WEBINAR

Dig Deep!

TUESDAY 16 APRIL 2024
10H - 11H30 AM CEST
info@europeanbiogas.eu
www.europeanbiogas.eu

Biogases towards 2040 and beyond: A realistic and resilient path to climate neutrality.

EBA
European Biogas Association

Harmen Dekker
CEO
European Biogas Association

Tom Howes
Advisor, DG ENER
European Commission

Gemma Toop
Associate Director
Guidehouse

Sacha Alberici
Associate Director
Guidehouse

Daan Peters
Managing Director
Common Futures

Giulia Cancian
Secretary General
European Biogas Association

Welcome

Harmen Dekker

CEO

European Biogas Association

EBA European Biogas Association

Agenda

10:00	**Welcome** Harmen Dekker, CEO, European Biogas Association
10:10	**Keynote** Tom Howes, Advisor, DG ENER European Commission
10:20	**Biogases towards 2040 and beyond** Gemma Toop and Sacha Alberici, Associate Directors, Guidehouse
10:40	**Achieving the 2040 Climate Target Economically** Daan Peters, Managing Director, Common Futures
10h55	**Q & A Session**
11h25	**Conclusions** Giulia Cancian, Secretary General, European Biogas Association

Keynote

Tom Howes

Advisor, DG ENER
European Commission

EBA European Biogas Association

The Biomethane Potential in 2040 and Beyond

Gemma Toop & Sacha Alberici

Associate Directors
Guidehouse

EBA
European Biogas Association

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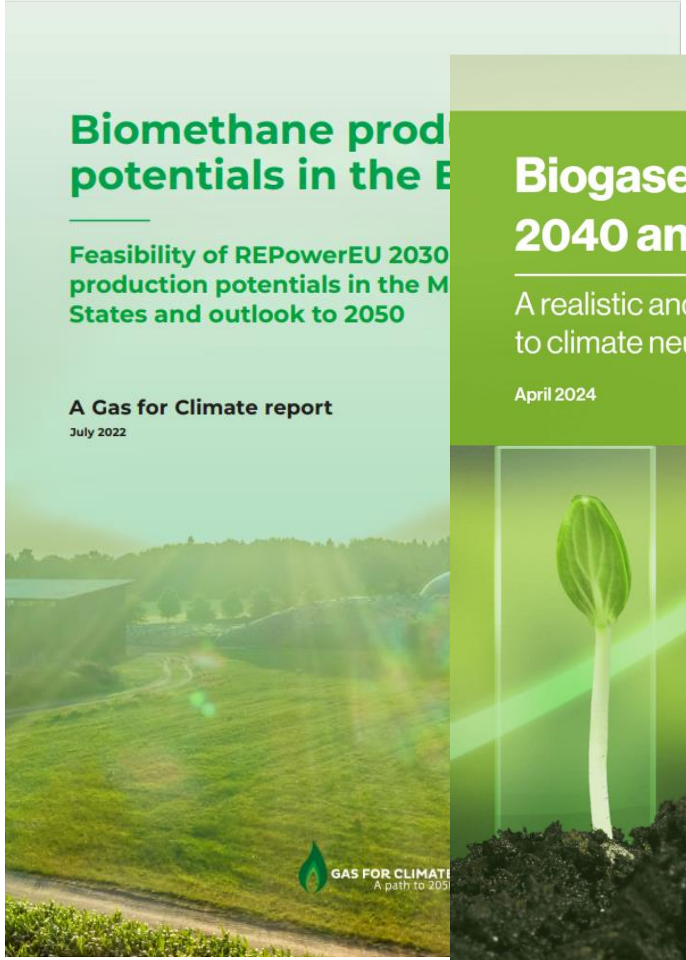
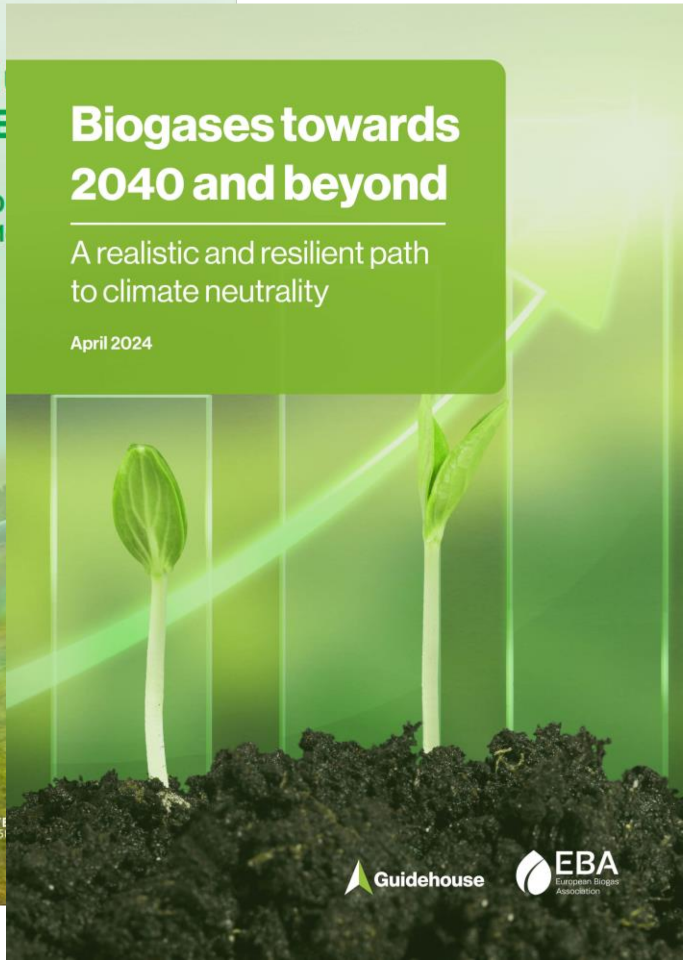
Biogases towards 2040 and beyond: A realistic and resilient path to climate neutrality

