrow with investments in Belgium, Europe and beyond



Be fit and grow in Belgium and Europe

We optimise our operations in Belgium and Europe while growing our assets selectively in view of the low-carbon future

Be the transporter of the future energy carriers

We support biomethane initiatives, explore new technologies and invest in infrastructure to accommodate hydrogen, CO₂ and other molecules for the low-carbon future

Invest outside Europe

We target infrastructure supporting the energy transition



Key asset: transmission infrastructure

4,000 km pipelines

— High calorific gas

— Low calorific gas

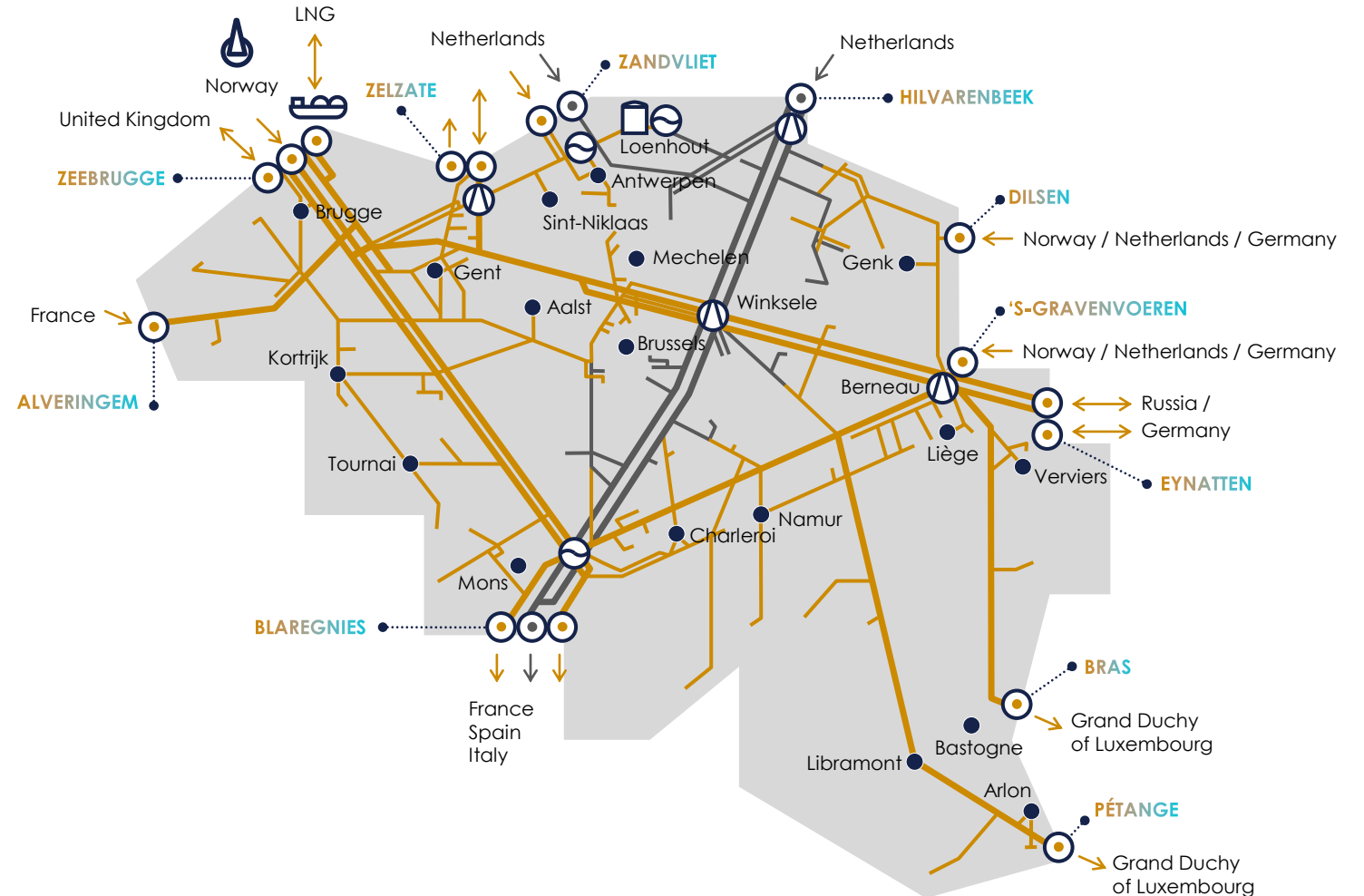
⊙ Physical interconnection points

⊔ LNG terminal

⊖ Compressor stations

⊕ Blending stations

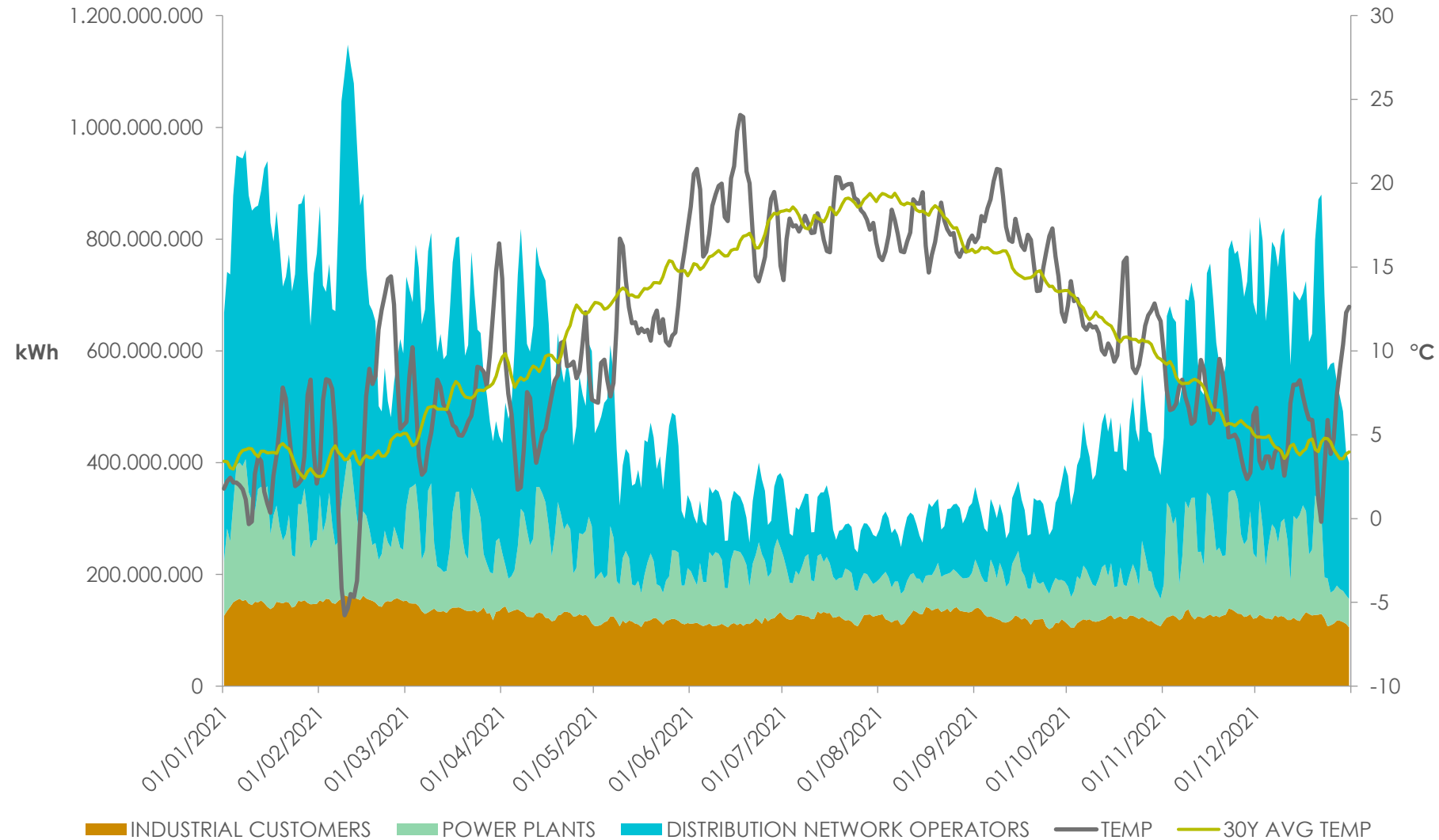
⊞ Storage



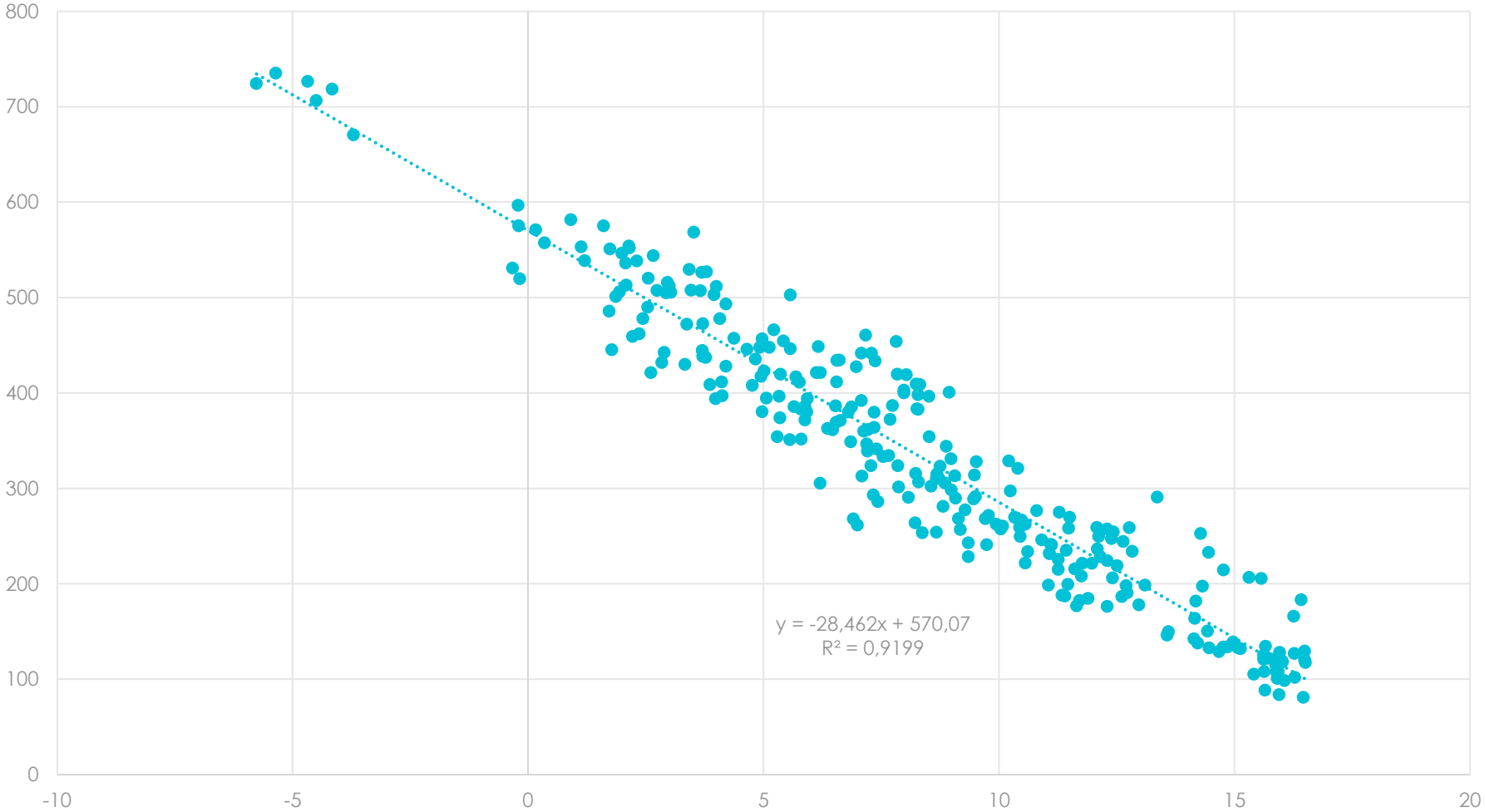
Daily Offtake Profile

Gas Consumption Evolution in Belgium 2021

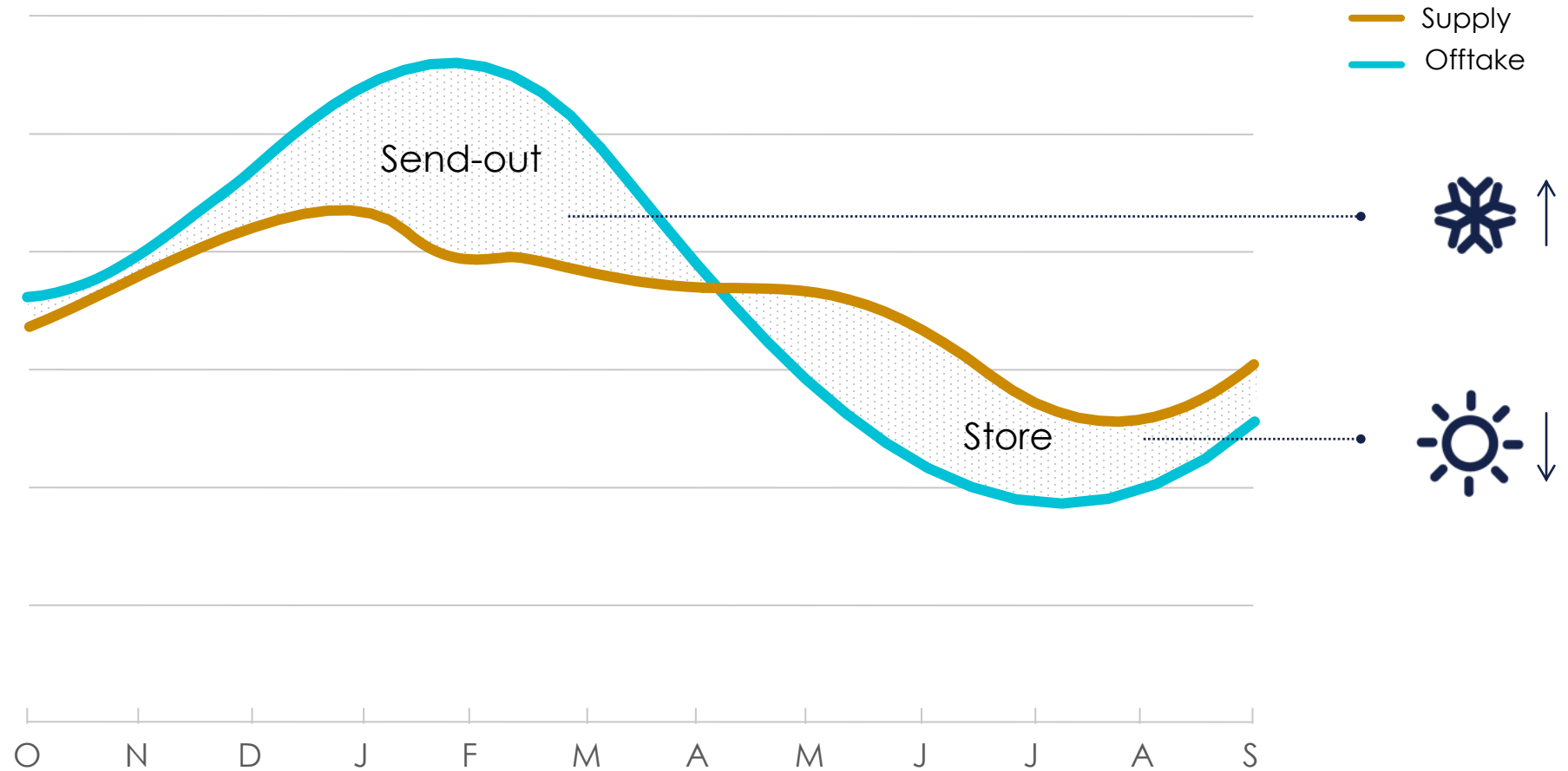
Peak/off-peak ratio DNOs:
1/13 daily & 1/20 hourly



Offtake DNO = f(equivalent temperature)



Why storage?

