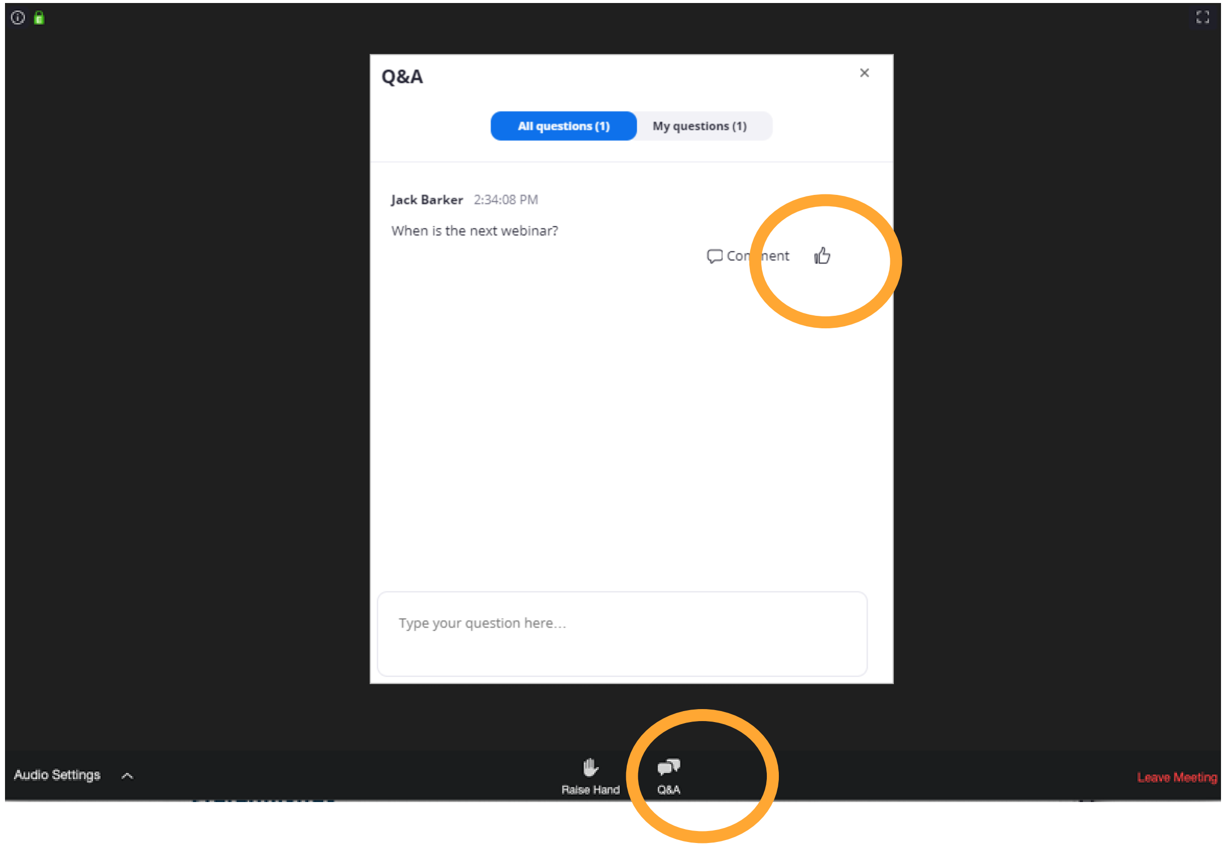
BIOMETHANE INDUSTRIAL PARTNERSHIP

BIOGENIC CO_2
THE ROLE OF THE BIOMETHANE INDUSTRY IN SATISFYING A GROWING DEMAND

Webinar 9th of April 2024 // TASK FORCE 4.1

BIP Europe
Biomethane Industrial Partnership

Welcome!



Practical information

- This webinar will be recorded and made available online afterwards
- You are very much welcome to submit questions in the Q&A section, which you can find at the bottom of the screen
- Like a question? Upvote the question by clicking the thumbs up icon!
- You will receive the slides after the webinar via email

Welcome

Introduction to the BIP and TF 4.1

Presentation of the study

Views of the industry

Q&A

Meet today’s speakers

Grazia Vascello
BIP secretariat

Julian Beatty
Nova Q

Kees van der Leun
Common Futures

Leo Gray
Common Futures

Marco Centurioni
STX Group

Tapio Vehmas
Carbonaide

Angelica Cortinovis
Nippon Gases

Matthías Ólafsson
Methanol Institute

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The Biomethane Industrial Partnership

The launch of the BIP by EVP Timmermans and Commissioner Simson on the 28 of September during the European Sustainable Energy Week.

The Commission's **REPowerEU plan** set the target of **35 BCM** of **biomethane** by **2030**.

A new **Biomethane Industrial Partnership** (BIP) was established upon REPowerEU plan to '*support the achievement of the target and create the preconditions for a further ramp up towards 2050*'. The partnership is formed by stakeholders involved in the biomethane sector, including the EC and MS.

Scaling up the biomethane production is vital because of:

1. the **need to reduce European dependency** on natural gas imports from **Russia**;

2. the **high energy prices**;

3. the aggravation of the **climate crisis**.

Meet the BIP Task Forces

Task Force 1
National biomethane targets, strategies and policies

Task Force 2
Accelerated biomethane project development

Task Force 3
Sustainable potentials for innovative biomass sources

Task Force 4
Cost efficiency of biomethane production and grid connection

Task Force 5
Research, Development and Innovation needs

Task Force 6
The integration of Ukraine as a supplier of sustainable biomethane

Task Force 1 focuses on the creation of national biomethane targets, strategies and policies, feeding into the NECP process

Task Force 2 works to identify and scale up best practices, initiate creative solutions and overcome barriers to speed up investments in biomethane

Task Force 3 works to identify the EU-wide potential for innovative (additional) biomass sources that help to achieve the 2030 target.

The goal of **Task Force 4** is to provide insights into best practices for efficient and low-cost biomethane production and grid injection.

Task Force 5 works to identify the current status of R, D&I in biomethane production nd needs for innovation to be commercialised.

Task force 6 will work to contribute to unlock biomethane production in Ukraine, building stronger energy cooperation between the EU and Ukraine.

Identifying and facilitating ways to decrease the cost of biomethane production and grid connection

Today's focus

The goal of Task Force 4 is to provide insights into **best practices for efficient and low-cost biomethane production and grid injection.**

4.1	4.2	4.3	4.4	4.5	4.6
Business case optimization	Production technology and operating costs	Consumer guide based on 4.2.	Grid injection optimization and reinforcement	Advantages and barriers of standardized product offering	Tour MS showcasing best practices *with all Task Forces*

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Presentation of the study

Julian Beatty, Managing Director, Nova Q

Kees van der Leun, Managing Director, Common Futures

Leo Gray, Consultant, Common Futures

NOVA Q

COMMON FUTURES

BIOMETHANE INDUSTRIAL PARTNERSHIP

BIOGENIC CO_2: THE ROLE OF THE BIOMETHANE INDUSTRY IN SATISFYING A GROWING DEMAND

APRIL 2024 // PREPARED BY TASK FORCE 4.1 OF BIP EUROPE

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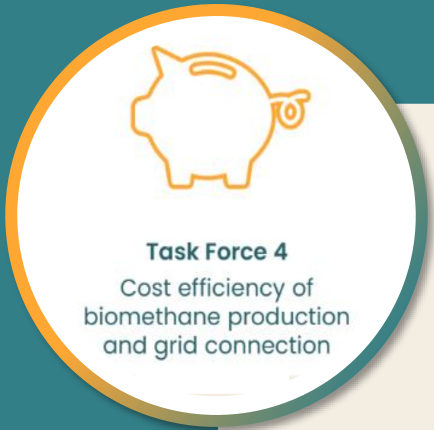
Biomethane Industrial Partnership

Workshop and study to better understand the potential role of biomethane in satisfying CO_2 demand



Task Force 4.1 focuses on biomethane business case optimisation through the valorisation of its co-products, including bioCO_2.

Workshop facilitated by Common Futures to gather, discuss, and interpret insights from contributing parties

Literature study to gather most recent public insights.

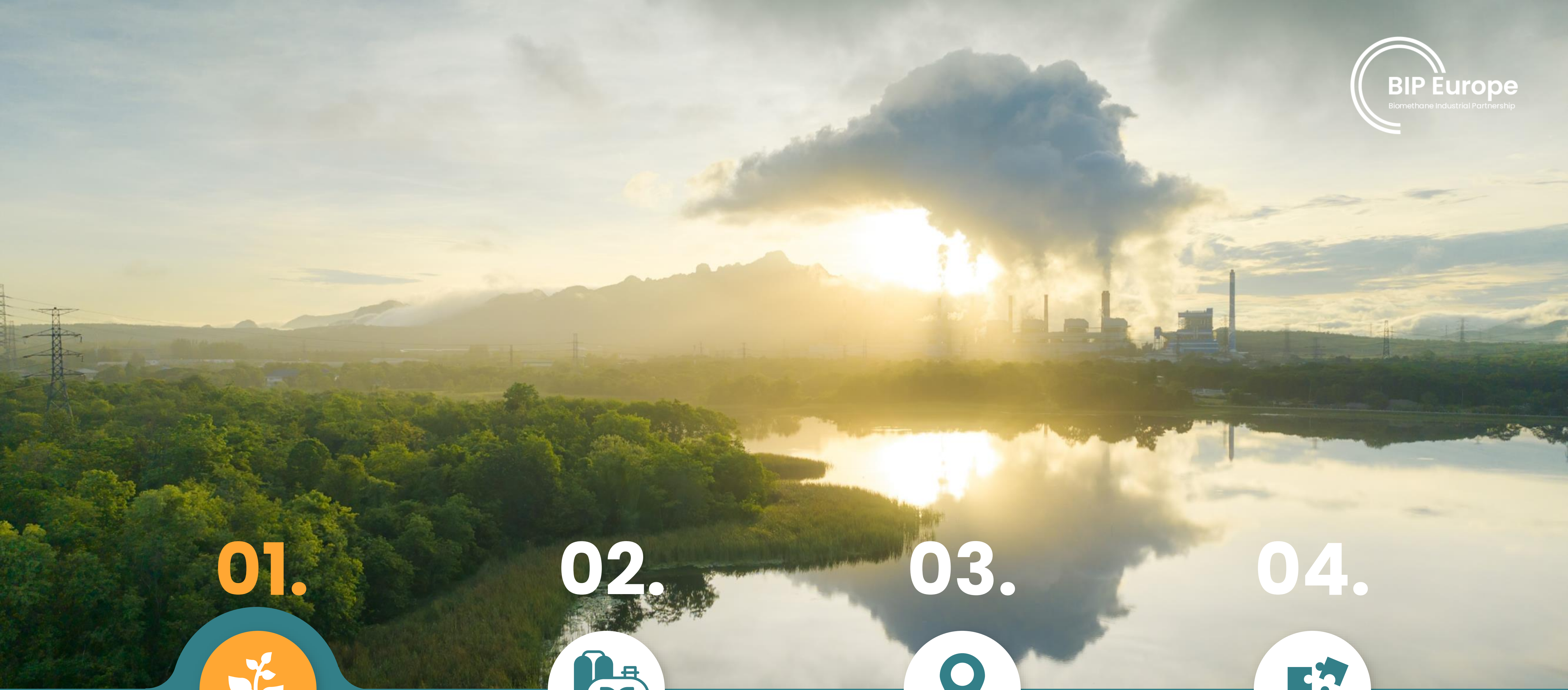
15 organisations across the biomethane supply chain contributed to developing the report.

