

# Building the Nordic biomethane ecosystem

**Ari Suomilammi**

Biogas PowerON  
27-28.9.2023

**Gasum**

# Gasum – a Nordic gas sector and energy market expert

We offer cleaner energy and services to help our customers to reduce their own carbon footprint as well as that of their customers.

Together with our partners, Gasum promotes development towards a carbon-neutral future on land and at sea.

Our services and solutions are used in maritime, road transport, industry and energy production.



Revenue  
**€2,722.5 million**

Balance sheet total  
**€1,947.3 million**

Personnel\*  
**321**

\*in 2022

Energy products  
**Biogas, LBG,  
Natural gas, LNG,  
Windpower, Power**

Services  
**Gas filling station network,  
Bunkering services for  
maritime transport,  
Energy Market Services,  
Portfolio Management  
Services,  
Trading services,  
Circular Economy Solutions**



Industry and  
energy production



Maritime transport



Road transport



Biogas and  
circular economy

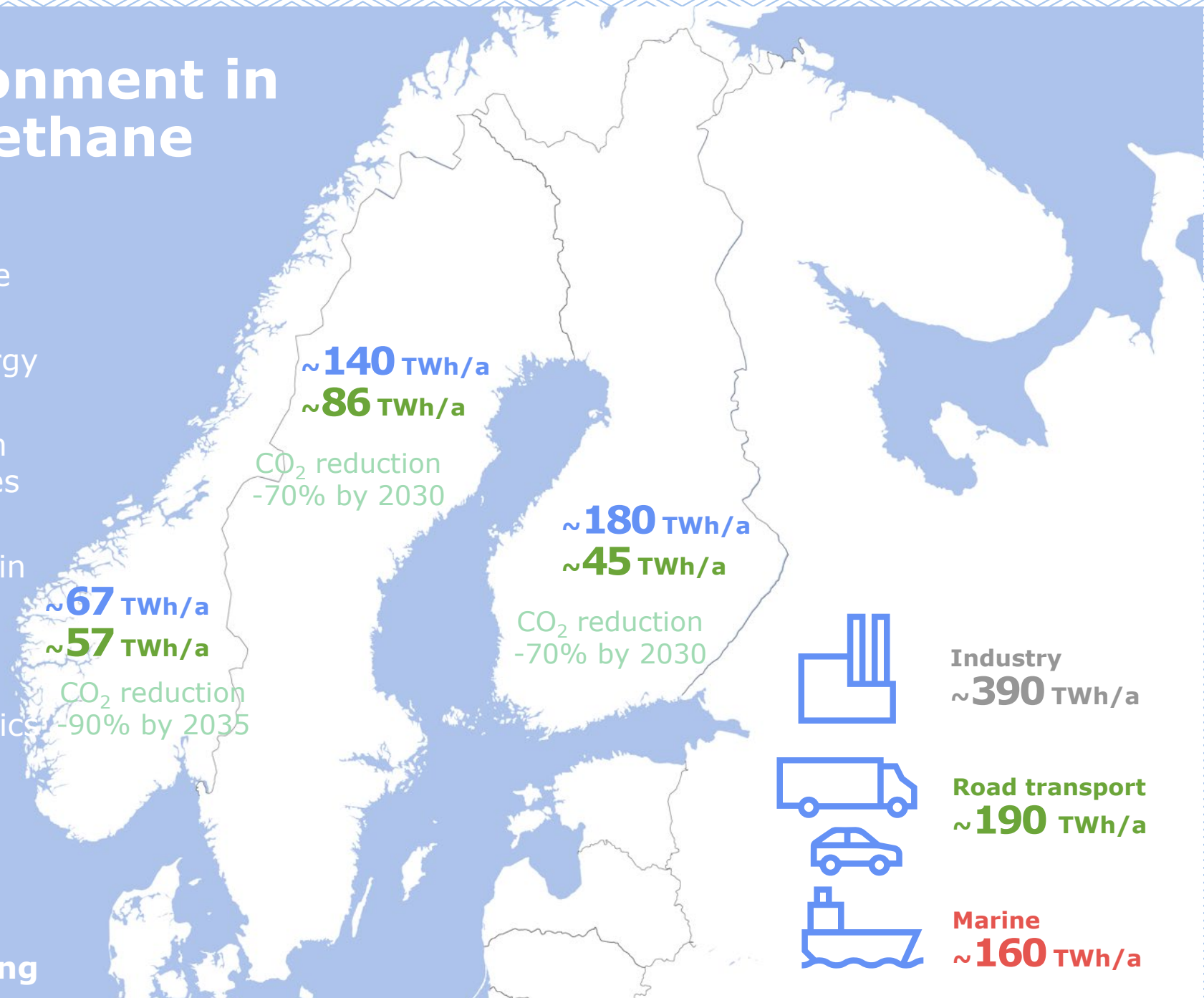