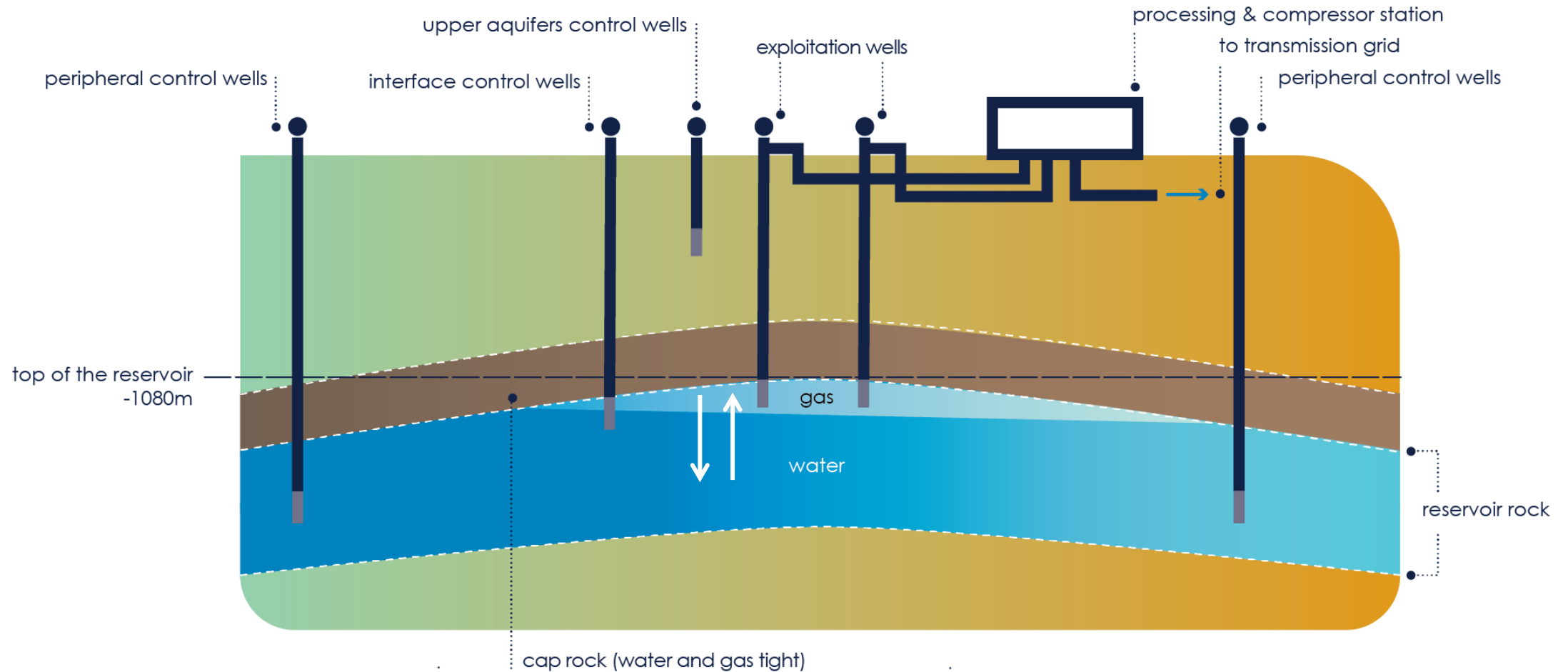


Underground natural gas storage Loenhout

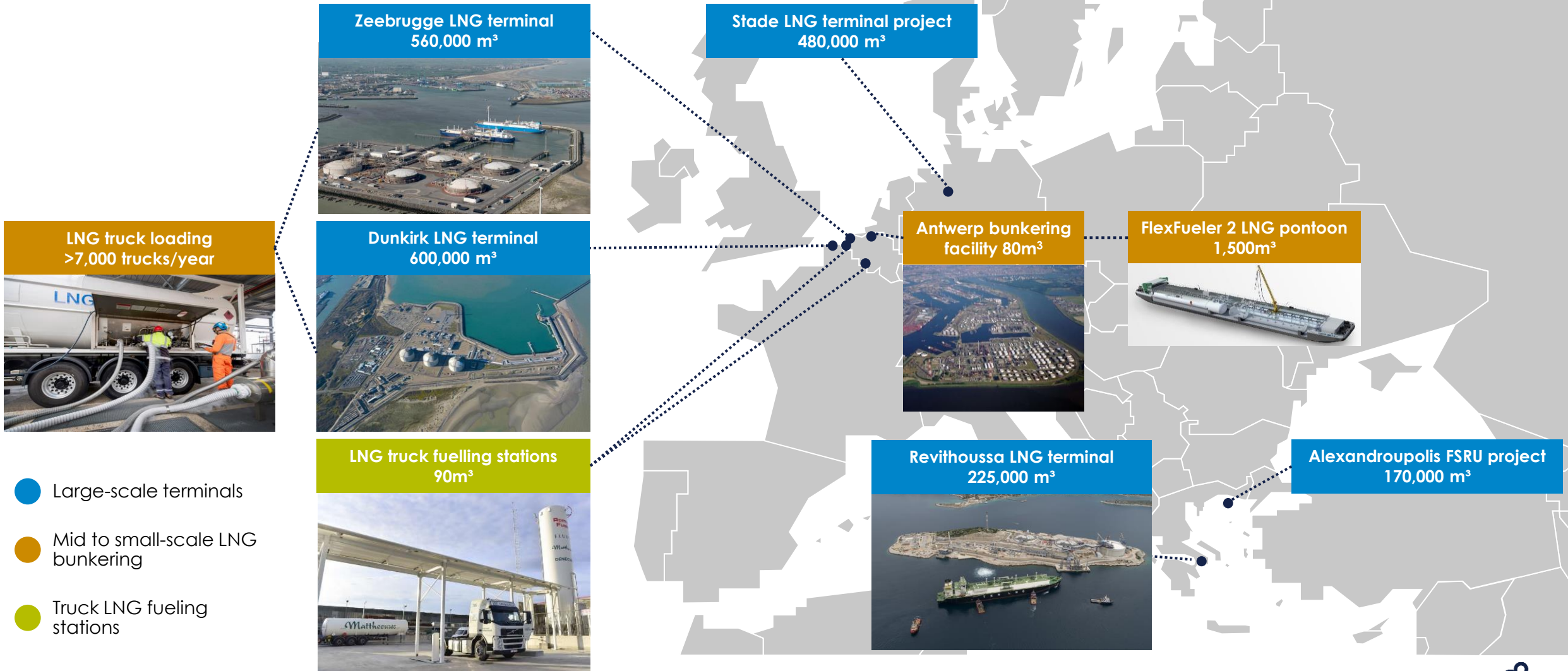
- Workable storage capacity:
750 million m³(n)
- Max. send-out:
625,000 m³(n)/h
- Max. injection:
325,000 m³(n)/h



Underground storage in aquifer: how?



Fluxys LNG assets portfolio



Zeebrugge LNG terminal in Belgium

- Commissioned in 1987 and fully owned by Fluxys
- Regulated open access terminal
- Full range of LNG services
- Fluxys centre of expertise for innovation in LNG terminalling services
- Unloading and loading of LNG vessels
(1 000 m³ to 266 000 m³ LNG)
- Storage capacity: **560 000 m³ LNG**
in 5 semi-buried full containment tanks
- Regas and send-out in the transmission grid
1 700 000 m³/h **(9 bcm/y gas throughput capacity)** and 4.5bcm/y under development
- **2** truck loading bays
- Access to European railway network
- ISCC certification for bio-gas to bio-LNG conversion



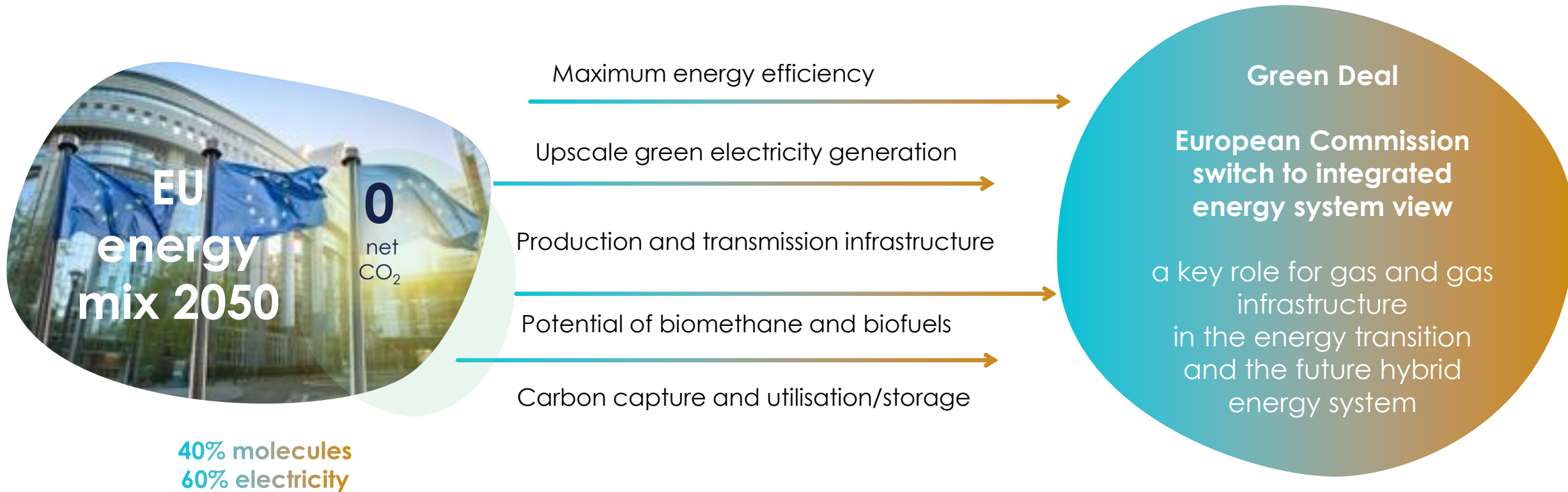
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1. Natural gas in a nutshell
2. Fluxys
- 3. Energy transition**



Fluxys fully support Europe's plan and roadmap to become the first carbon-neutral continent by 2050 and making the Green Deal a reality



And we are convinced that Fluxys, as energy infrastructure company has several assets to help shift to a net-zero energy system with a robust energy mix

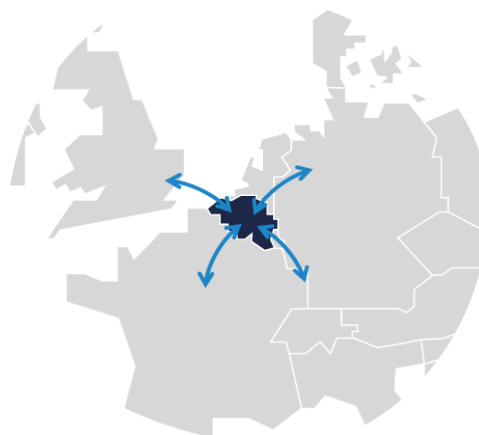
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highly **interconnected** infrastructure with 1/4 of the European consumption landing in Zeebrugge



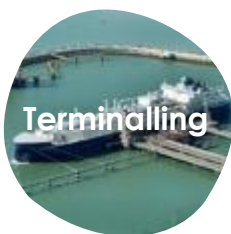
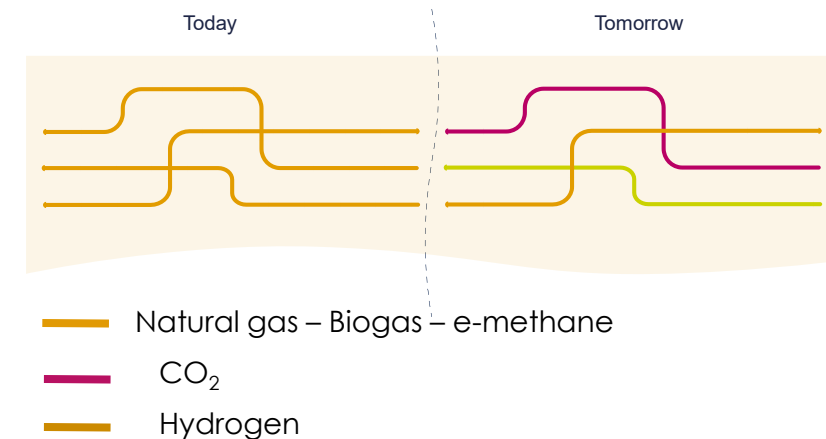
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Belgium = **heart** European crossroad with 4 pipelines arriving in Zeebrugge as potential future connectors for importing energy