The study will be available today for download in **bip-europe.eu**

Study rationale: biomethane can be more than a renewable fuel source

- Biomethane production gives us
  - A storable & transportable renewable energy source
  - A natural fertilizer (digestate)
  - **Biogenic CO_2**

Biogenic CO_2 has been widely overlooked



01.

What is biogenic CO_2?

02.

Why bioCO_2 from biomethane?

03.

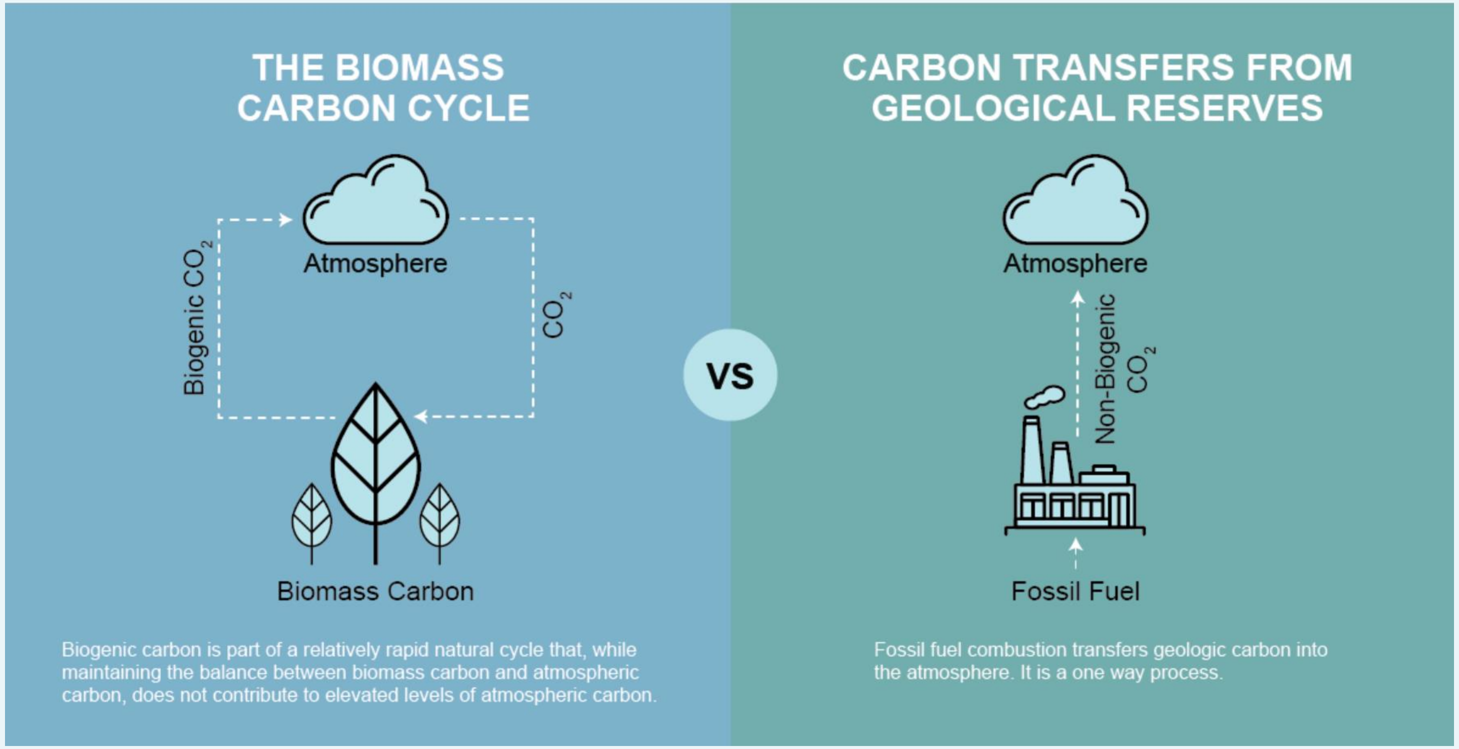
How can bioCO_2 from biomethane be used?

04.

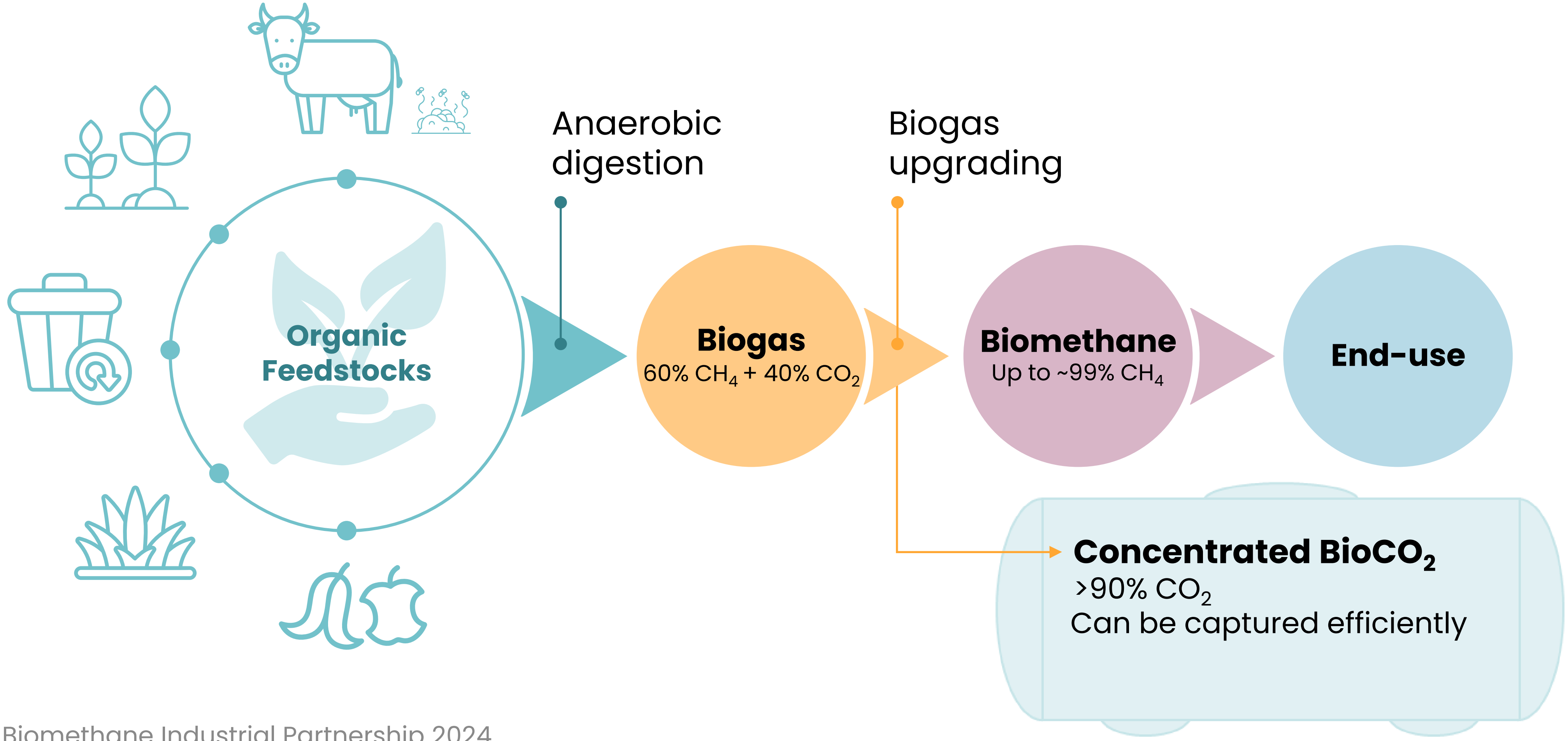
Conclusions

Biogenic CO_2 is a renewable form of CO_2

Biogenic CO_2 (bioCO_2) is short cycle CO_2 released from natural biological processes