Energy market services

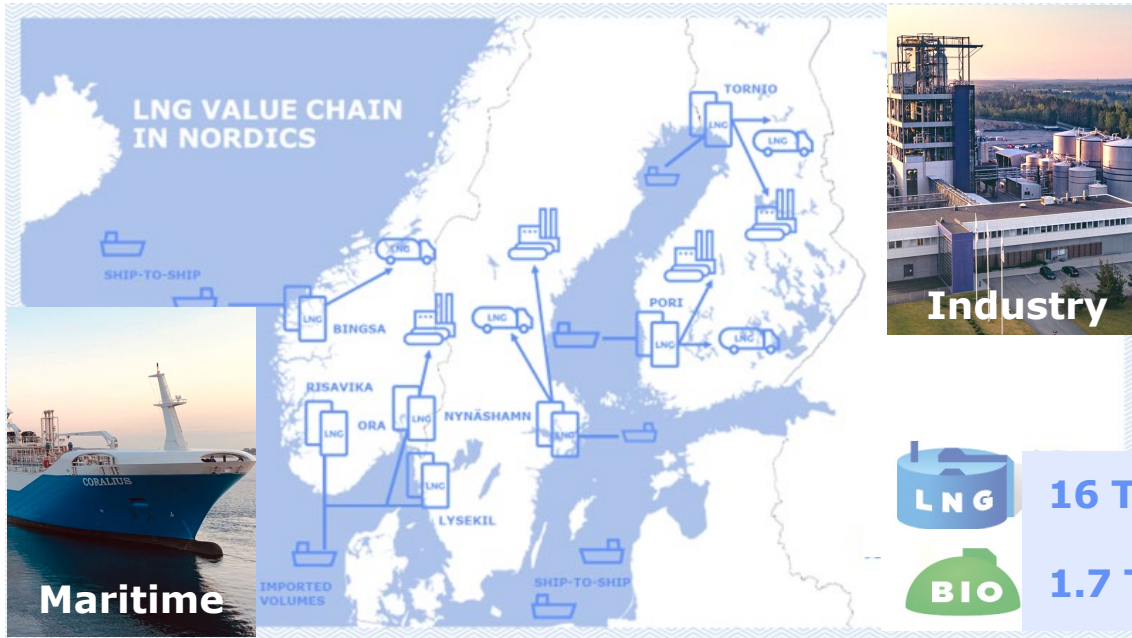
# Operating Environment in the Nordic Biomethane Ecosystem

- Actions are required to achieve environmental targets
- Demand for low emission energy solutions is a new standard
- Some incentives are already in place, right mechanism enables transition
- Geopolitical situation and war in Ukraine is putting additional pressure on gas deliveries to Europe
- Huge market potential in Nordics with total energy consumption 750 TWh/a

**Demand for biomethane is rapidly increasing and European markets are merging**

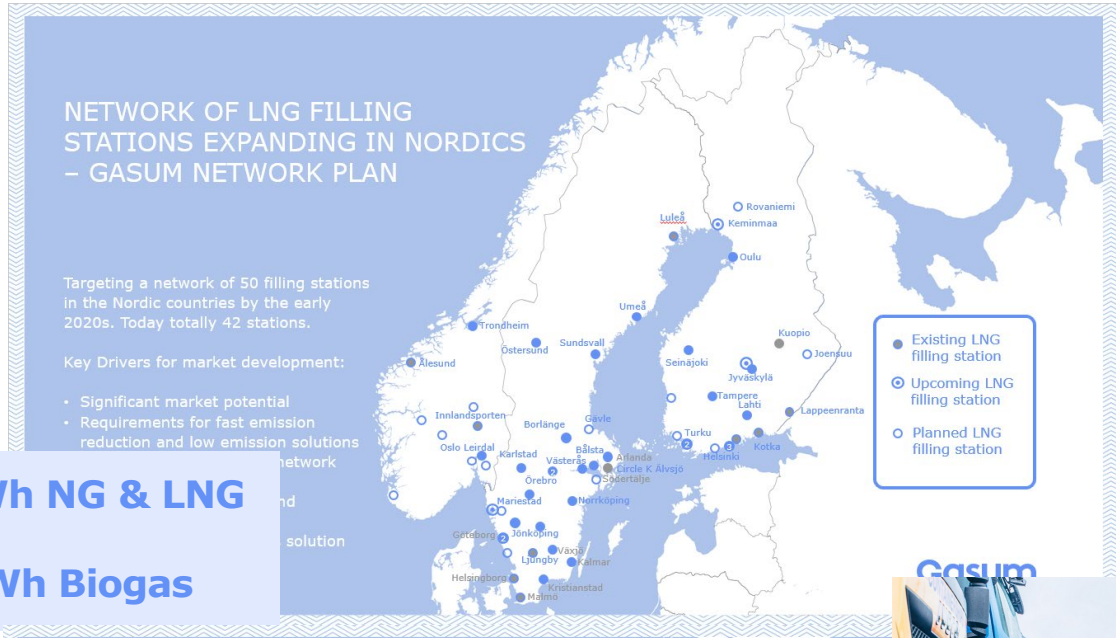


# The Gas Ecosystem serving Market Growth



**16 TWh NG & LNG**

**1.7 TWh Biogas**



- 7 LNG-terminals
- 5 Bunkering vessels
- 17 Biogas plants, 3 partner plants
- 1 (+4) Biogas plants under construction
- More than 100 gas filling stations

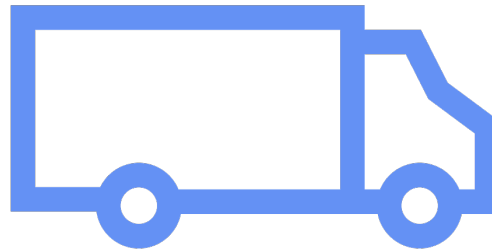


# Gasum's Biomethane 2022 in numbers:

## 1.7 TWh

of biomethane delivered to customers including **775 GWh** of Gasum's own production.