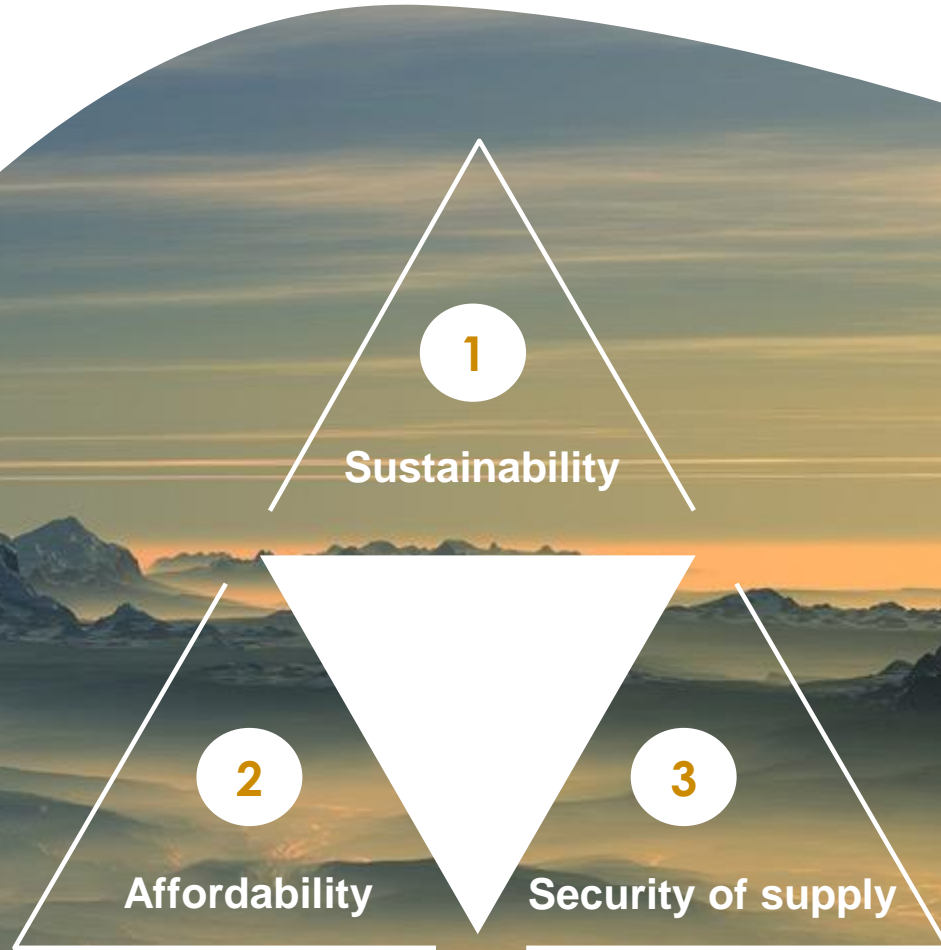


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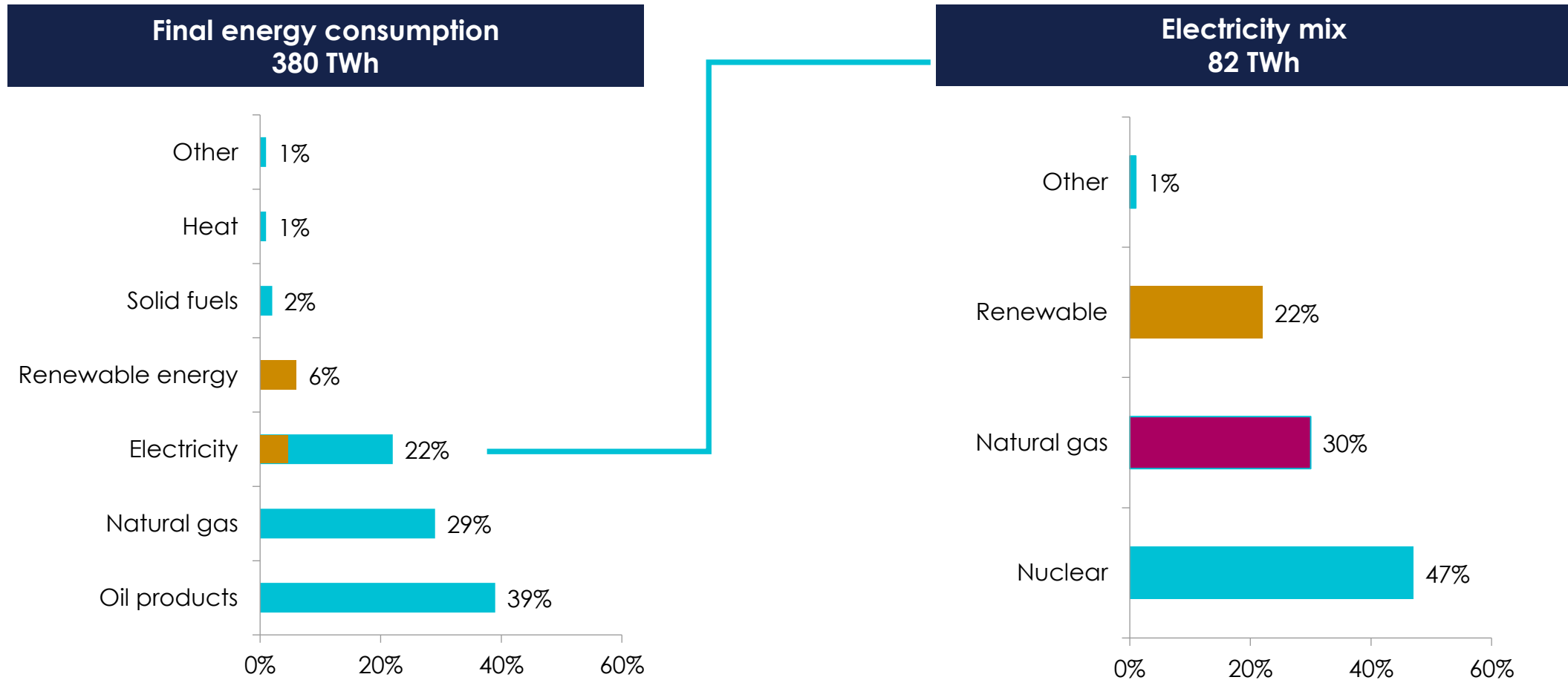
versatile infrastructure with high repurposing potential



Always 3 important variables to keep in balance



A zoom on the energy consumption in Belgium

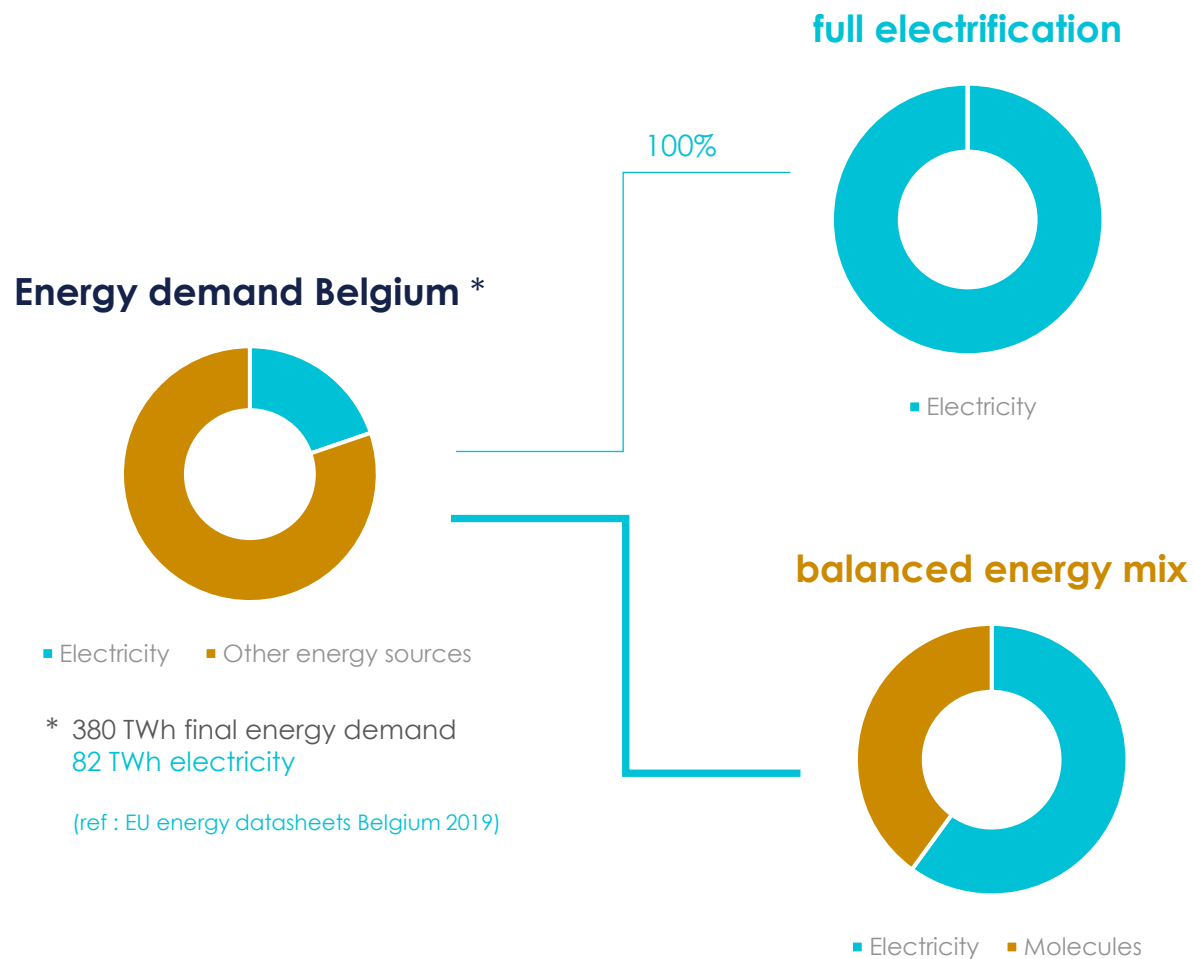


[EC DG Energy update June 2021 – year 2019]

[EC DG Energy update June 2021 – year 2019]



We stand behind a robust energy mix that comprises both electrons and carbon neutral molecules to meet all energy needs



Very challenging

- Crucial industrial sectors and heavy-duty transport cannot be electrified
- Sun & wind not always present