Biomethane production is a readily available source of bioCO_2



Different uses of bioCO_2 have different impacts on atmospheric CO_2 levels

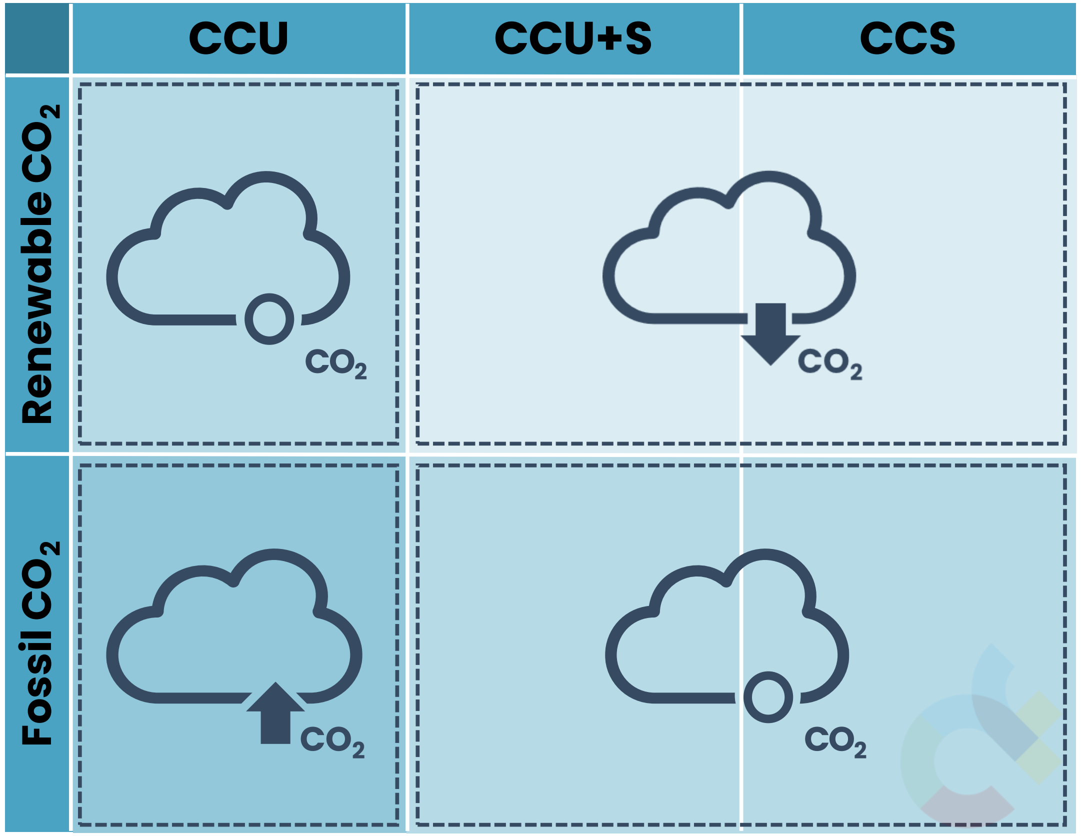
What do you do with captured CO_2?

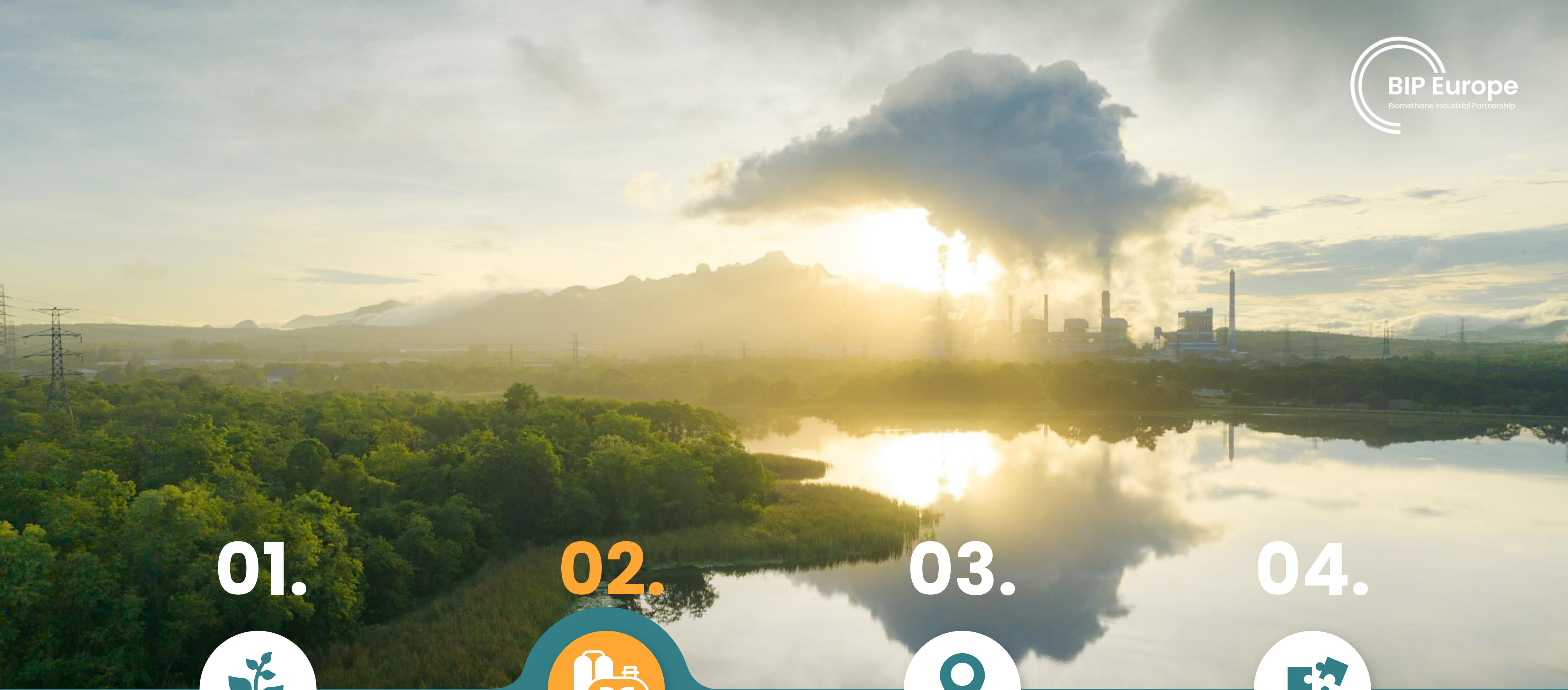
CCU: Carbon Capture and Utilisation

CCU+S: Carbon Capture Utilisation and Storage

CCS: Carbon Capture and Storage

↳ **CDR:** Carbon Dioxide Removal





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EU demand for CO_2 estimated to grow to hundreds of Mt/year by 2050

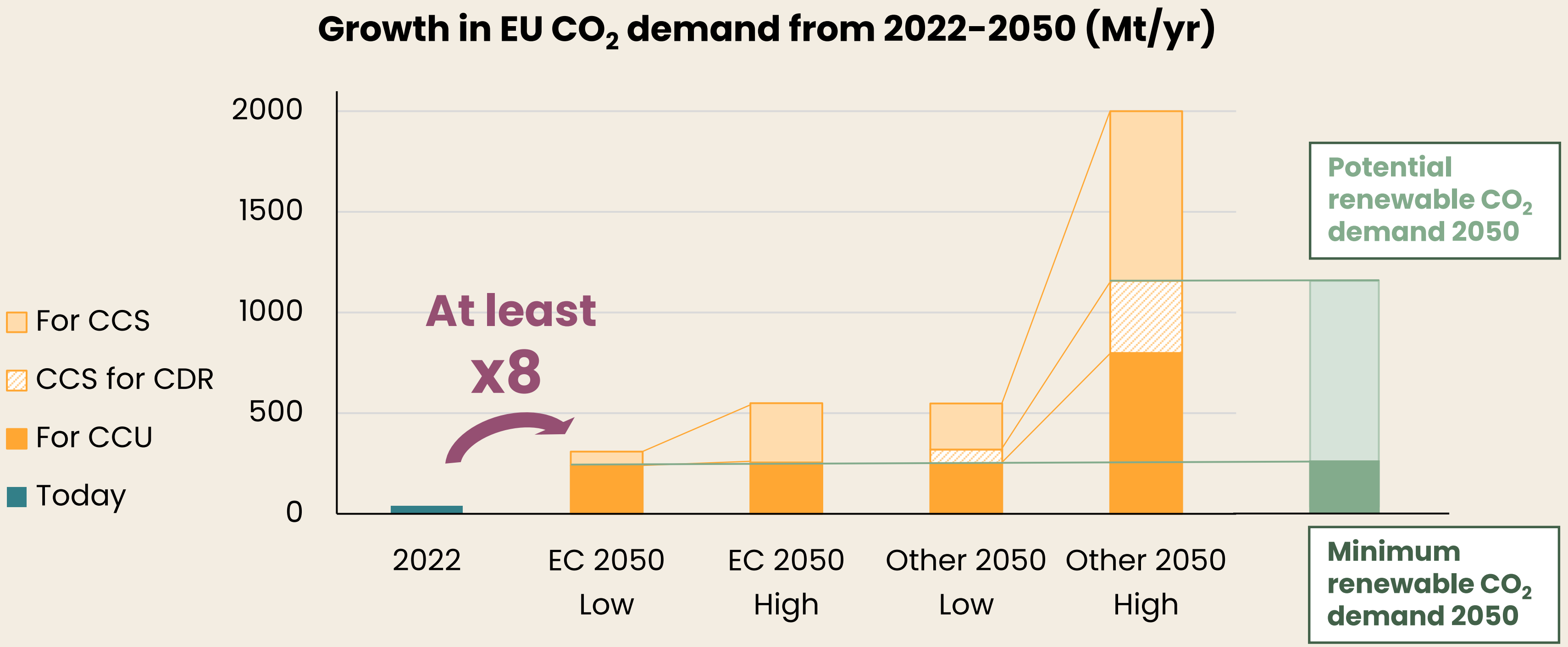
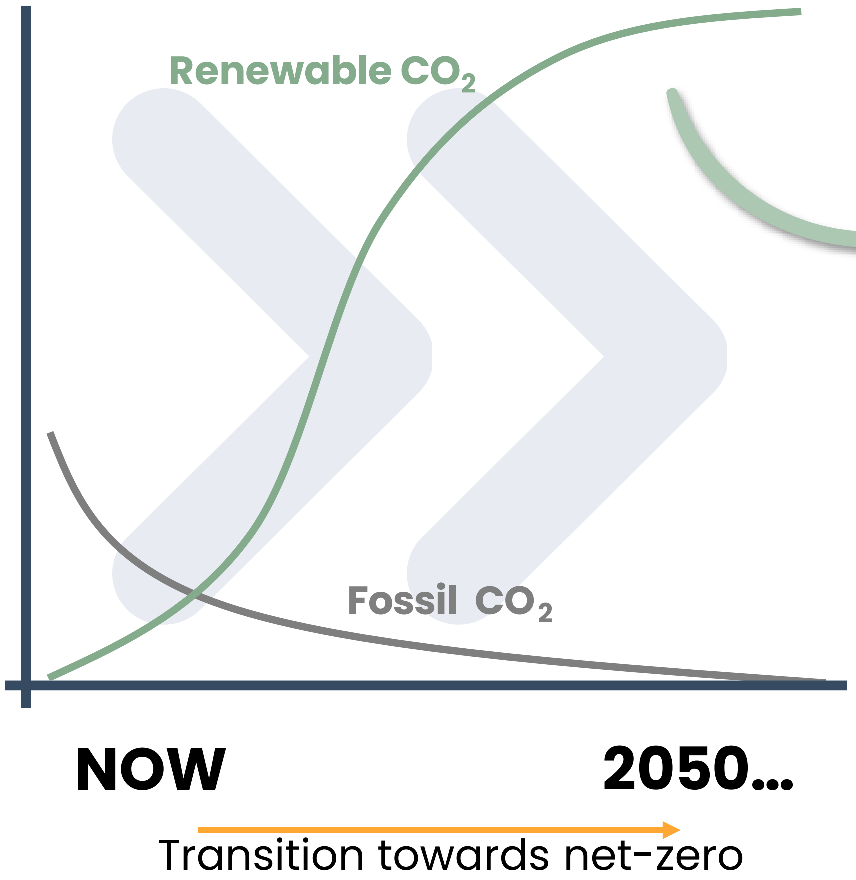


Figure 2. The potential demand for CO_2 in the EU in 2050 split between CCU, CDR, and CCS, and between the modelling for the European Commission and other modelling studies.