That's **65,700** times around the globe in a gas-powered car or **170,000** homes heated for a year.



## 1 million tons

of different types of waste (**biowaste, manure, sewage sludge**) managed through biogas production process.

That's

## 20,000 truckloads

of waste.

At the same time, we produced

## 940,000 tons

of recycled nutrients.

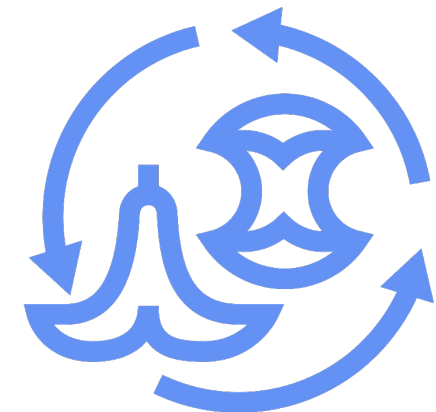
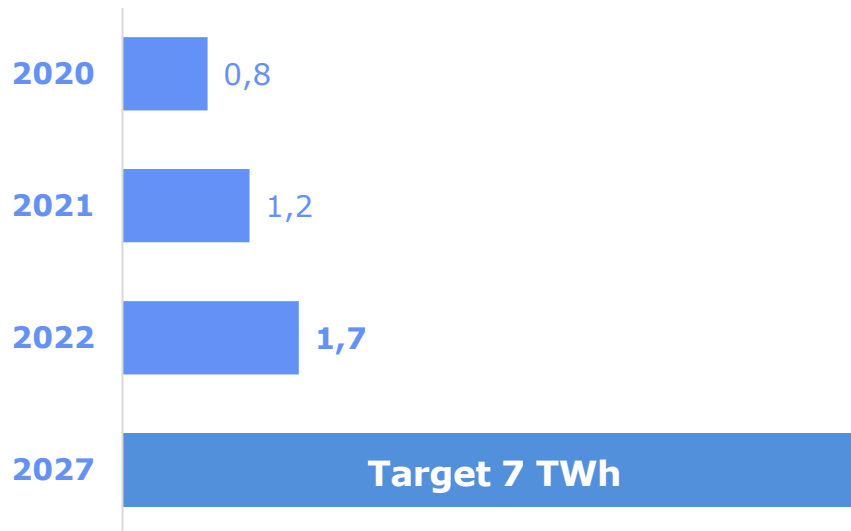
## 444,000 tons

of CO<sub>2</sub>eq emission savings for our customers with biogas. This equals the carbon footprint of about **65,000** average EU citizens.

Our goal is to reach a cumulative reduction of **1.8 million tons** of carbon dioxide emissions by 2027.