Aim of this study

- Refresh 2022 Gas for Climate biomethane potential study
- Update 2030 and 2050 potential estimates based on latest data and insights
- Focus on 2040 time horizon
- Additional focus on novel feedstocks and technologies
- Contribute to policy discussion on 2040 Climate and Energy Target





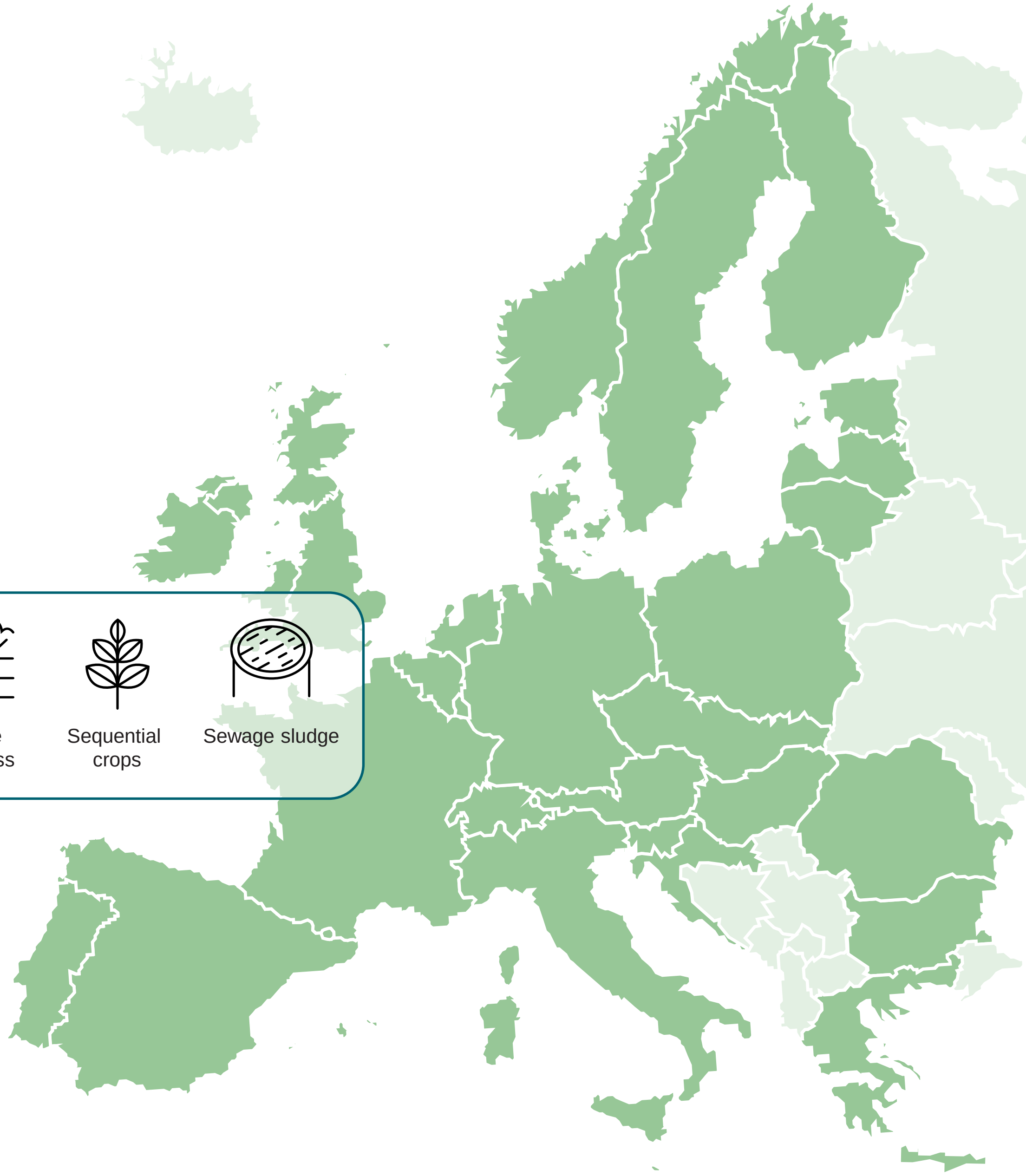
Research Scope

Time horizon

2040 (2030 & 2050)

Countries

EU-27 + Norway, Switzerland and UK



Technology & Feedstocks

Anaerobic Digestion

- Agricultural residues
- Animal manure
- Biowaste
- Industrial wastewater
- Permanent grassland
- Roadside verge grass
- Sequential crops
- Sewage sludge

Thermal Gasification

- Forestry residues
- Landscape care wood
- Municipal solid waste
- Pruning
- Wood waste

! **The study allocated each feedstock to one technology type to avoid potential double counting.**

Methodology

Step 1

Identify feedstocks and conversion technology option per feedstock

Step 2

Update potentials per feedstock per country in 2030/40/50

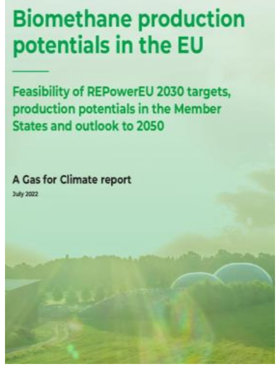
Step 3

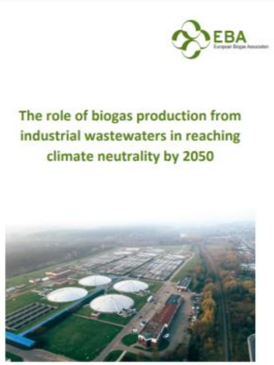
Convert feedstock potentials to biomethane potentials in 2030/40/50