- Current EU CO_2 demand: ~40 Mt/yr.
- New processes will increase 2050 demand, e.g:
  - E-fuels: 150-800 Mt CO_2/yr
  - CDR: 70-360 Mt CO_2/yr

CO_2 is mostly captured from fossil fuels today, so a switch to renewable CO_2 is needed



Two types available:

- Biogenic CO_2
- Direct Air Capture

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Biomethane production can be a cost-effective source of renewable CO$_2$ today and in the future

Direct Air Capture

- Can be located anywhere
- Low CO$_2$ concentration, high cost
- Consumes renewable electricity

Biogenic CO$_2$

Costs change with

- Volume
- Concentration
- Availability of waste heat

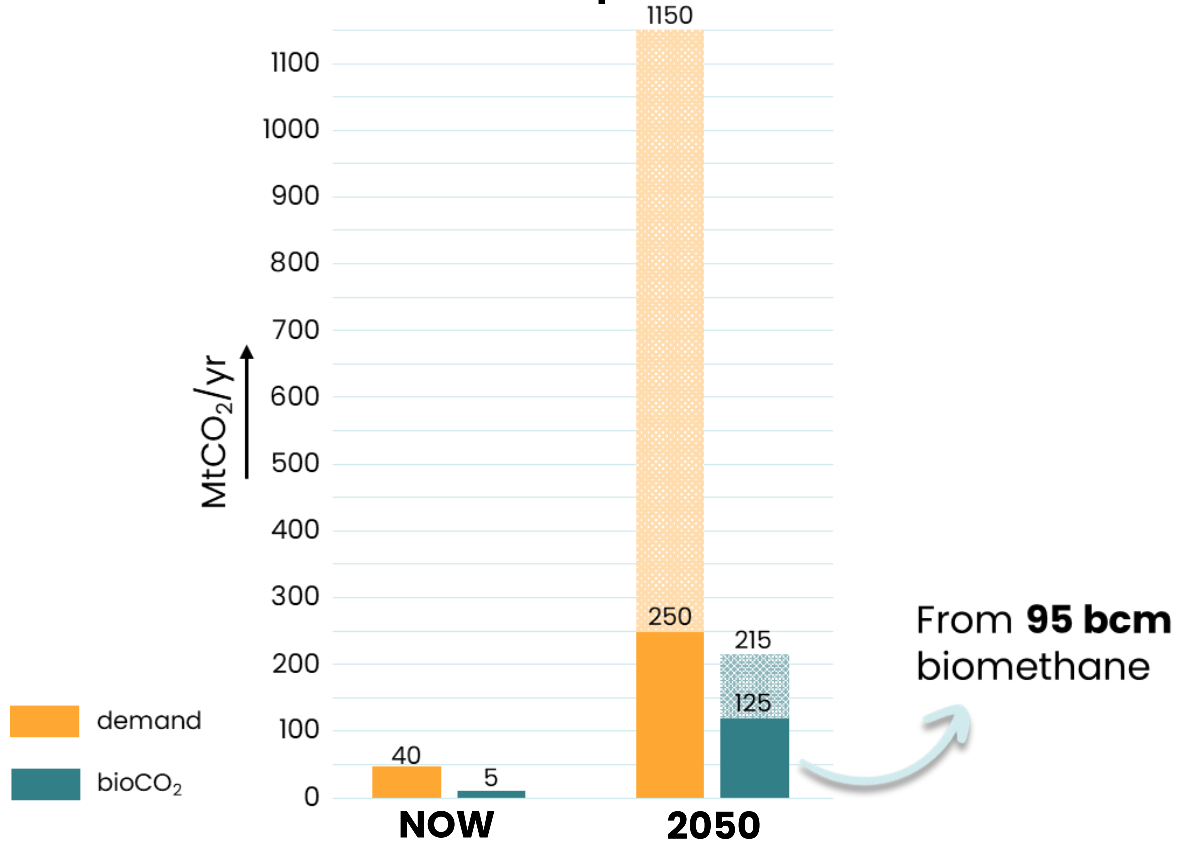
Table. Characteristics of different renewable CO$_2$ sources.

	CO$_2$ source	Concentration (% CO$_2$)	Capture cost (€/t CO$_2$)	Potential bioCO$_2$ supply 2050
	Bioethanol	98-100	25-35	-
	Biomethane	96-100	25-90	+
	Paper and pulp	14-30	40-92	+
	Waste to energy	6-12	60-80	+
	Biomass for power & heat	10-12	100-200	++
	Direct Air Capture	0.04	120-540	++

Biomethane has low carbon capture cost, as CO$_2$ separation is part of the existing process

$BioCO_2$ captured from biomethane production can produce 125 – 215 Mt $bioCO_2$ in 2050

Potential renewable CO_2 demand and $bioCO_2$ supply from biomethane production in EU



- **35 bcm** biomethane in 2030: **~46 Mt $bioCO_2$**

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01. What is biogenic CO_2?

02. Why bioCO_2 from biomethane?

03. **How can bioCO_2 from biomethane be used?**

04. Conclusions

BioCO_2 has many applications; the preferred end-use is influence by different factors

- **Cost of alternatives**
- **Cost of logistics**
- **Cost of electricity**
- **Purity requirements**
- **Evaluation of CDR**

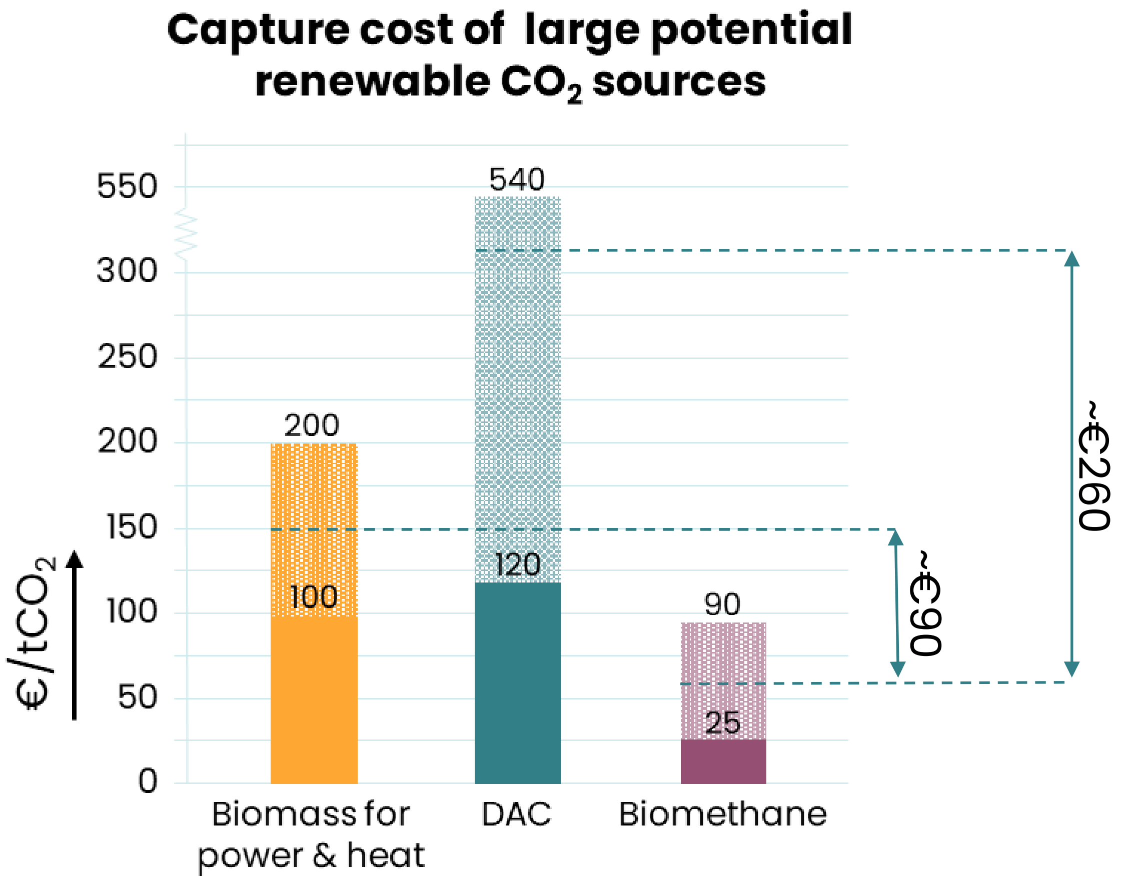
<table>
<tr><th></th><th>On-site</th><th>Off-site</th></tr>
<tr><td rowspan="2">Avoiding CO_2 emissions</td><td rowspan="2">Methanation with H_2 (CCU)</td><td>E-fuel production (& other CCU)</td></tr>
<tr><td rowspan="2">Use in long lived products (CCU+S)</td></tr>
<tr><td rowspan="2">Negative emissions/ Storing CO_2 emissions</td><td rowspan="2">N/A</td></tr>
<tr><td>CO_2 storage (CCS)</td></tr>
</table>

Logistics: $bioCO_2$ from biomethane production requires reliable, low-cost transport

- Biomethane plants are typically remote
  - Truck transport most likely

€0.1-0.15/tCO_2/km

€40-60/tCO_2 for a distance of **200 km***



- Additional transport costs for $bioCO_2$ from biomethane production must be lower than the capture cost advantage (€90-260/tCO_2)