444,000

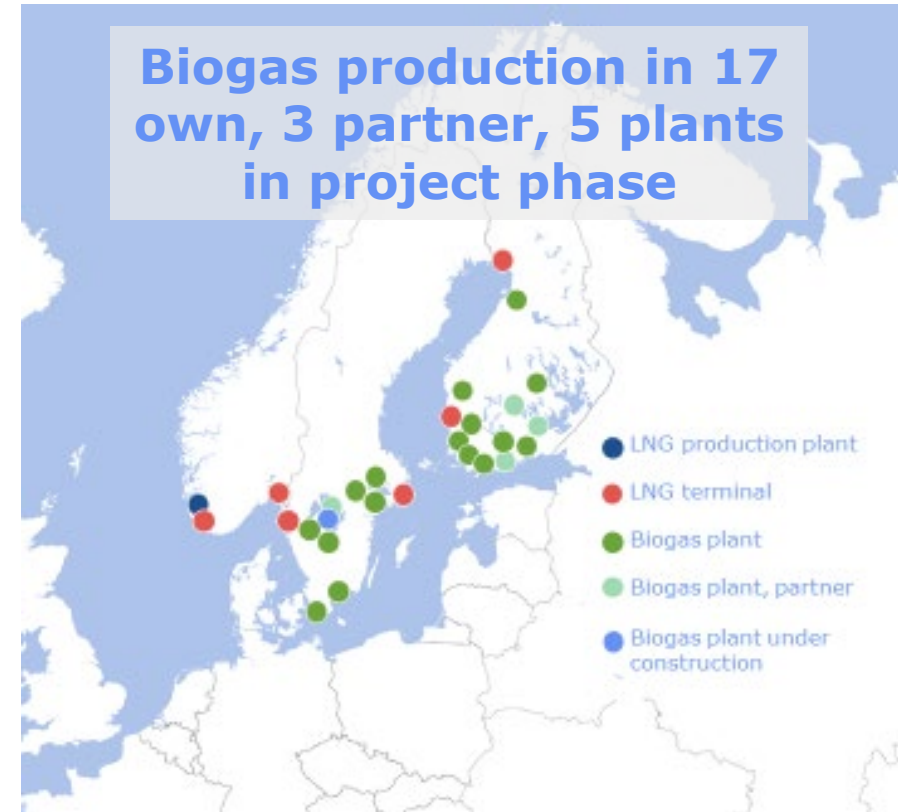
Target 1.8 million





# Biomethane Production in the Nordics 2015 - 2021

- Realistic feedstock potential 40 TWh in the Nordics (maximum 75 TWh)
- Biogas production in Nordics added up to approximately 11 TWh in 2021 (more than double since 2015)
- Fertilizer and nutrient recycling through re-use → non-existent market

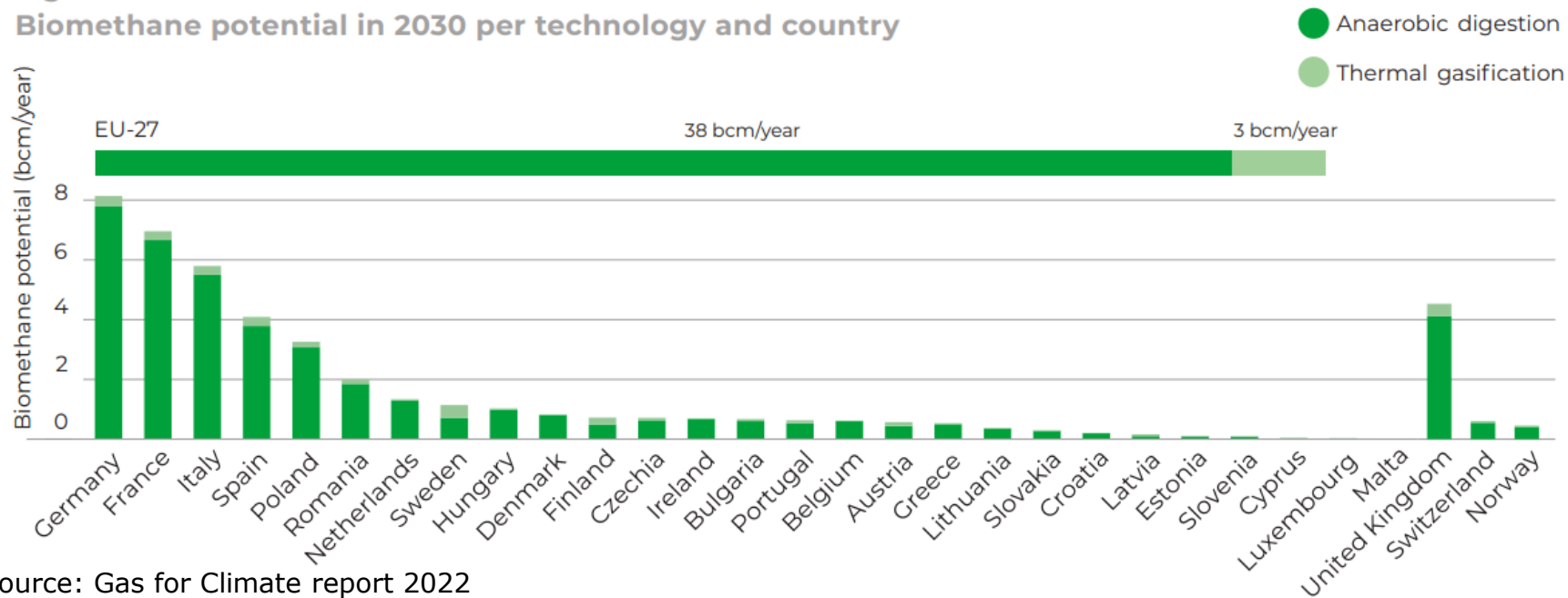


Year/GWh	Finland	Norway	Denmark	Sweden	Nordics	EU
2021	907	700	7 279	2 266	11 152	196 000
2020	987	1 000	5 939	2 161	10 087	191 000
2019	630	400	4 509	2 111	7 650	166 000

Reference: European Biogas Association (Values reported as GCV)

# DEMAND FOR BIOMETHANE IS INCREASING AND REQUIRES MORE FEEDSTOCK

**Figure 1.**  
Biomethane potential in 2030 per technology and country



Source: Gas for Climate report 2022

## Feedstock:

- Techniques are not developed enough to economically collect all potential feedstock
- Biowaste utilization needs to be increased
  - In Europe ¼ of biowaste is not utilized as compost or biogas
- Increased international competition in feedstock requires new approaches