Step 4

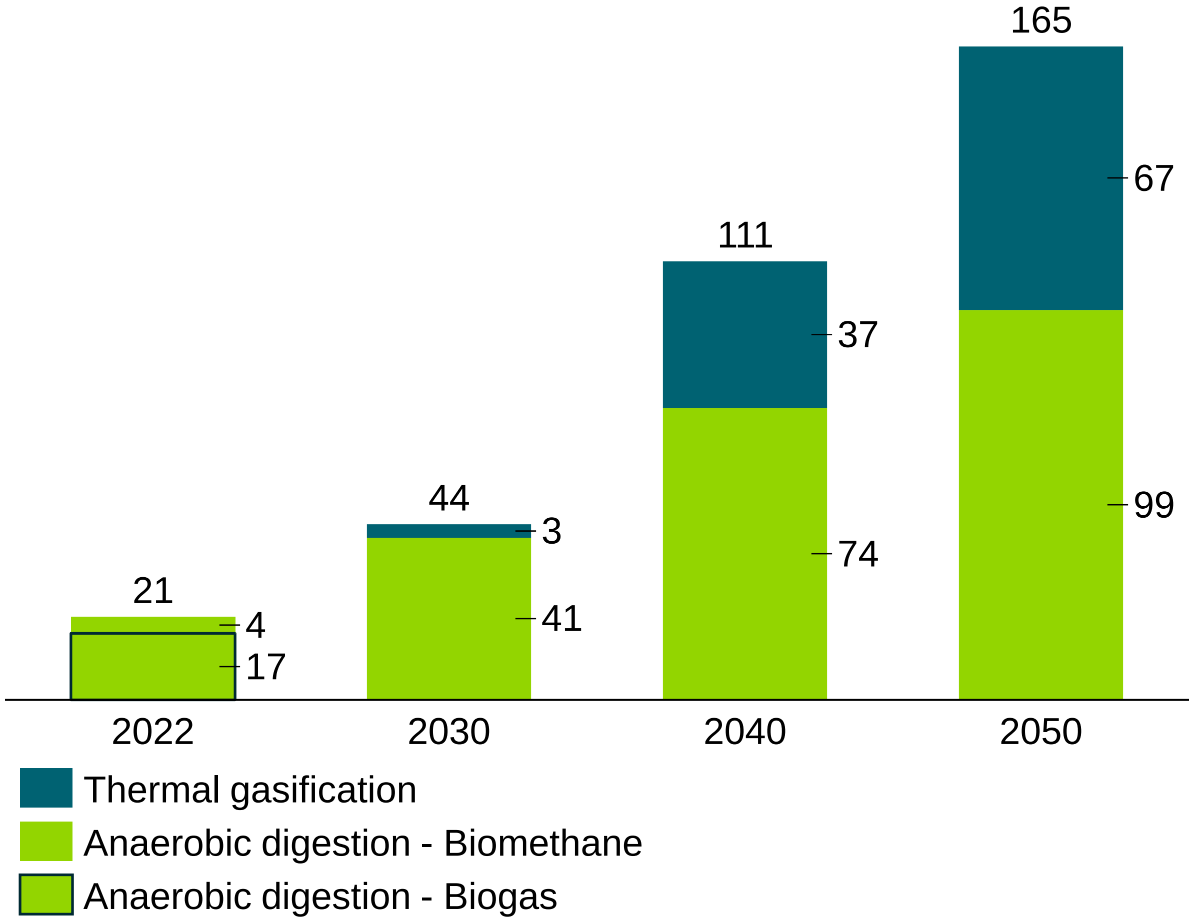
Research novel feedstocks and technologies

Based on **published reports** covering 2030-2050 time horizon or **current statistical data** (including Eurostat, FAOstat). Expert interviews