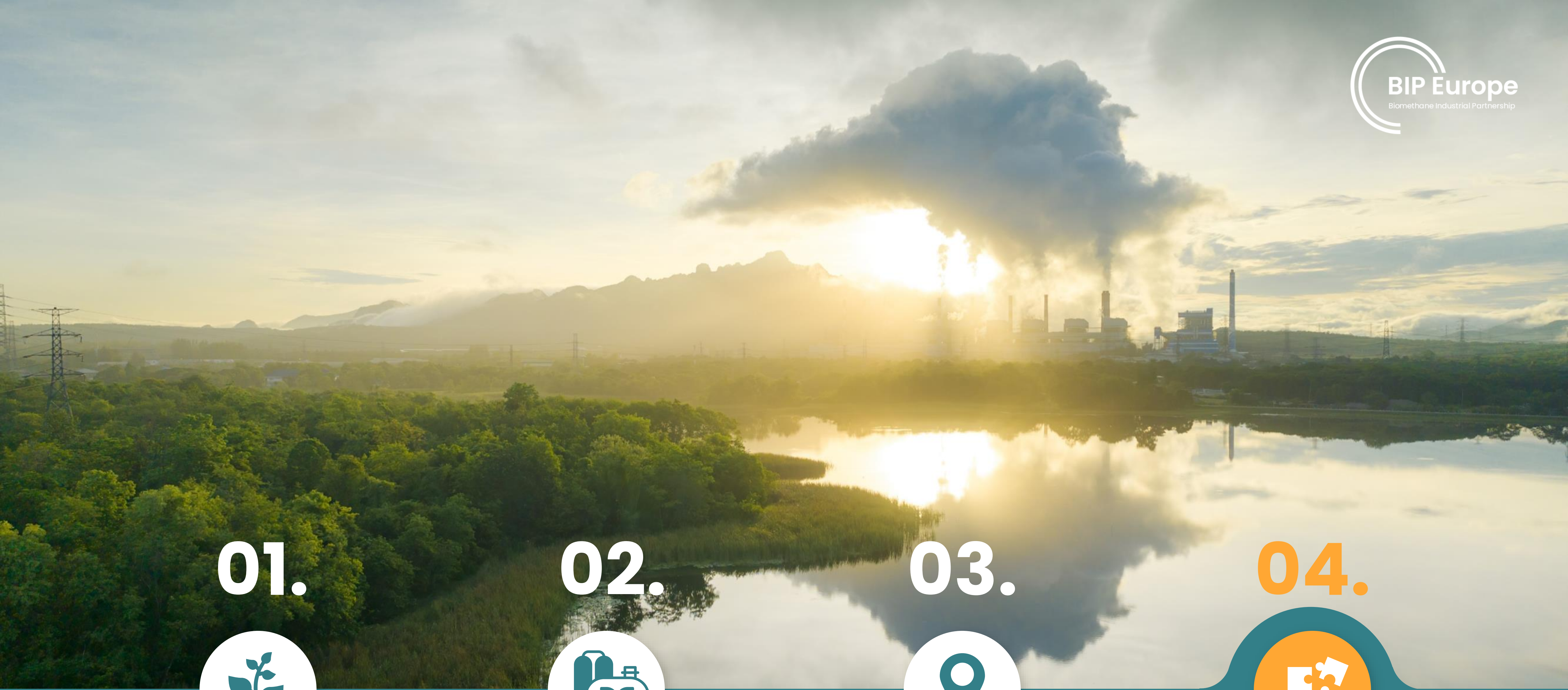
* 200 km delivery distance but round trip assumed

BioCO_2 in the market; how can producers valorise this useful by-product?

As part of the biomethane process	As its own new product			
Lower the **carbon intensity of biomethane** production through CDR from bioCO_2.	Sell **bioCO_2** directly on the **voluntary** market.	Sell **bioCO_2** directly on the **compliance** market	**Sell CDR** from bioCO_2 with permanent storage on the **voluntary** market	Sell **CDR** from bioCO_2 with permanent storage on the **compliance** market

Not possible today

Certification is crucial to enable this!



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Biomethane production provides a valuable and much needed source of cost-effective renewable CO_2

1 **The demand for CO_2 is expected to rise significantly, and it must be renewable**

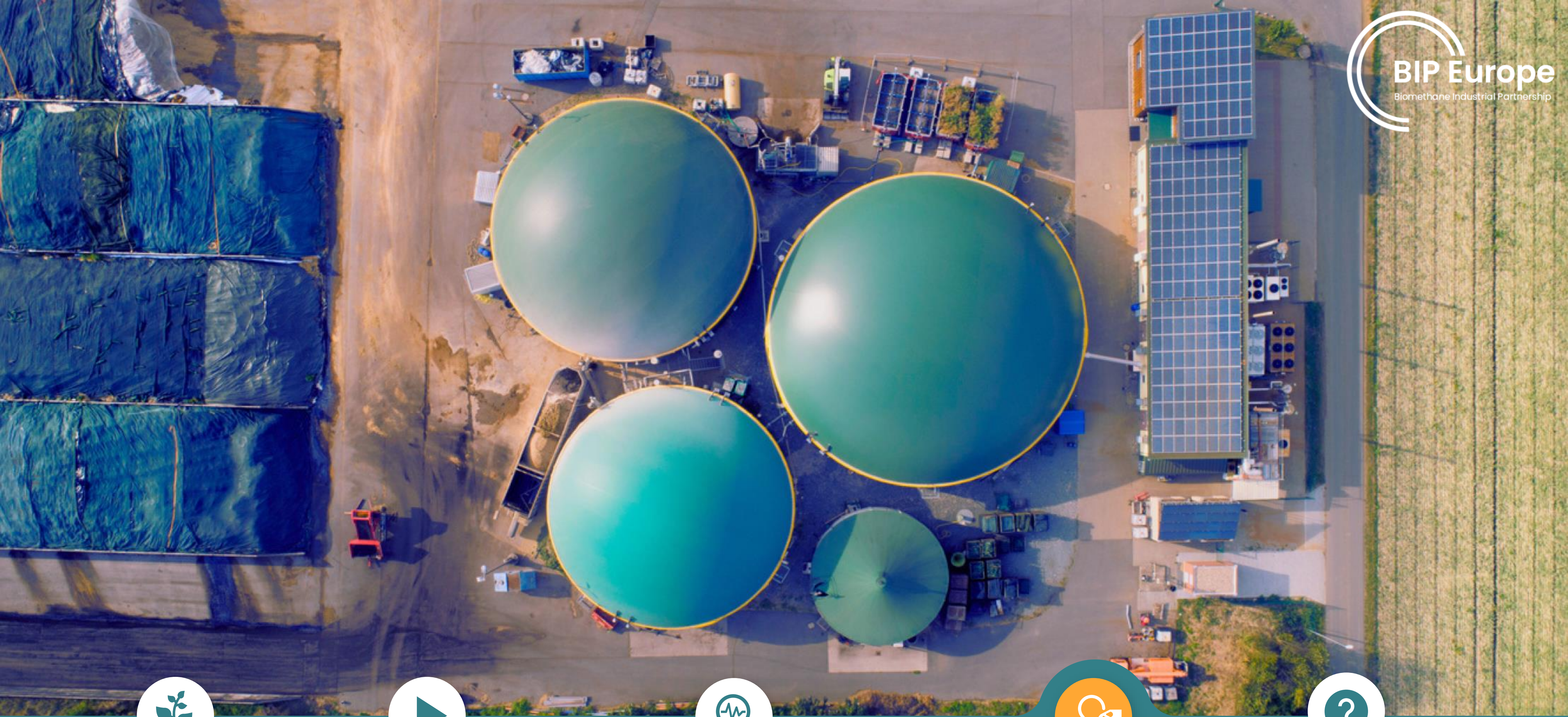
2 Biomethane production is an **existing, cost-effective source of bioCO_2**

3 BioCO_2 is crucial to **facilitate important new processes**

- **Hydrogen economy**: E-fuel production
- **Negative emissions**: Carbon Dioxide Removals

4 Several key factors must be considered to determine how best to valorise bioCO_2 e.g. cost of logistics

5 Contributors highlighted that **supporting policy & certification are a crucial factor in realising this potential**



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Views of the industry

Marco Centurioni

Business Development Manager

STX Group

STX

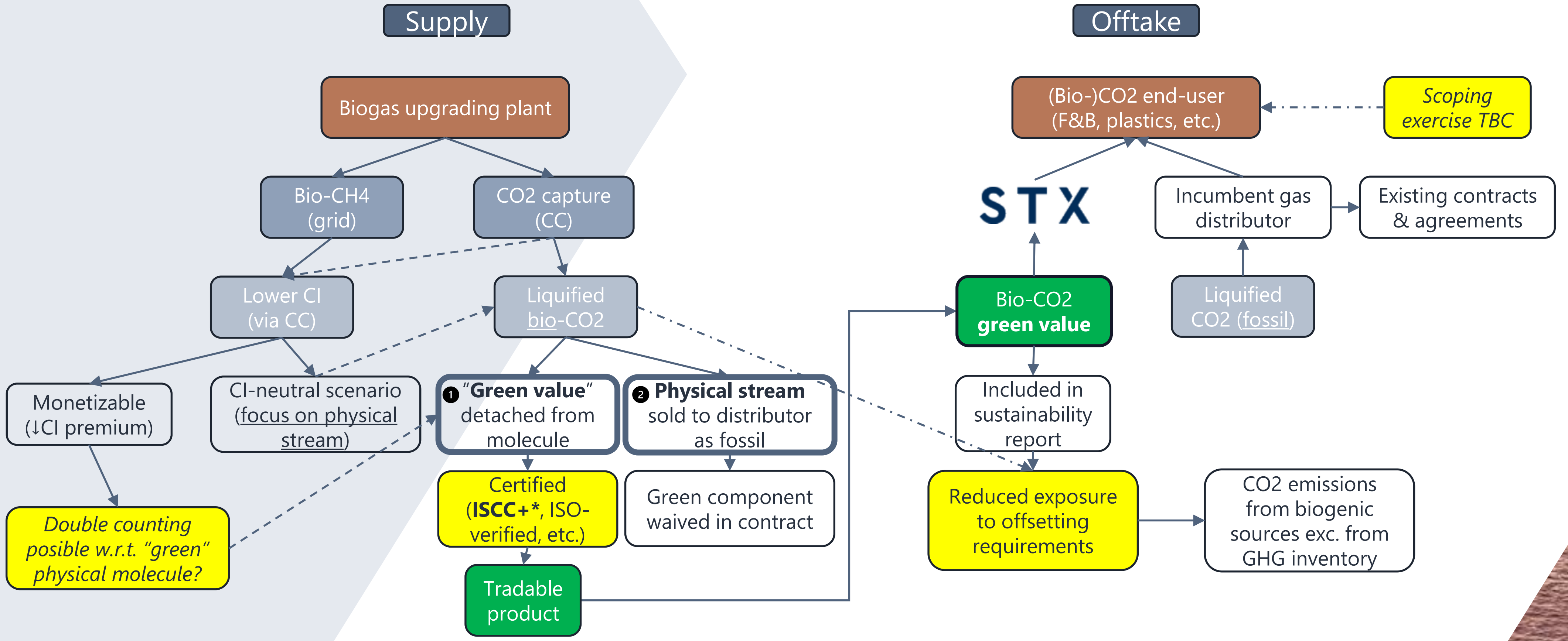
Biomethane Industrial Partnership

Bio-CO2 Webinar

9 April 2024

Marco Centurioni

A potential certificate recognizing the bio-CO2 “green value”