**Teaming up to achieve 35 bcm of sustainable biomethane by 2030**



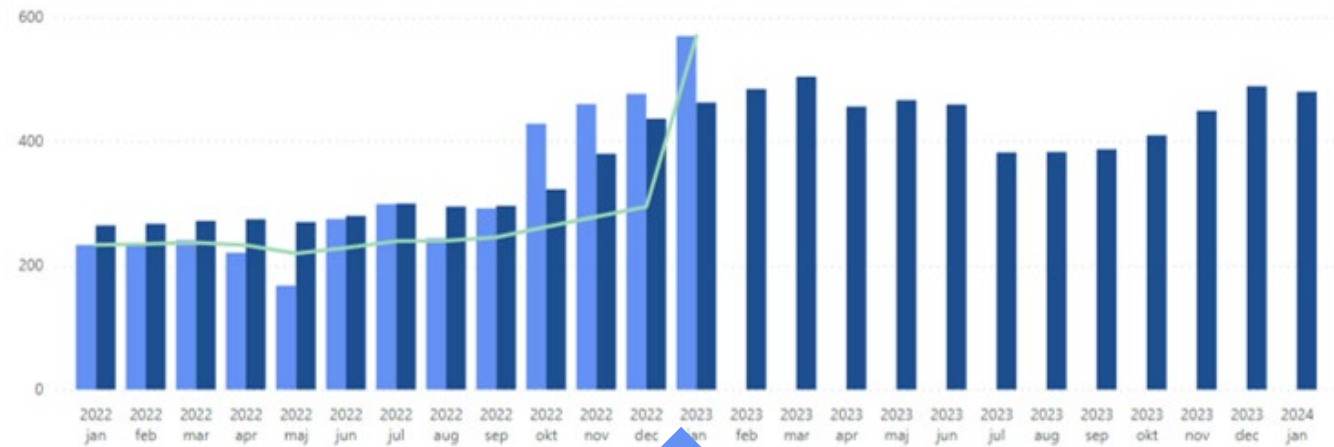
# Feedstock is the main biomethane cost driver

Energy market changes affects directly to the feedstock value/price

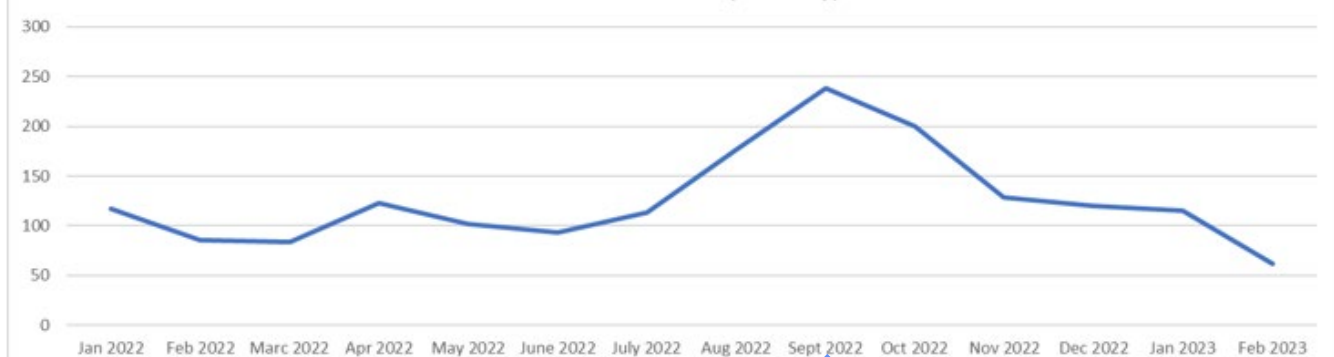
- Transport cost from fuel price
- Gas value from TTF
- Gas value from Certificate markets
- Digestate cost/revenue from nutrient value