Significant potential to scale-up biomethane production to 2040 and beyond

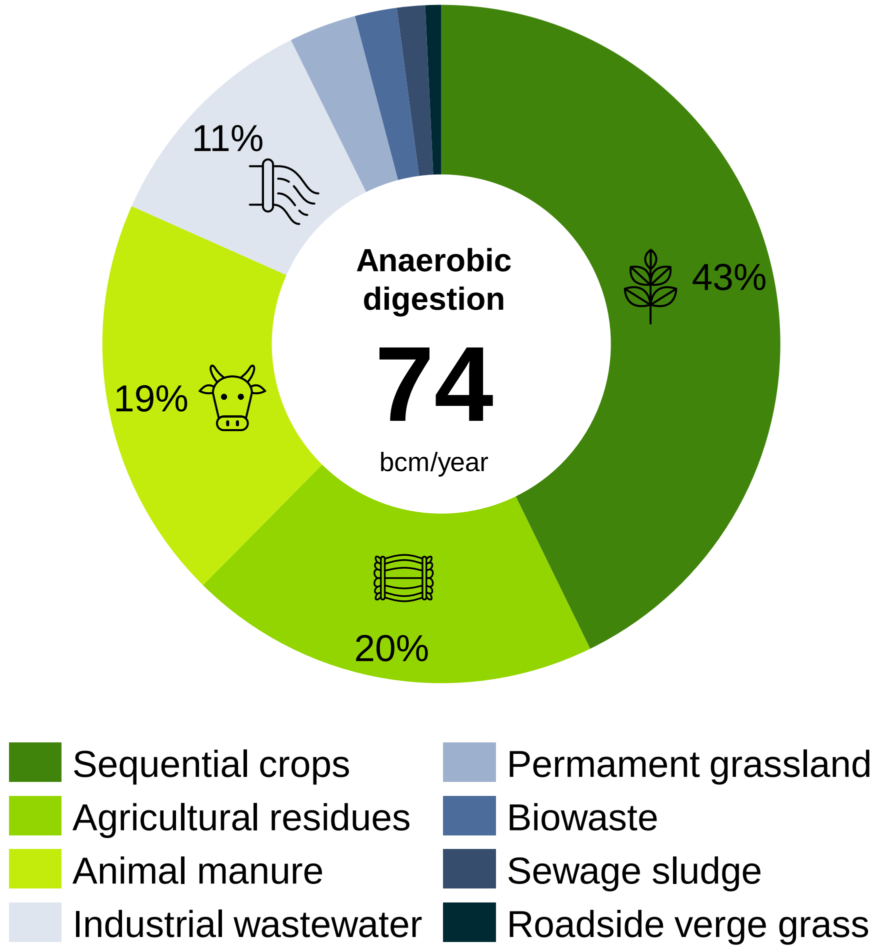


- Biogases production in 2022 almost exclusively based on anaerobic digestion, and dominated by biogas
- Potential projected to steeply increase by 2030, and still be dominated by anaerobic digestion
- Further steep increase is seen towards 2040 and 2050, with both production technologies playing an important role
- Thermal gasification set to become significantly more relevant in the 2040 timeframe as the technology further commercialises

Biomethane potential of 111 bcm/yr in Europe in 2040 - dominated by anaerobic digestion

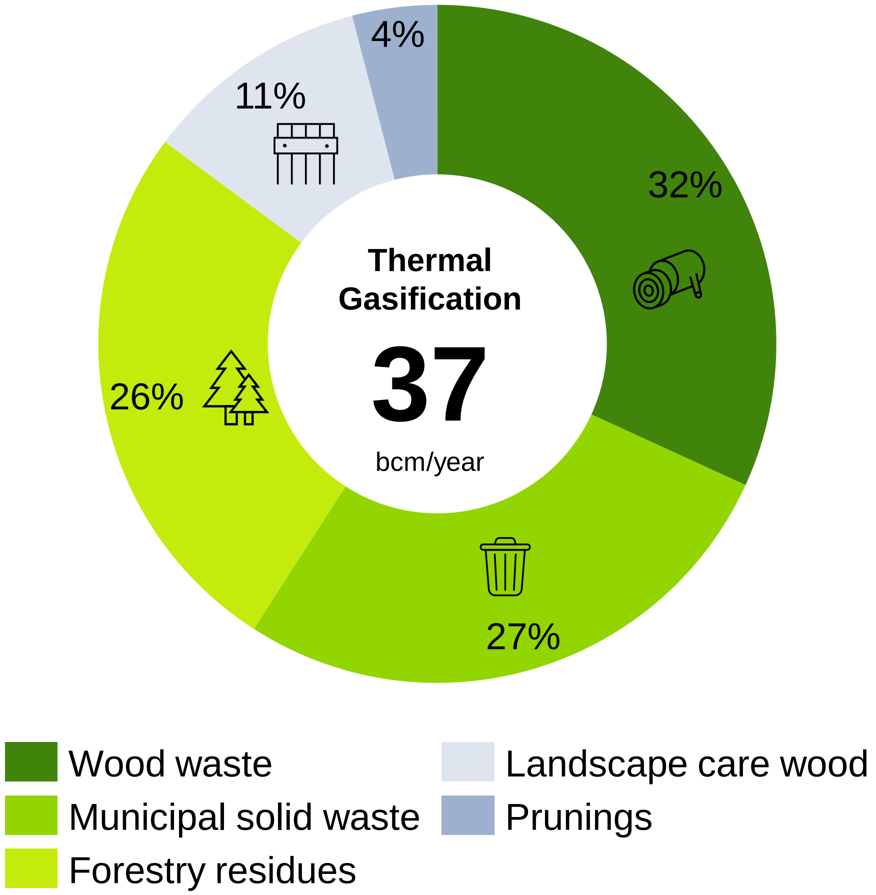
Estimates may deviate from nationally specific studies assessing feedstock availability for sustainable biomethane production