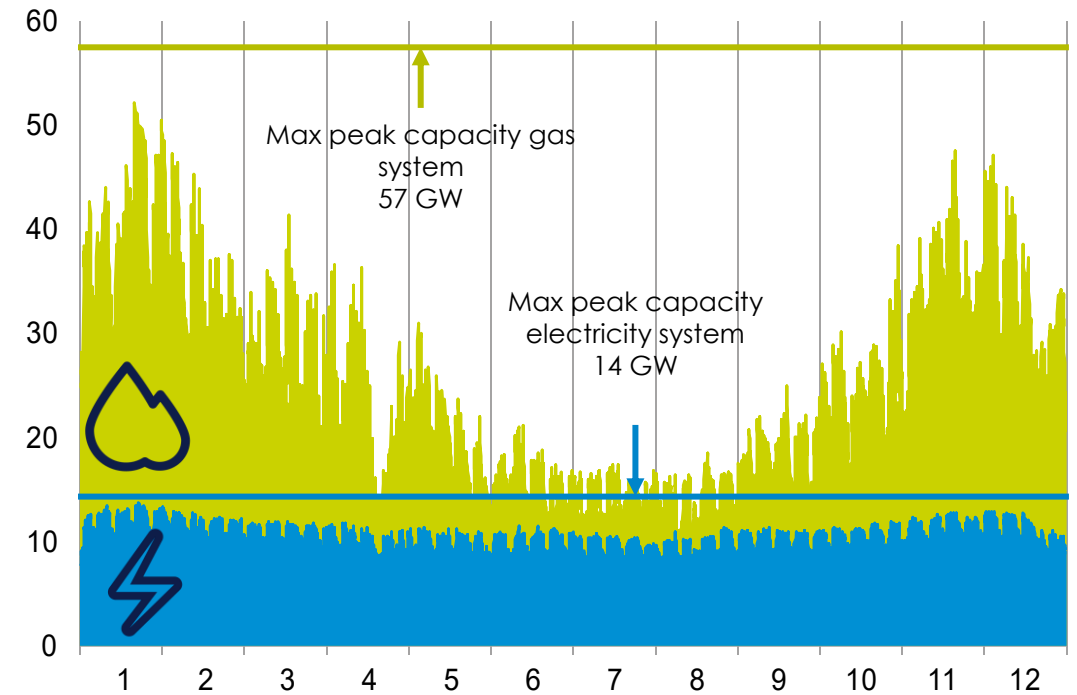
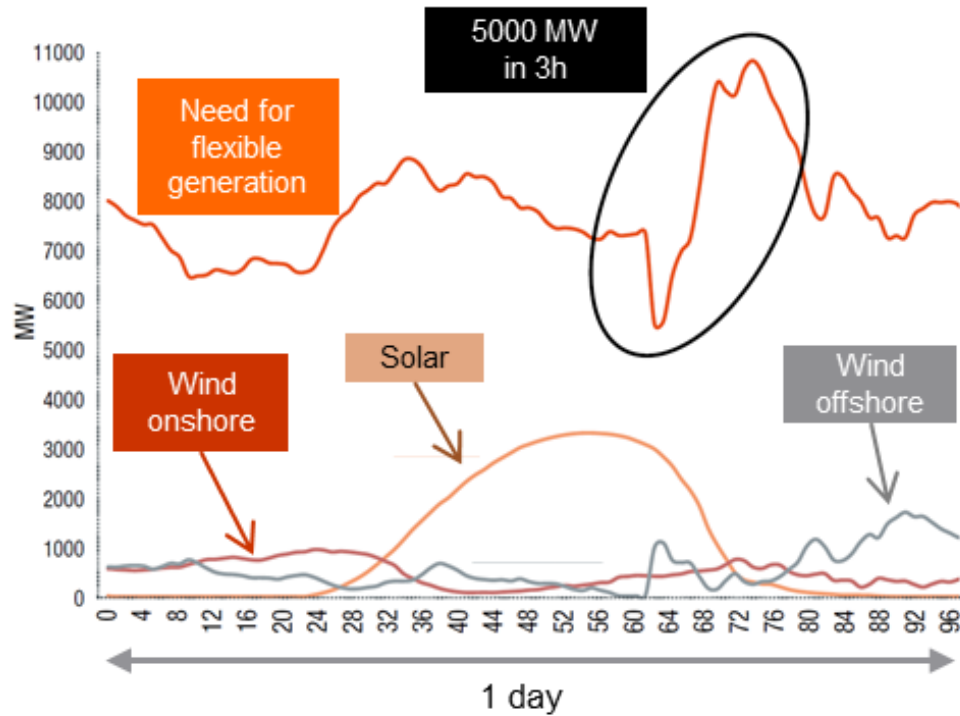
A balanced energy mix

- Molecules are clean, versatile and most suitable as feedstock, energy vector, large-scale storage and transport
- Molecules essential for a balanced energy system

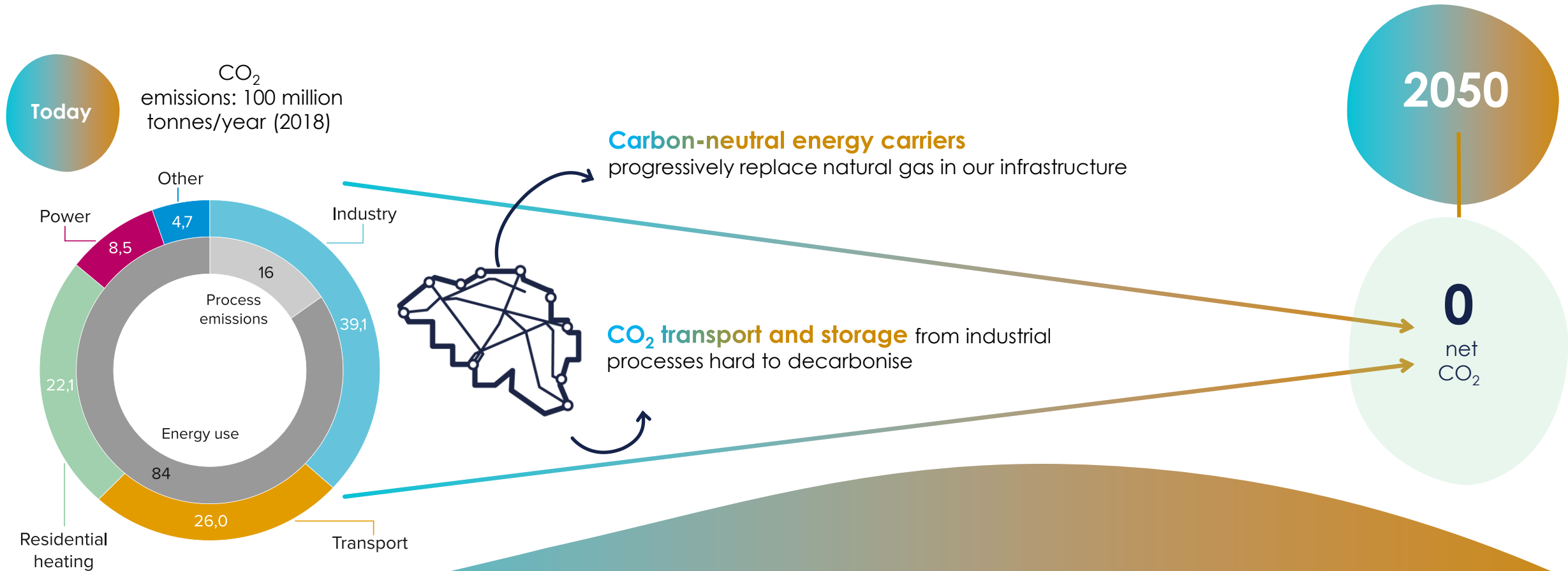
Hydrogen	Ammonia	Methanol	Synthetic methane
H_2	NH_3	CH_3OH	CH_4