Competition on feedstock has become fierce

Feedstock cost, actual and forecast

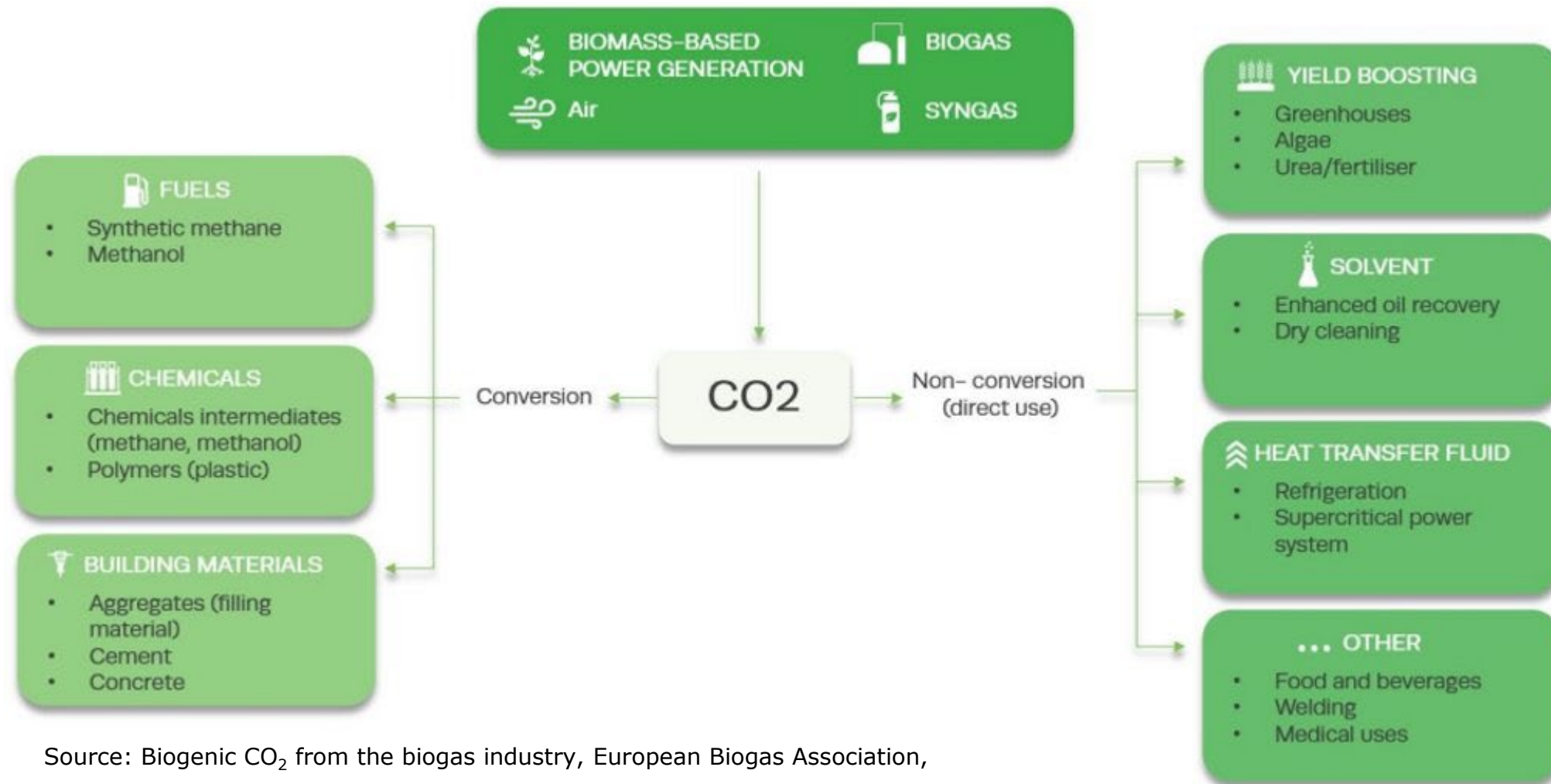


ICIS Heren TTF MA (monthly)





# Use of carbon dioxide potential – various possibilities



Source: Biogenic CO<sub>2</sub> from the biogas industry, European Biogas Association,

# Gasum



## CO<sub>2</sub> POTENTIAL OF GASUM BIOGAS TODAY

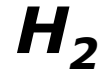
All CO<sub>2</sub> in produced biogas: 114 000 tn/a

- 40 000 tn/a at > 95 % CO<sub>2</sub> conc.
- 64 000 tn/a at ~15 % CO<sub>2</sub> conc.
- 10 000 tn/a – no current CO<sub>2</sub> stream (no upgrading)

\*Note that potentials are indicative maximum potentials – actual production is depending on operation, own biogas use etc.

- Gasum biogas plant
- Gasum upgrading plant
- Gasum biogas plant under construction

# OPTIONS FOR CO<sub>2</sub>?



Gasum

CO<sub>2</sub> to methane

CO<sub>2</sub> use, no carbon storage

**Direct uses:** Food industry uses, industry uses  
**Raw material for:** plastics, proteins, feeds, drop-in fuels, fertilizers, chemicals

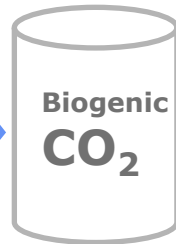
CO<sub>2</sub> use, carbon stored

**Raw material for:** Concrete curing, insulation materials, slag processing

CO<sub>2</sub> storage

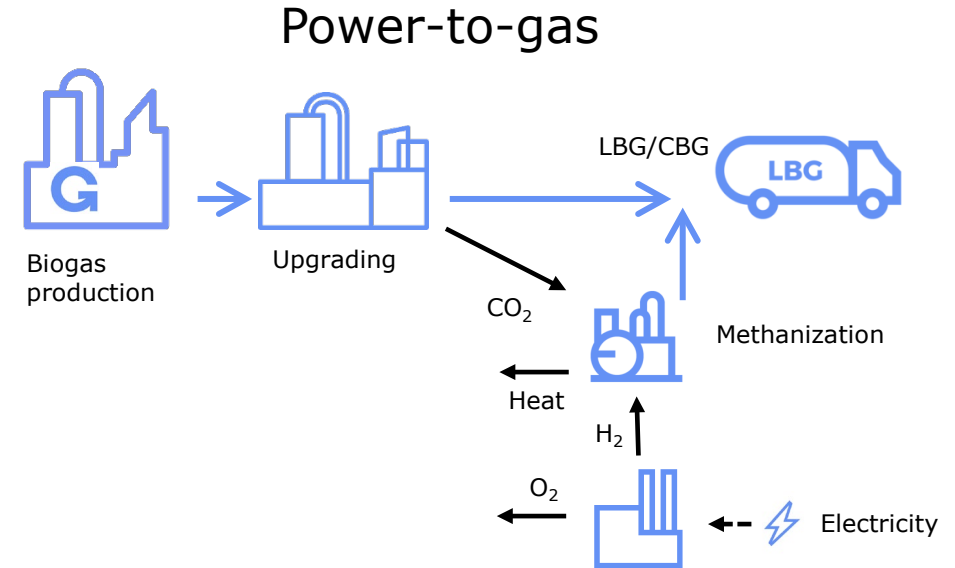
CO<sub>2</sub> permanently stored to e.g. sea bottom