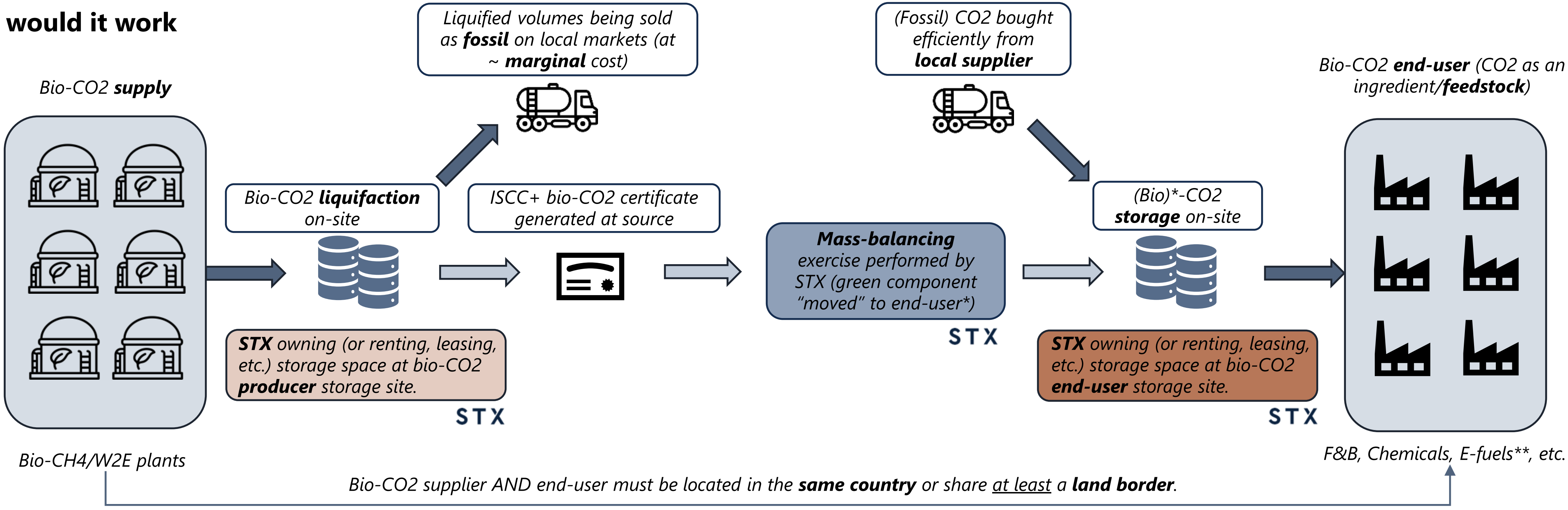
Summary of intended structure

1. Possibility for companies to **detach “green value” of bio-CO2** by placing it into a certificate (verified independently)
2. “Green value” sold over to companies exposed to CO2 sustainability requirements (**compliance vs voluntary**)
3. Ongoing efforts to **test this value proposition** with verifiers (compliance) and with end-buyers (voluntary)
4. Significant opportunity if the above structure could be adapted to **RFNBOs trade dimension**

* Example on next page

Possibilities for bio-CO2 volumes mass-balancing under ISCC+

How would it work



Upstream

The above structure allows bio-CO2 suppliers to sell physical streams at cost locally, while gaining a premium from the "green component" that is transferred via certificate to the end-user.

Midstream

The **midstream segment is significantly simplified** → limited need to build any transport/logistics infrastructure to match S&D. Need to encounter a **local off-taker** (at supply) and find a **cheap CO2 source close to end-user**.

Downstream

End-user rents out to STX (part of) their storage facility and via mass-balancing of bio-CO2 volumes can source fossil volumes (cheaply) and **receive the green component as accompanying certification** (ISCC+*).

Use the Q&A section to submit your questions
Don’t forget to upvote your preferred questions!

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Views of the industry

Tapio Vehmas
CEO
Carbonaide

CO_2 utilisation and storage in precast concrete

- Carbonaide provides a carbon dioxide (CO_2) reuse and storage technology (CCUS) for concrete industry.
- In CCUS process, concrete is cured under specified CO_2 atmosphere that enables formation of carbonate minerals.
- The process improves mechanical properties of concrete and enables cost savings.
- CO_2 is stored permanently as carbonate minerals which decreases the carbon footprint of the concrete.
- The process enables new supplementary cementitious materials due to carbonate formation and further improves the cost efficiency.

Biogas based CO_2 is a fit for concrete

- Carbonaide's process does not have limitation for CO2 purity.
- Upgraded biogas has naturally high CO_2 concentration that enables liquification without further processing.
- Biogas CO_2 is fully biogenic that enables production of high-value carbon dioxide removal.
- Both parties gain economic and environmental benefits.
  - Concrete industry utilises less cement.
  - Biogas stores CO2 and generates removals.

Large scale, delocalized, non-utilized opportunity

- Concrete provides a 1,5 billion tonnes annual technical carbon sink.
- The capacity is delocalized as the typical plant can mineralize 5 000 -10 000 tonnes per year.
- The plants exist almost everywhere as the transportation distances of the ready products are minimized.
- The sink potential is currently non-used.

“We are the first generation to feel the impact of climate change and the last to be able to do anything about it.”

-Barack Obama-

Tapio Vehmas
Carbonaide
tapio.vehmas@carbonaide.com
+358 40 591 1589

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Views of the industry

Angelica Cortinovis

Renewable Energy Business Manager

Nippon Gases

Biogenic CO_2 : perspectives from an Industrial Gases company

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Established 30th Oct **1910**

Head office In Tokyo **Japan**

With more than **19K** employees

Operations in more than **30** countries

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The Gas Professionals

Our presence in Europe positions us as a leading company:

Over **3K** employees in Europe

27.9% of which are women

13 European countries today

Belgium, Denmark, France, Germany, The Netherlands, Ireland, Italy, Norway, Poland, Portugal, Spain, Sweden and the United Kingdom.

serving more than **150K** customers

achieving revenues above **1.9B€** in FYE2023

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Carbon neutral world
Our Pillars

Greening Combustion | Hydrogen Solutions | CO_2 Capture | Circular Economy | Digitalisation

Visit carbonneutralworld.com to know more!

NIPPON GASES

Nippon Gases: Using biogas to drive the Net Zero transition

By Anthony Wright on May 12, 2023 | 0 | Translate NEWS | BIOGAS

Biogas is rapidly becoming a key player in the ongoing global transition to renewable energy. As the world continues to move away from fossil fuels, the gas is emerging as a reliable, sustainable and cost-effective alternative.

Produced through the anaerobic digestion (AD) of organic matter such as agricultural waste, sewage sludge and food scraps, biogas is generated when microorganisms break down the organic matter and release a mixture of gases, primarily methane and carbon dioxide (CO2).

One of its key benefits is its ability to reduce greenhouse gas emissions. By capturing the methane released during AD and using it as a fuel, biogas projects can significantly reduce emissions to help combat global warming.

The versatility of biogas also lends itself to applications such as electricity generation, for heating power plants, fuelling vehicles and even being injected into natural gas pipelines.

It can also be used to help address waste management challenges, particularly in agricultural and urban areas. By diverting organic waste from landfills and using it for energy production, biogas projects can reduce the volume of waste in landfills and lower associated environmental and public health risks.

These benefits have seen biogas skyrocket in popularity around the world over the past few years. In Europe, biogas production has grown significantly, particularly in Germany, Denmark and Sweden. The US, China and India are also investing heavily in biogas projects, recognising its potential as a sustainable and cost-effective renewable energy source.

This growth has been partially driven by widespread adoption of biogas by leading industrial companies offering clean energy initiatives such as Nippon Gases and its Carbon Neutral World campaign.