Gas system to provide the flexibility required

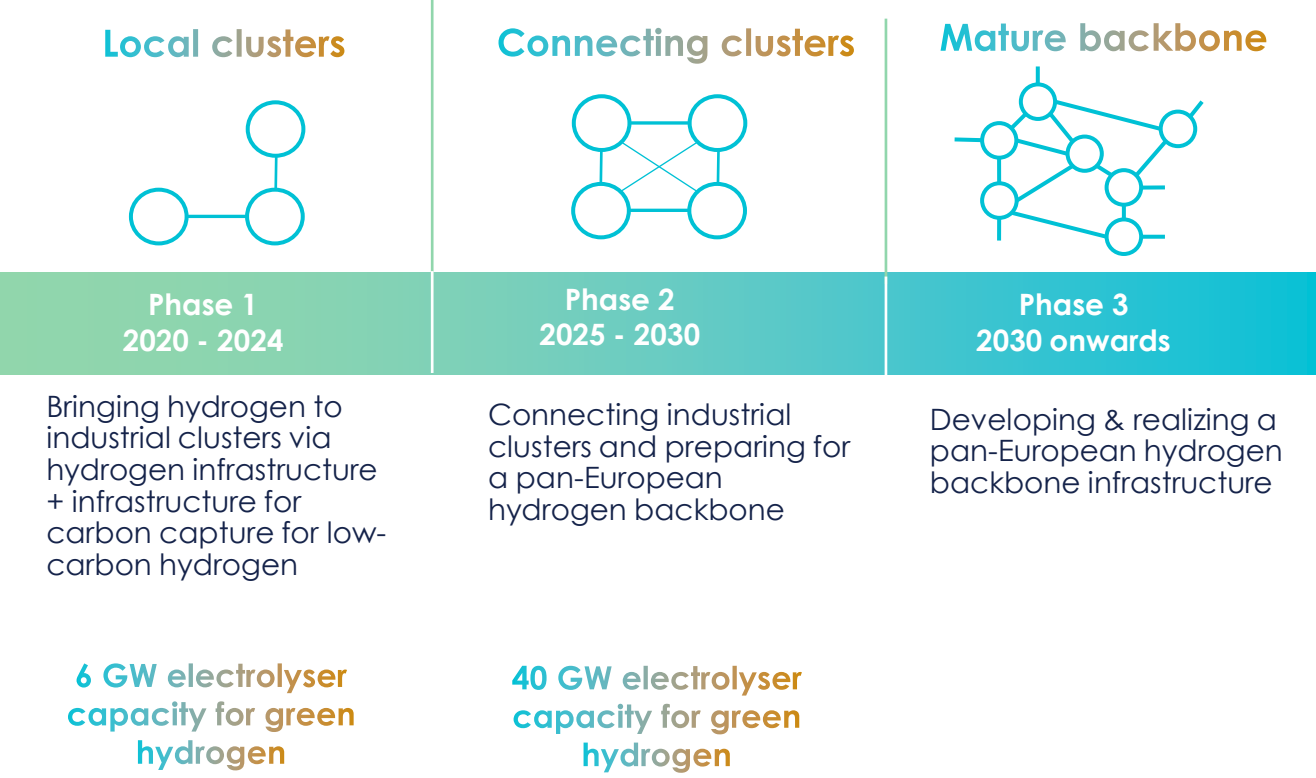


With our infrastructure we can contribute to the decarbonisation



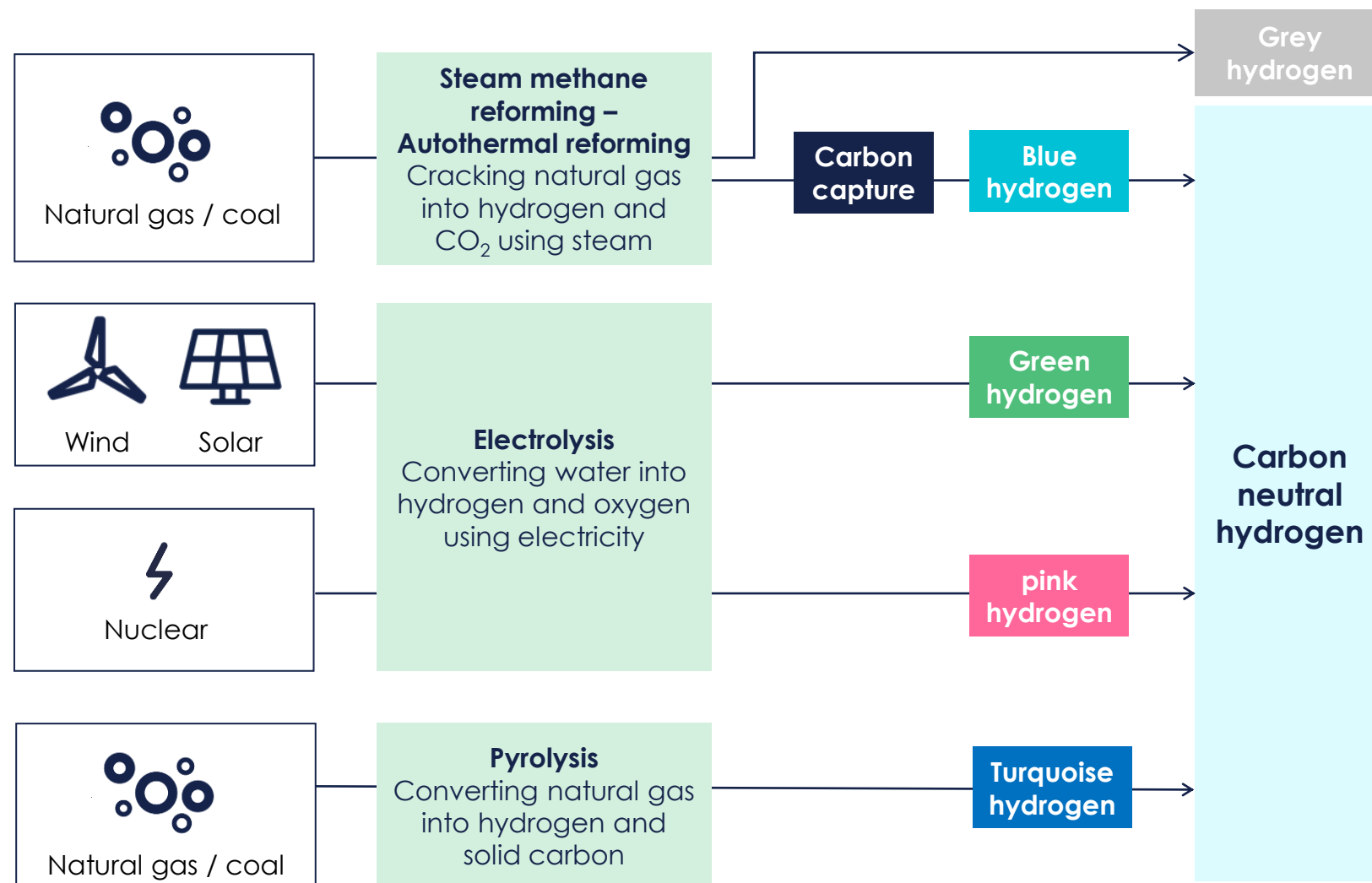
Natural gas = key energy bridge to a carbon-neutral society

Our proposal : in line with European approach to develop progressively hydrogen infrastructure

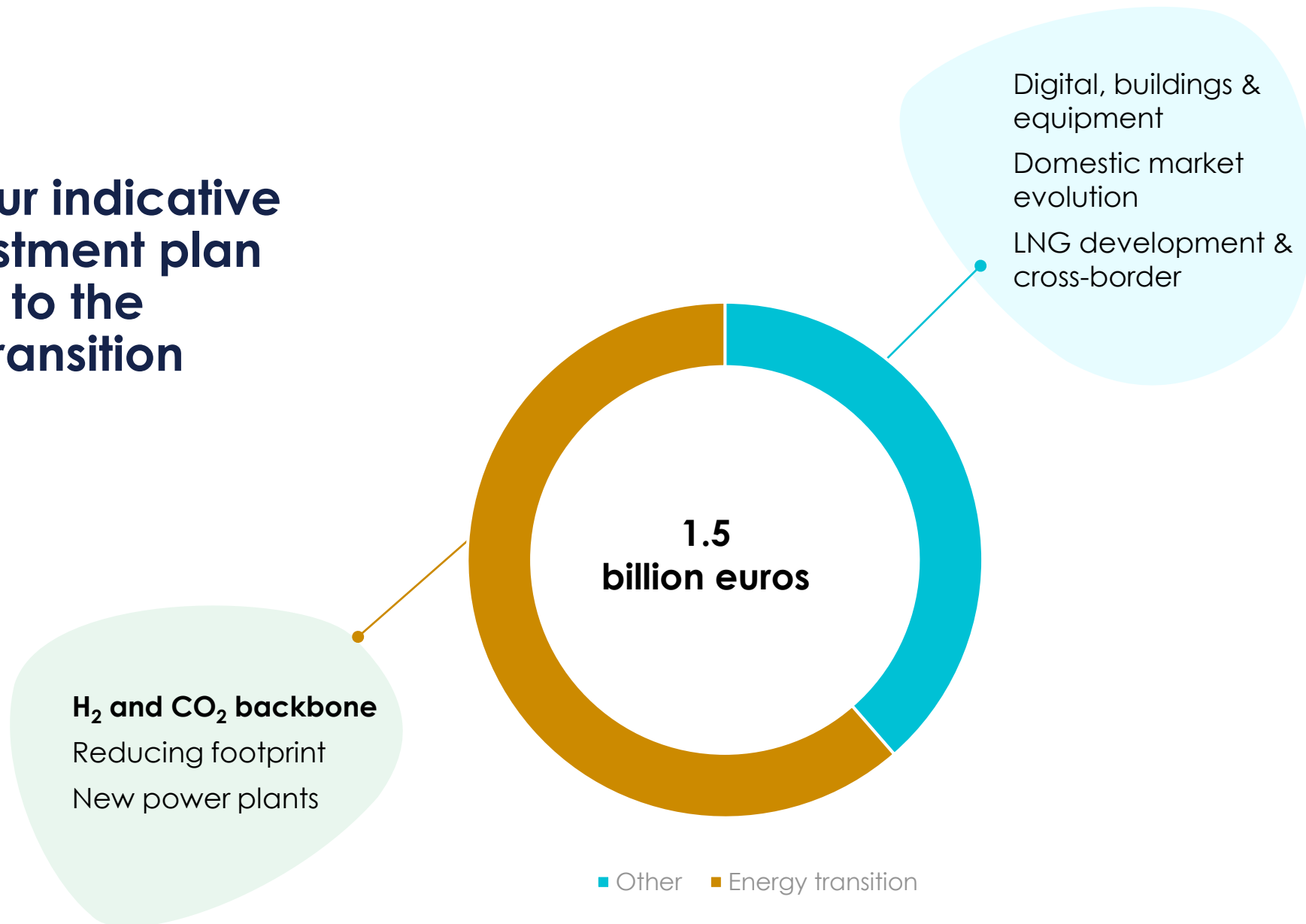


Natural gas has an added value in a transition period to bridge our energy needs and to produce blue hydrogen

+ the different colours of hydrogen



**60% of our indicative
10y investment plan
targeted to the
energy transition**



Meanwhile we see the urgency to act and embrace decarbonisation as one of the biggest opportunities for Fluxys

Dec 2020

Development of H2 and CO2 infrastructure vision for Belgium

In line with **Federal hydrogen strategy**

Supported by **the European hydrogen backbone**

Mar 2021

Assess industrial appetite for H2 and CO2 infrastructure

More than 150 industrial sites show **interest**

Jan 2022

Market reach out becomes more concrete with H2 and CO2 infra plan per cluster

Forward

Anticipating binding commitment

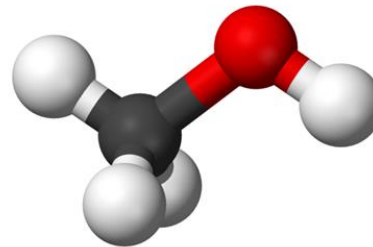


Carbon capture utilization & storage infrastructure besides Hydrogen infra is paramount

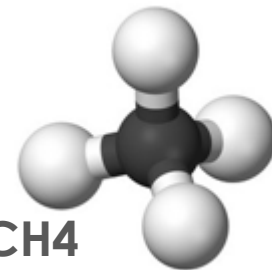


Produced CO₂ can be **captured stored** or **reutilised** in products like polymers and steel. It can be recombined as well to green hydrogen to produce **green molecules**.

Methanol - CH₃OH

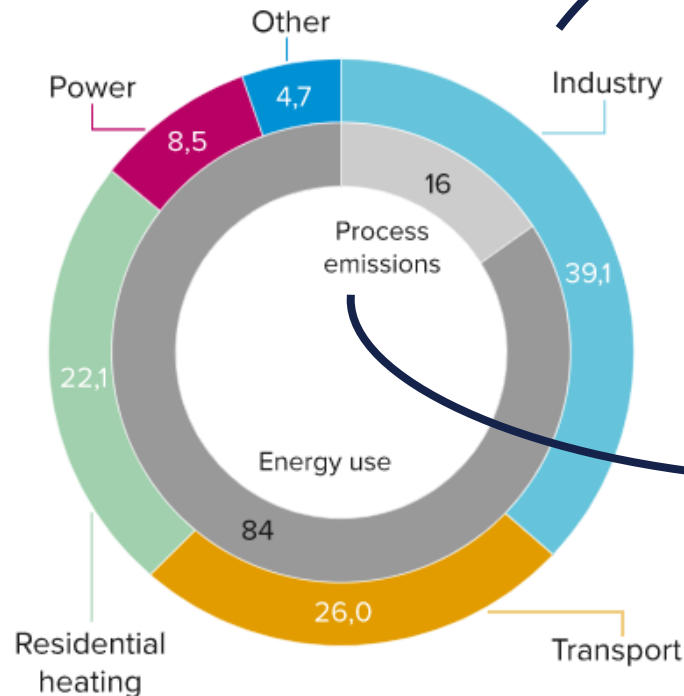


Synthetic methane – CH₄



Starting with the industry

Belgium :
100 mt/y CO₂ emissions



Belgium: breakdown of carbon emissions in 2018 in million tonnes

(Source: climat.be / klimaat.be)