Biogas plant



# CO<sub>2</sub> to methane

- Gasum’s existing plants and projects in execution phase enables additional 650 GWh/a of synthetic biomethane production with P2G technology
- Increase of biomethane production by 65%
- Total electricity need for electrolysis for hydrogen production sums up to ~1100 GWh/a → exposure to OR benefit from electricity price volatility
- Biomethane production costs extremely dependent on electricity price, rough range 150 – 200 €/MWh



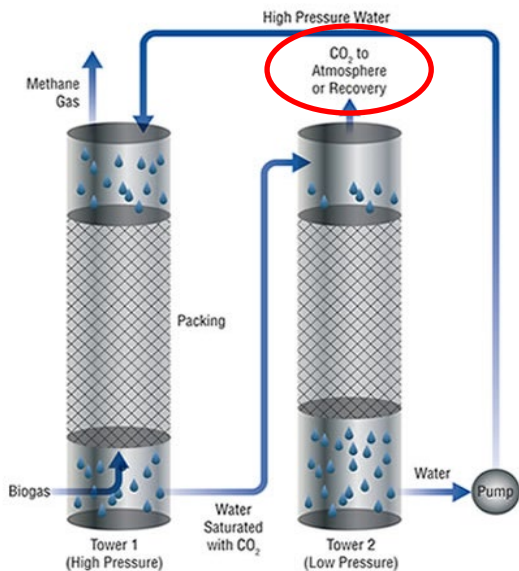
Total	Biomethane	Synthetic biomethane	
Existing & execution projects	1000	650	GWh/a
Total		1650	GWh/a

# CO<sub>2</sub> content impact

- Depending on upgrading technology, CO<sub>2</sub> content varies in exhaust; membrane and amine scrubber >95%, water scrubbing ~15%
- CO<sub>2</sub> content sets limitations to usage:
  - Lower volume content CO<sub>2</sub> is less feasible to be separated from exhaust gas flow → methanize
  - High volume content CO<sub>2</sub> can be utilized → direct use

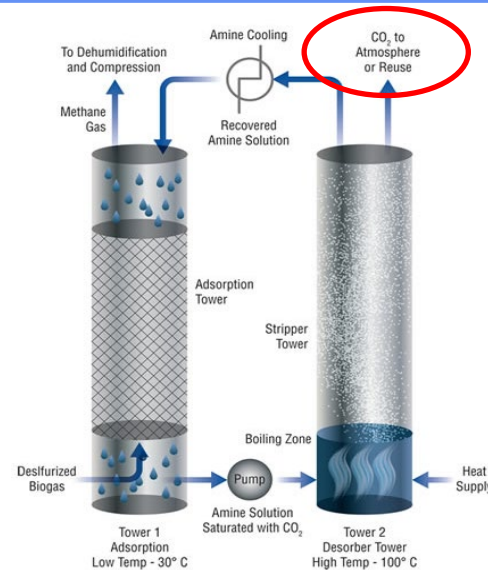
## 1. Water scrubbing

- Proven, robust technology
- Product gas quality not high enough for liquefaction
- Quite high methane slip, ~1% - low quality CO<sub>2</sub> stream



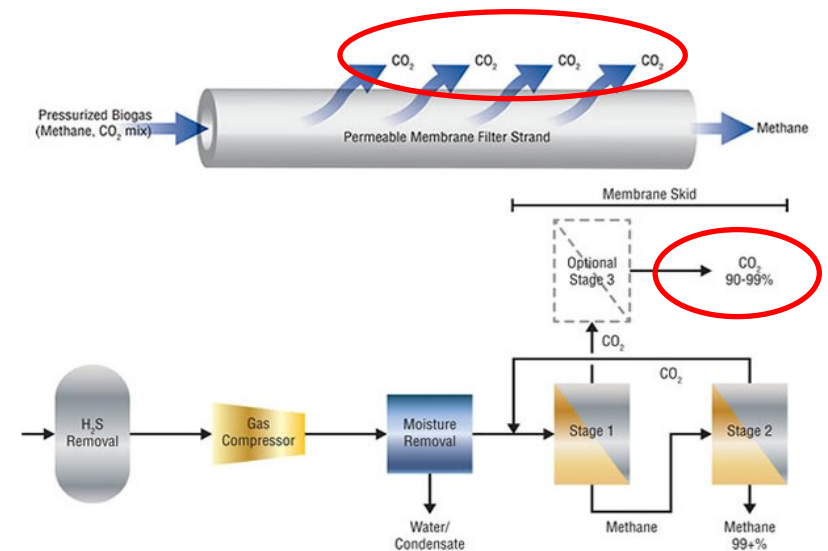
## 2. Amine scrubbing

- High upgrading quality >99% suitable for liquefaction
- Low methane slip, <0.5%, high quality CO<sub>2</sub> stream
- Requires heat