2040 Anaerobic digestion feedstock mix: dominated by sequential crops, agricultural residues and manure



- Potential of 74 bcm/yr estimated for Europe
- Top 5 countries: Germany, France, Spain, Italy, Poland
- 43% of AD potential based on sequential cropping (significant growth from 2030)
- Agricultural residues and Animal manure make up 39% collectively
- Industrial wastewater makes up 11%

2040 Thermal gasification feedstock mix: dominated by woody biomass feedstocks and MSW



- Potential of 37 bcm/yr estimated for Europe
- Top 5 countries: Sweden, Germany, Spain, United Kingdom, France
- 73% of the feedstocks are woody biomass based, including 32% wood waste and 26% forestry residues
- Municipal solid waste accounts for the remainder (27%)

Biomethane production potential can be further increased by deploying novel feedstocks and technologies, as well as landfill gas

Feedstocks

Digestate from anaerobic digestion

Digestate can be used to produce additional biomethane using either Hydrothermal gasification or Pyrolysis, in specific cases

Marginal and contaminated land

Significant potential for underutilised lands to produce bioenergy crops, without contributing to increase in land use change, or compromising existing food or feed production

Seaweed

Interest in using ‘cast’ seaweed as a sustainable feedstock for biomethane production, while also delivering multiple co-benefits

Technologies

Hydrothermal gasification

Versatile technology that can process a wide variety of (wet) biogenic and fossil wastes and effluents into biomethane, as well produce multiple co-products

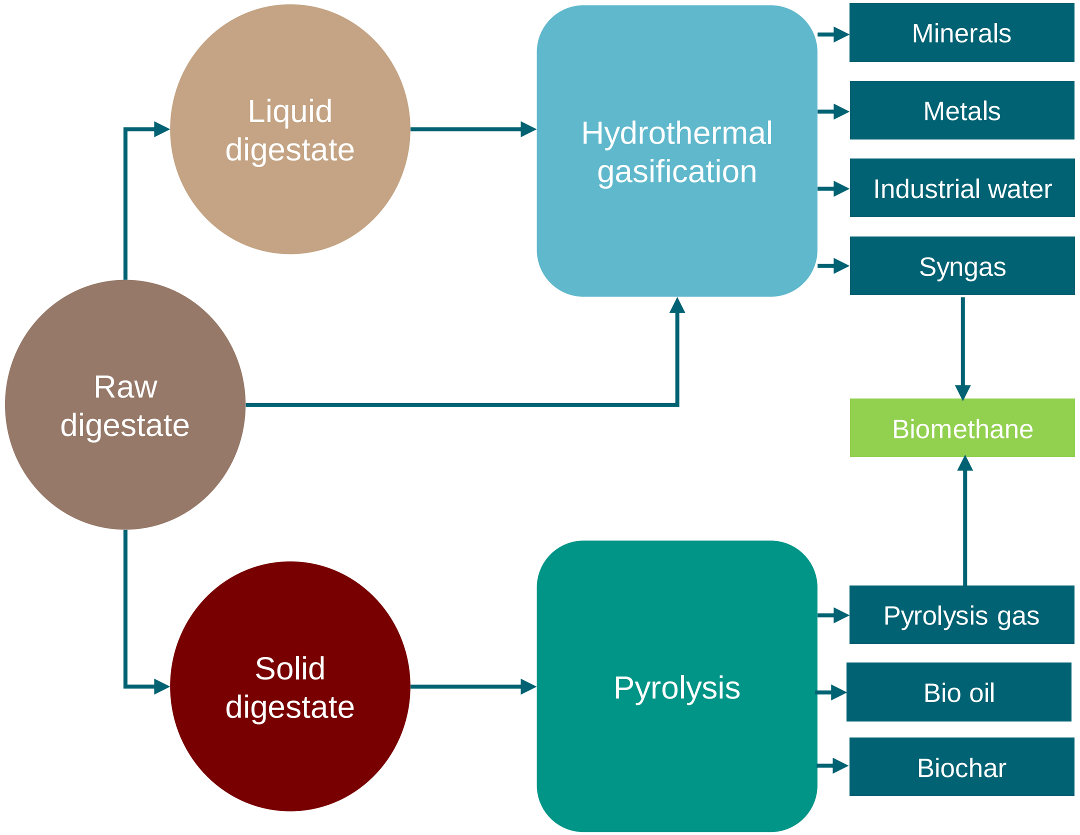
Landfill gas

Existing landfill gas sites represent an important source of low cost biomethane production in the short to medium term