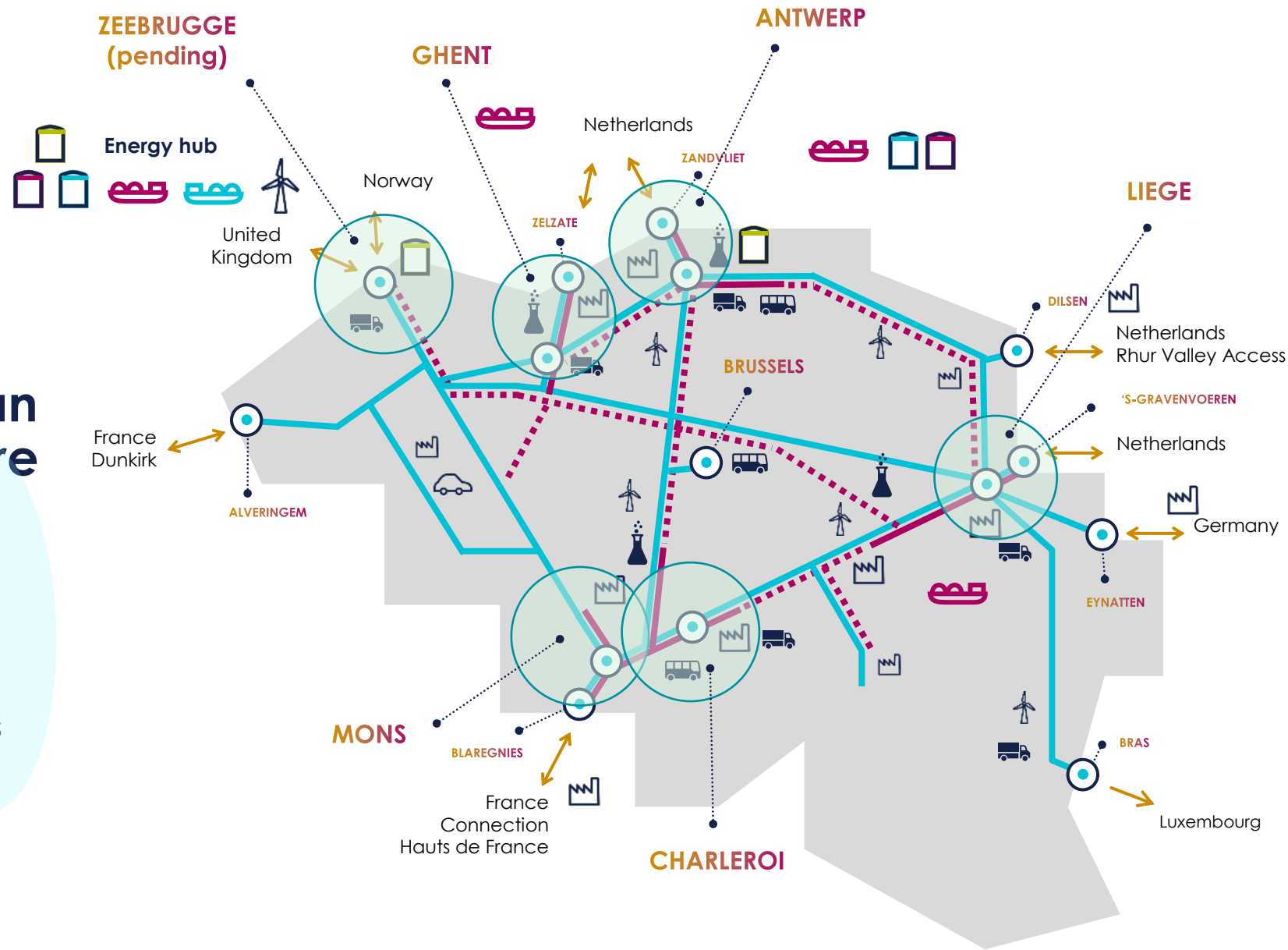
A range of industrial processes requires high temperature heat for which (carbon-neutral) **electricity is not an option**. Connecting these industries into **hydrogen** supply enables them to switch to a **carbon-neutral alternative**..

Carbon capture and re-use/storage is considered to be a key technology for reducing carbon emissions and creating clusters for circular re-use of carbon in the production of e.g. carbon-neutral biofuels. The technology is especially important **for hard-to-abate sectors** with processes inherently generating carbon emissions. Offering transport of captured carbon to destinations of re-use or storage is key to this solution.

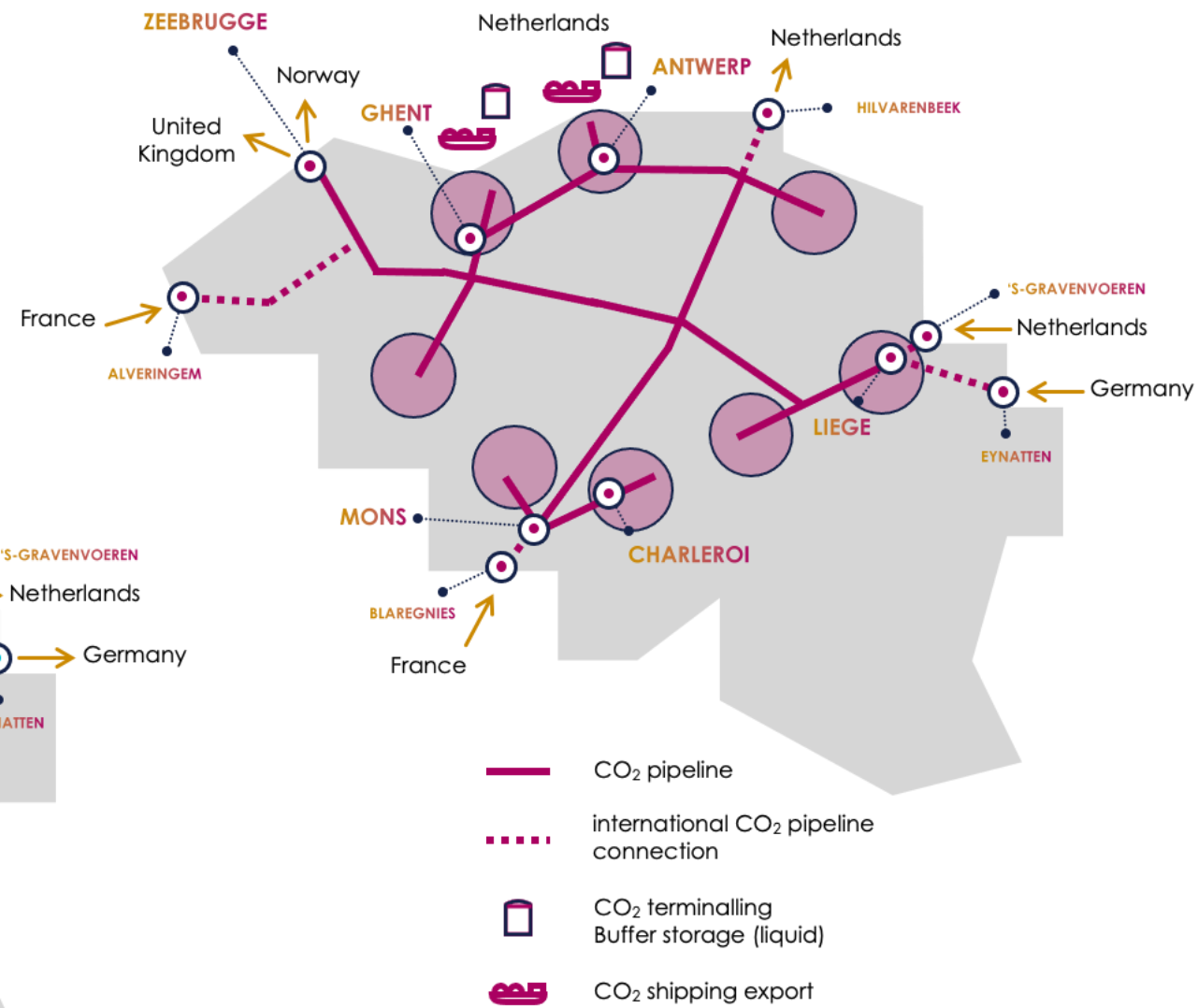
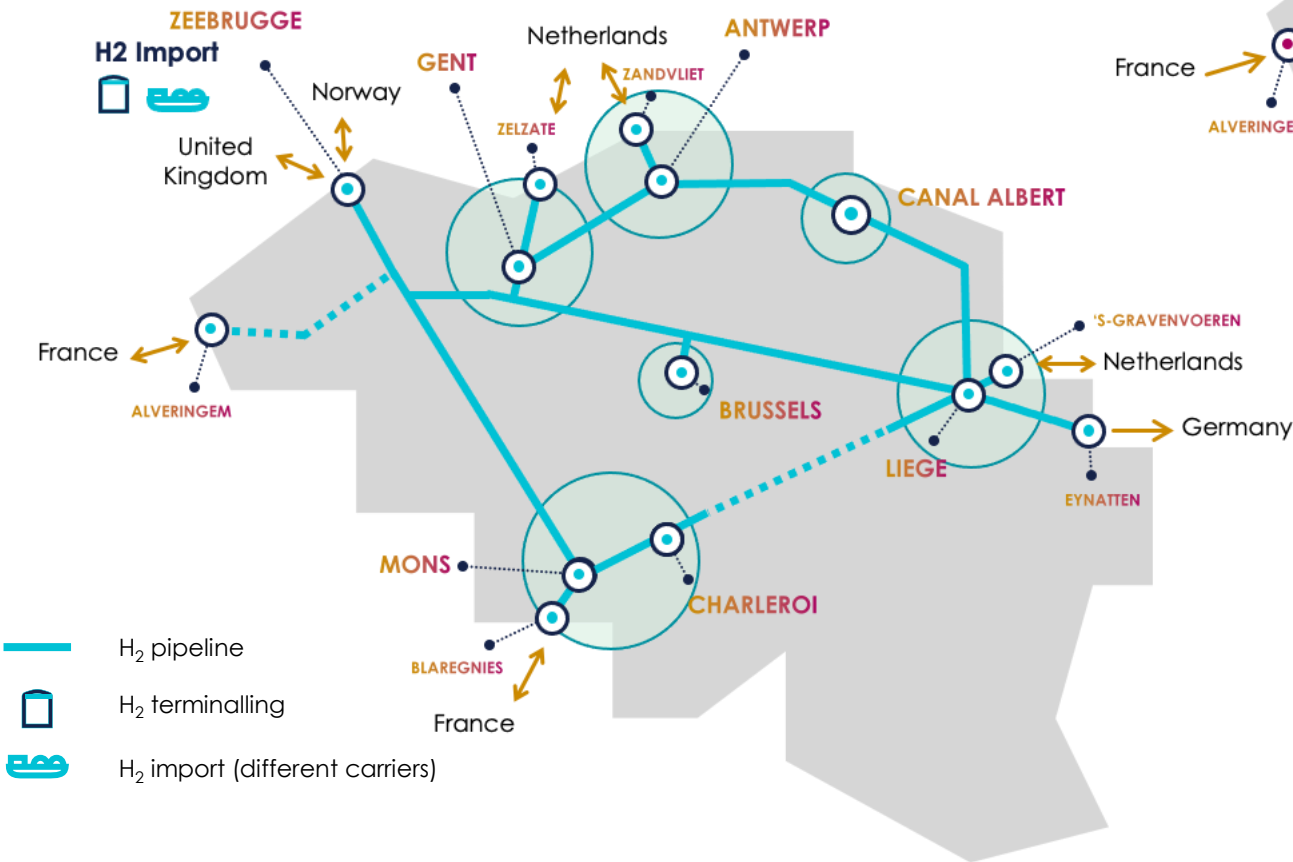