## 3. Membrane upgrading

- High upgrading quality >99%, suitable for liquefaction
- Low methane slip, <0.3%, high quality CO<sub>2</sub> stream





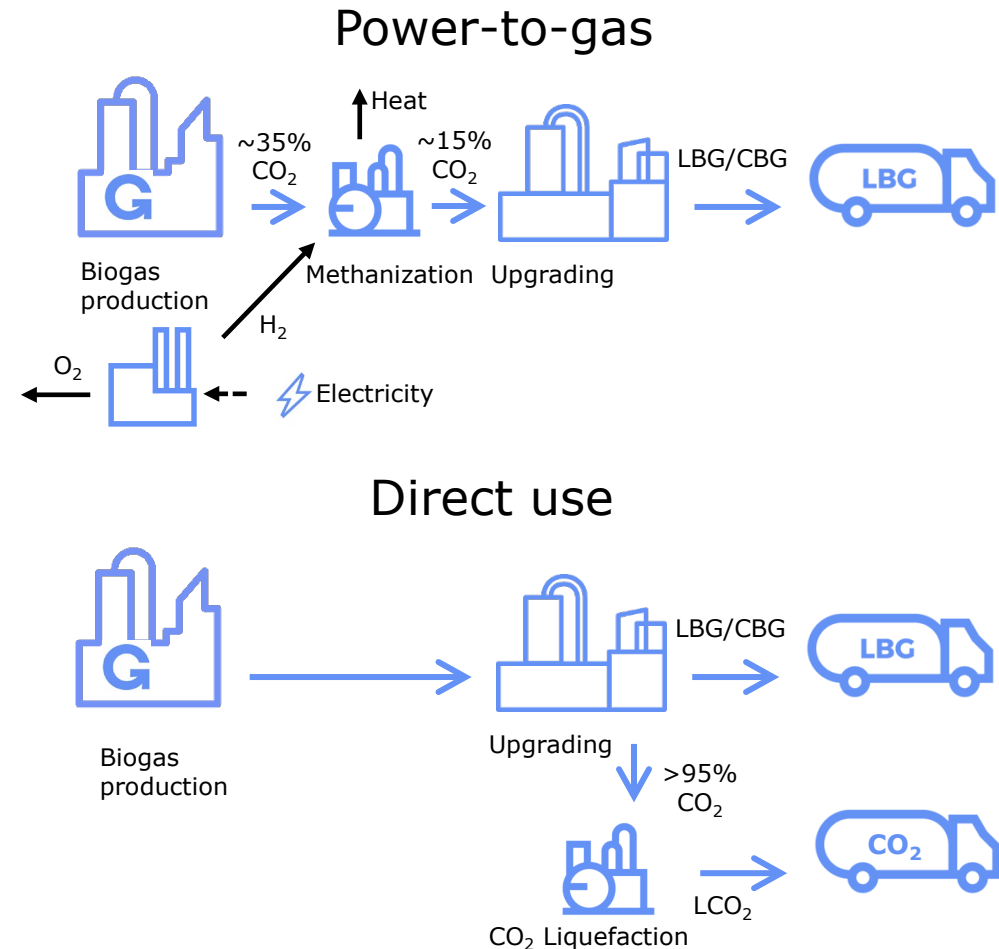
# CO<sub>2</sub> to methane or direct use, depending on content

## Methanization

- Instead of using low content CO<sub>2</sub> from water scrubbing in P2G production, methanization could be used to increase methane content of raw gas
- Higher raw gas methane content enables to increase biomethane volumes with existing upgrading units
- In Gasum's existing plants, potential increase of biomethane production is estimated to be ~35%

## Direct use

- High CO<sub>2</sub> content flue gas from upgrading is feasible for direct use
- Demand for biogenic CO<sub>2</sub> is increasing
- Liquid CO<sub>2</sub> production cost is roughly in the range of 100 – 150 €/t
- The market value of CO<sub>2</sub> ton is expected to be higher, either in physical or in the form of Carbon Dioxide Removal credits ("CDR-credits")



# Keys to increased biomethane availability

## Summary

1. Continue developing the gas distribution infrastructure
  2. Continue to expand cost efficient biomethane production
  3. Continue to develop the biofertilizer/nutrient market
  4. Utilize resources fully with new possibilities. Revenues from CO<sub>2</sub> can compensate the increased feedstock costs and increase biomethane availability
- Secure biogas/biomethane availability to end-users in a sustainable way



# Gasum

**CLEANER ENERGY**