SOME STATS

CO2 emissions in the EU in 2022

- 2.700.000 Mt total per year
- 5,8 Mt per capita per year
- 30% below 1990

Demand of merchant CO2 in Europe

- 35-40 Mt per year
- 0,14% of all the CO2 being produced

Data referred to 2022


Its abundance is a
global disaster

Its utilization is an
Opportunity
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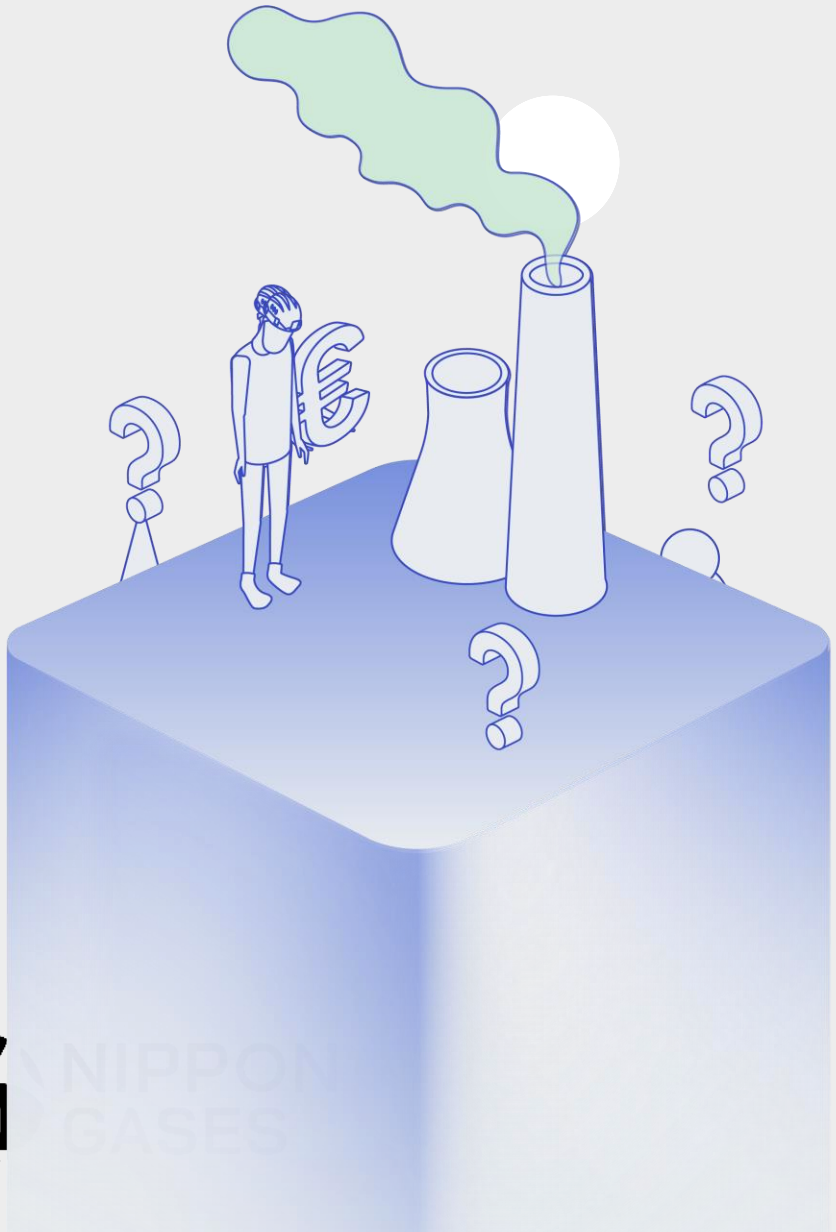
Increasing number of industries capturing or planning to capture their CO2 emissions and making them available for the market

Increasing number of anaerobic digestion sites producing BIO CO2 also available for the market



BIOGENIC CO2

- Uncertainty
- Availability
- Consumer acceptance
- Reliability

Great Opportunities Result from Great Challenges.

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YouTube
LinkedIn
info@nippongases.com

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Matthias Ólafsson
Chief EU Representative
Methanol Institute

METHANOL INSTITUTE
www.methanol.org

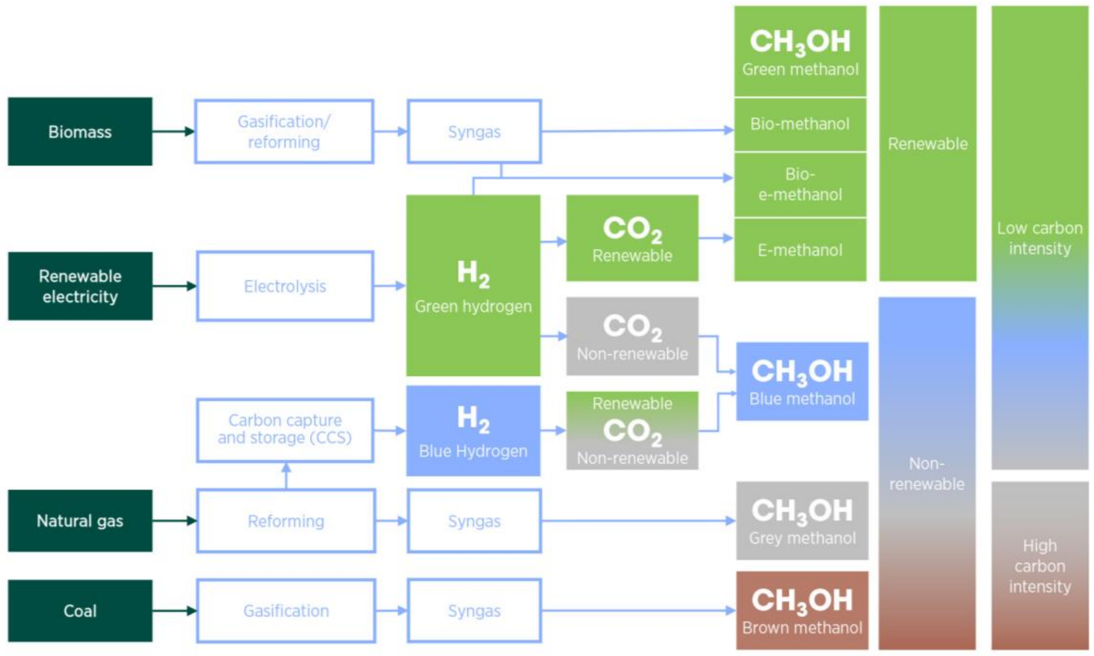
Low Carbon and Net Carbon-Neutral

E-Methanol

- Feedstocks: green hydrogen and captured CO2
  - Green hydrogen produced from the electrolysis of water with renewable energy (e.g. solar, wind, geothermal etc.)
  - CO2 from industrial flue gas (e.g. steel, cement, ethanol), biogenic sources, or direct air capture
- E-methanol is a very-low to net carbon-neutral

Bio-methanol

- Feedstocks: Municipal Solid Waste (MSW), Agricultural Waste, Black Liquor, Bio-Methane from wastewater treatment, landfills, or animal husbandry
- Feedstocks can be gasified or anaerobically digested to produce syngas used in methanol production
- Avoided emissions from landfills, incinerators, or dairy farms potentially allow bio-methanol to be a net carbon-negative fuel