Fluxys ambitious vision for the Belgian energy infrastructure

Open access to infrastructure crucial for emerging markets

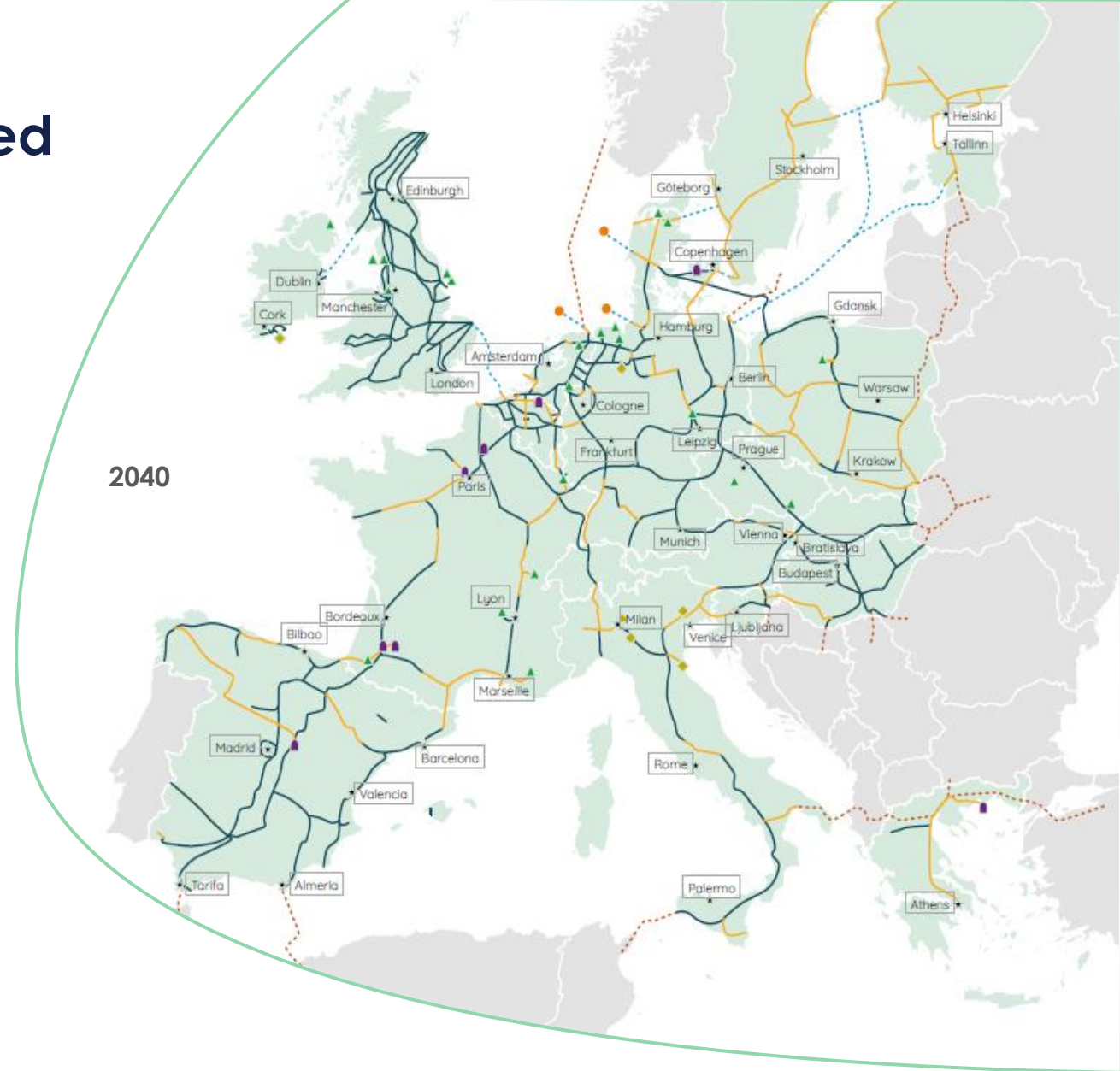


Whith CO₂ and H₂ infrastructure up & running in the coming years



With cross-borders connections linked to European hydrogen backbone

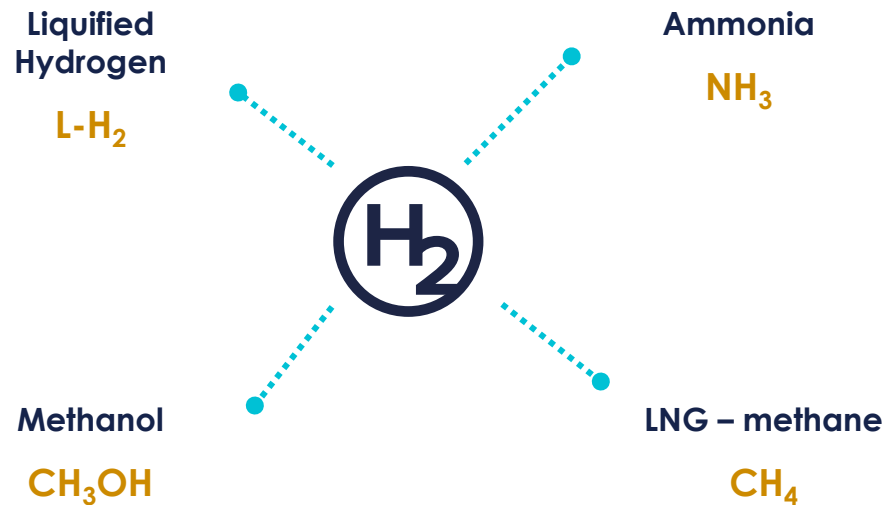
- **Vision 2030-2035-2040** developed by 31 TSOs from 28 countries in line with EU hydrogen strategy
- **Fluxys key promotor** of vision and proposed H₂/CO₂ backbone Belgium integral part of EU backbone



Source : Extending the European Hydrogen Backbone – a European hydrogen infrastructure vision covering 27 countries, April 2021

With the import of low carbon molecules from outside EU likely to become necessary

Wind and sun rich regions outside Europe
hydrogen export through different carriers



A hydrogen import coalition demonstrating the technical and economical feasibility of imports

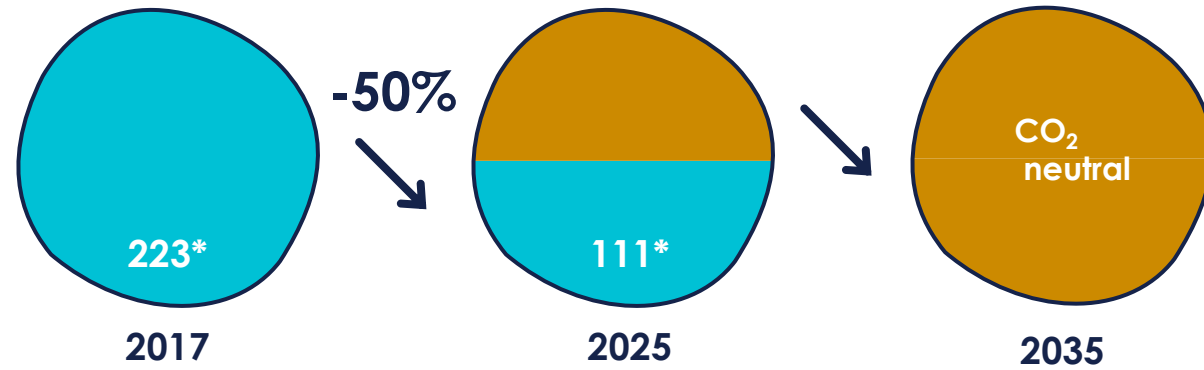
- **Extensive logistics chain analysis** for several regions with promising conditions for efficient hydrogen production
- **Most promising low-carbon energy carriers for hydrogen:** ammonia, methanol and synthetic methane



With the Zeebrugge terminal as a hub for low-carbon molecules



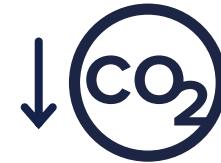
And at the same time
working on our own
footprint



How?



- Use state-of-the-art network equipment avoiding methane emissions
- Proactive leak detection & repair campaigns
- During technical interventions: reduce to a minimum gas release in the air



- Minimum use of gas-fired compressor facilities
- Use heat from sea water to regasify liquid natural gas at Zeerbrugge Terminal
- Use green gas for heating purpose

* in thousand tons of CO₂ equivalent

3 take-aways

1

Decarbonization
of the Belgium
economy
is our top priority

2

Our interconnected
infrastructure and
worldwide footprint as
key levers

3

An integrated
energy vision
requires
collaboration



shaping together
a bright energy
future

fluxys 