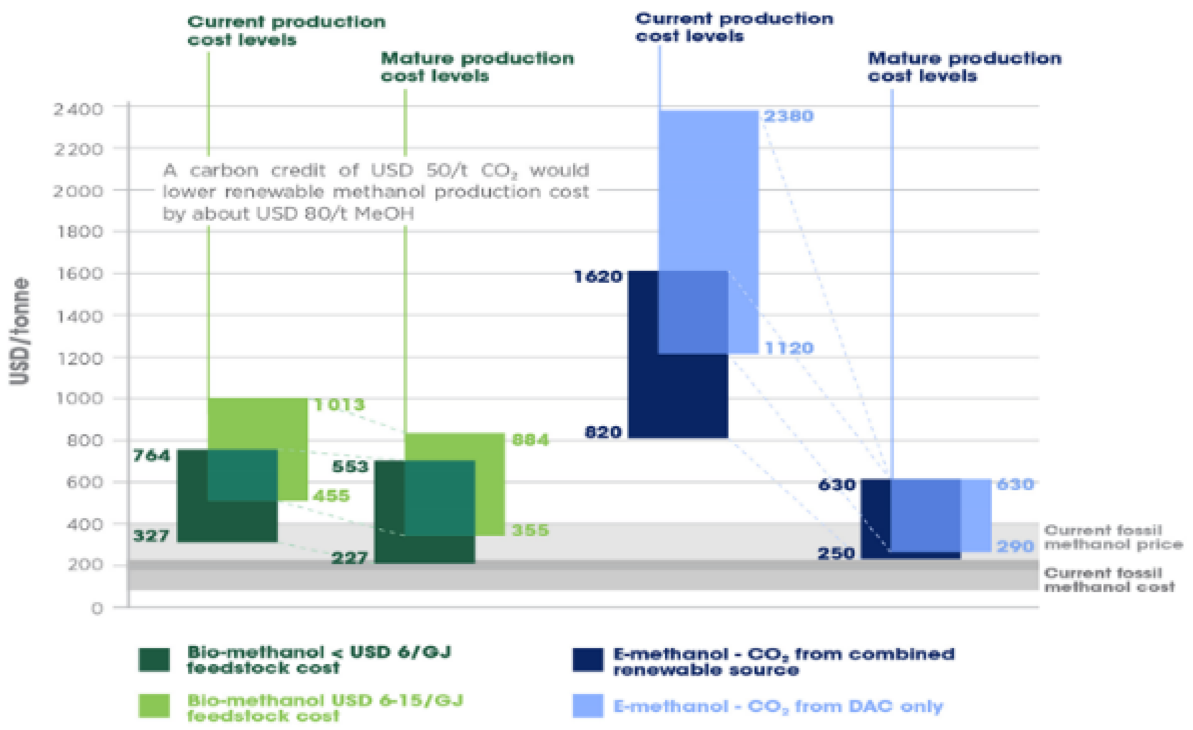


Renewable CO_2: *from bio-origin and through direct air capture (DAC)*

Non-renewable CO_2: *from fossil origin, industry*

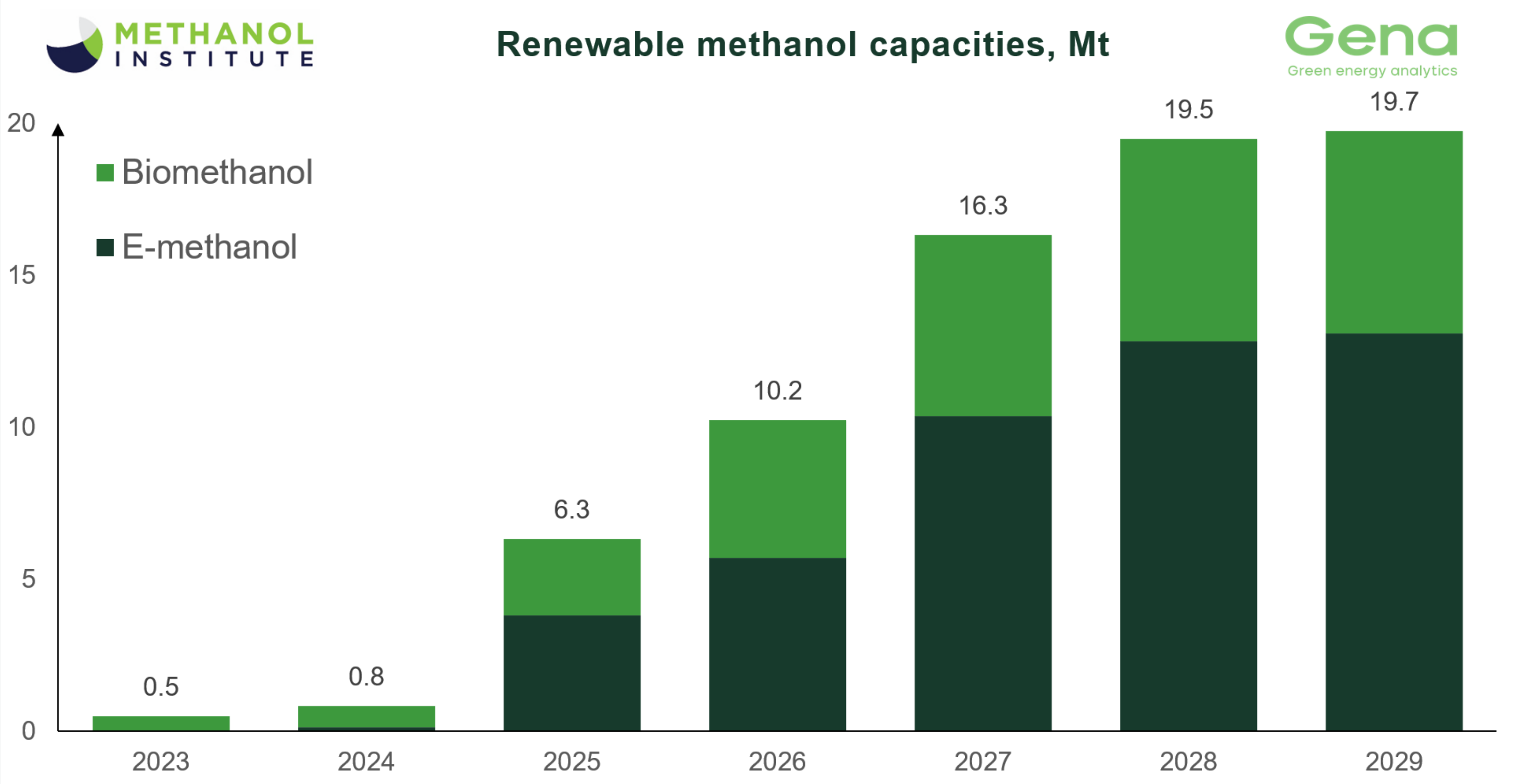
While there is not a standard colour code for the different types of methanol production processes; this illustration of various types of methanol according to feedstock and energy sources is an initial proposition that is meant to be a basis for further discussion with stakeholders

Cost of production coming down



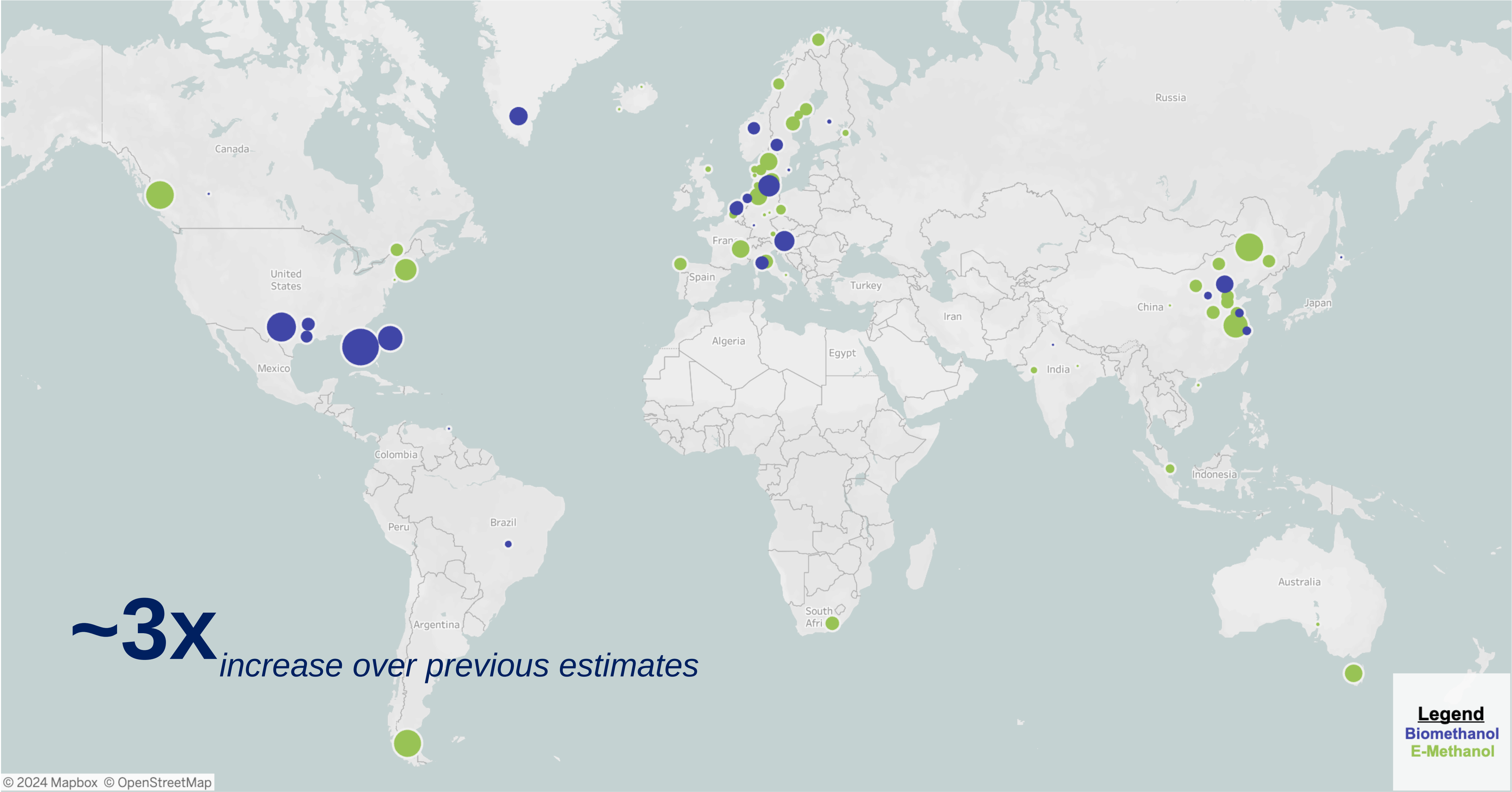
Notes: *MeOH = methanol. Costs do not incorporate any carbon credit that might be available. Current fossil methanol cost and price are from coal and natural gas feedstock in 2020. Exchange rate used in this figure is USD 1 = EUR 0.9.*

Supply: Near term ramp-up



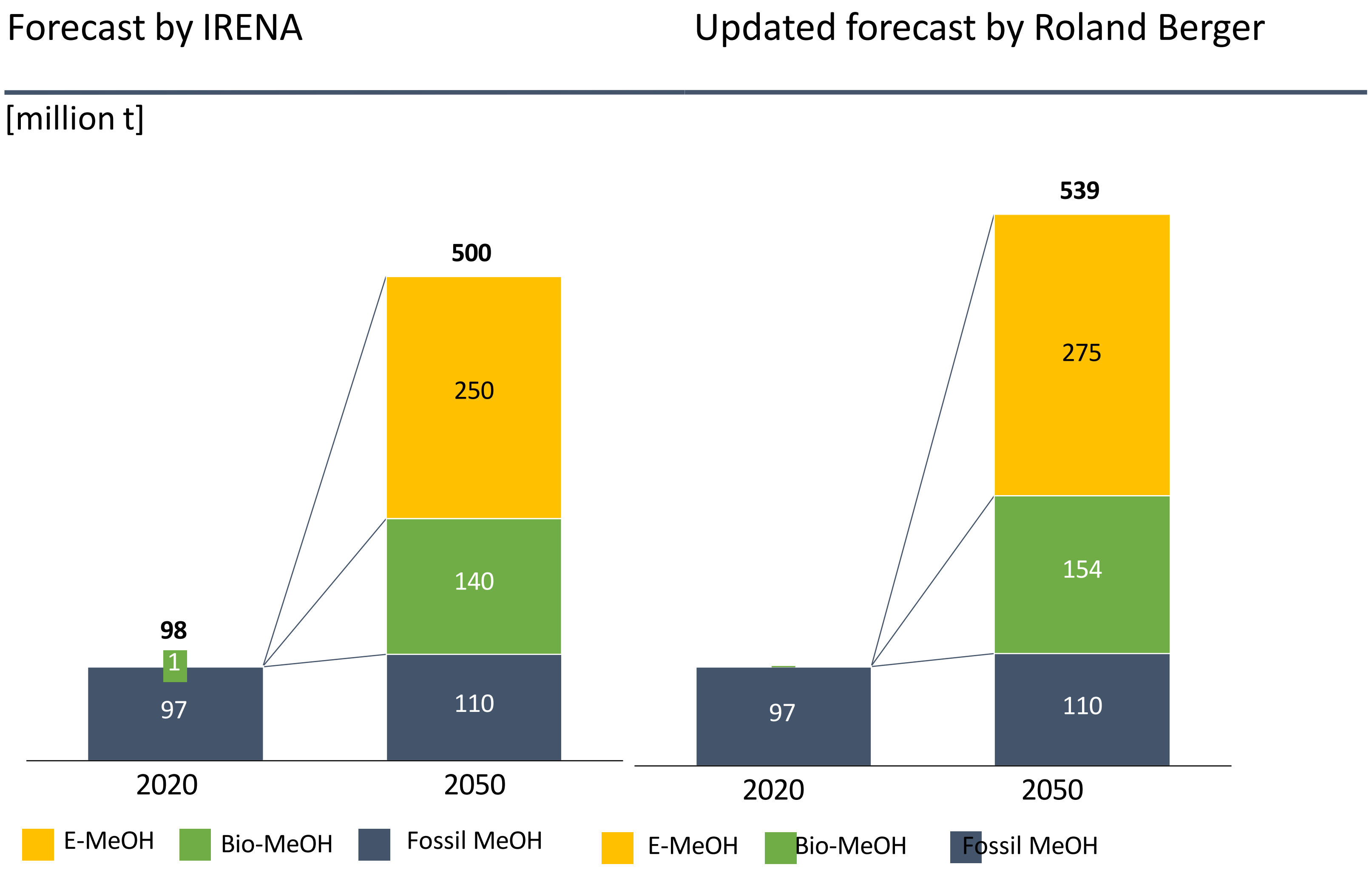
Source: GENA Solutions, www.genasolutions.com. Note: Based on announced startup dates.

Supply: Geographical Distribution



~3x *increase over previous estimates*

Supply: Long-term Growth



Source: IRENA, Roland Berger

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QUESTIONS? Contact the BIP secretariat secretariat@bip-europe.eu

DOWNLOADS The study will be available today on the BIP website: www.bip-europe.eu/downloads

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