Renewable methane

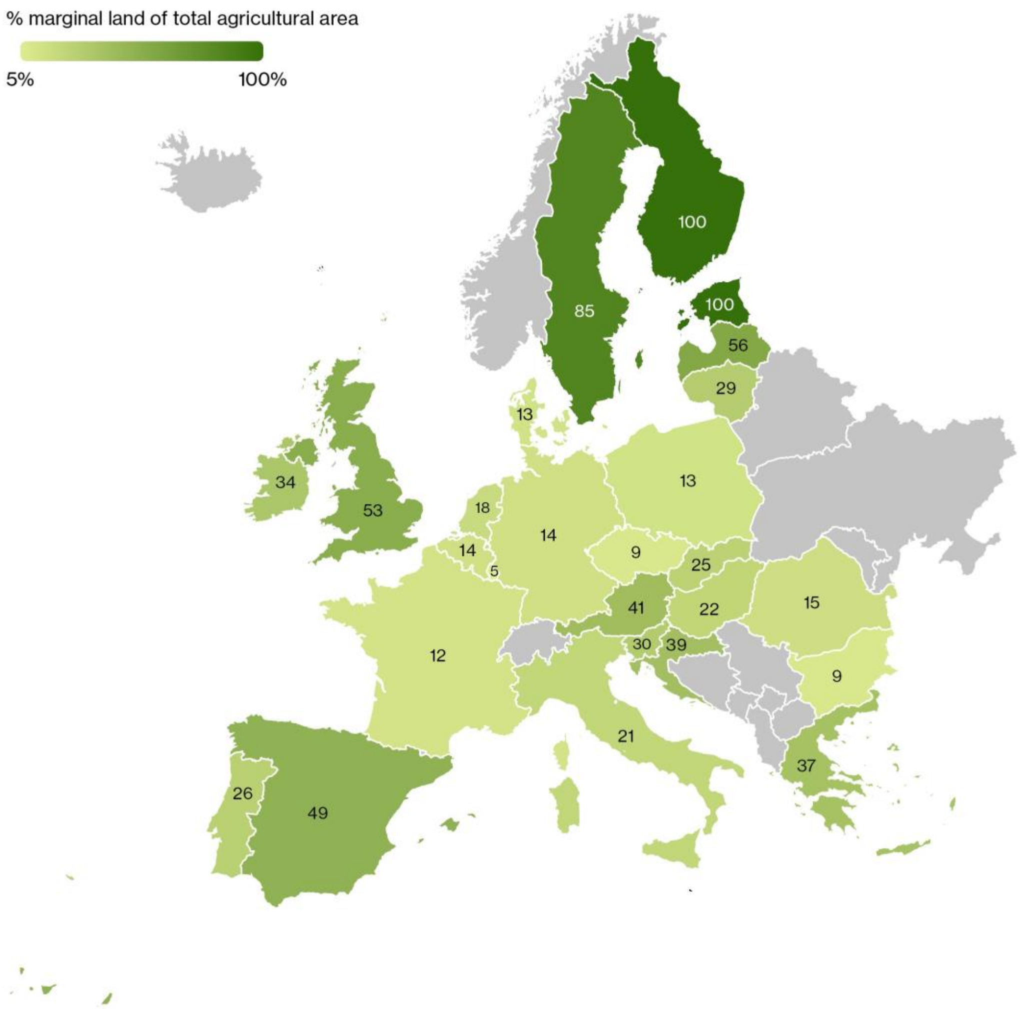
Renewable methane production can facilitate energy system integration, and also help to increase overall biomethane production yields

Digestate from anaerobic digestion



- Application of digestate to land should always be prioritised where feasible and environmentally safe to do so
- Alternatively, two technology options are available to process digestate and produce additional biomethane:
  - Hydrothermal gasification
  - Pyrolysis
- Both technologies also yield several co-products which can be valorised – including nutrients and biochar

Marginal and contaminated lands



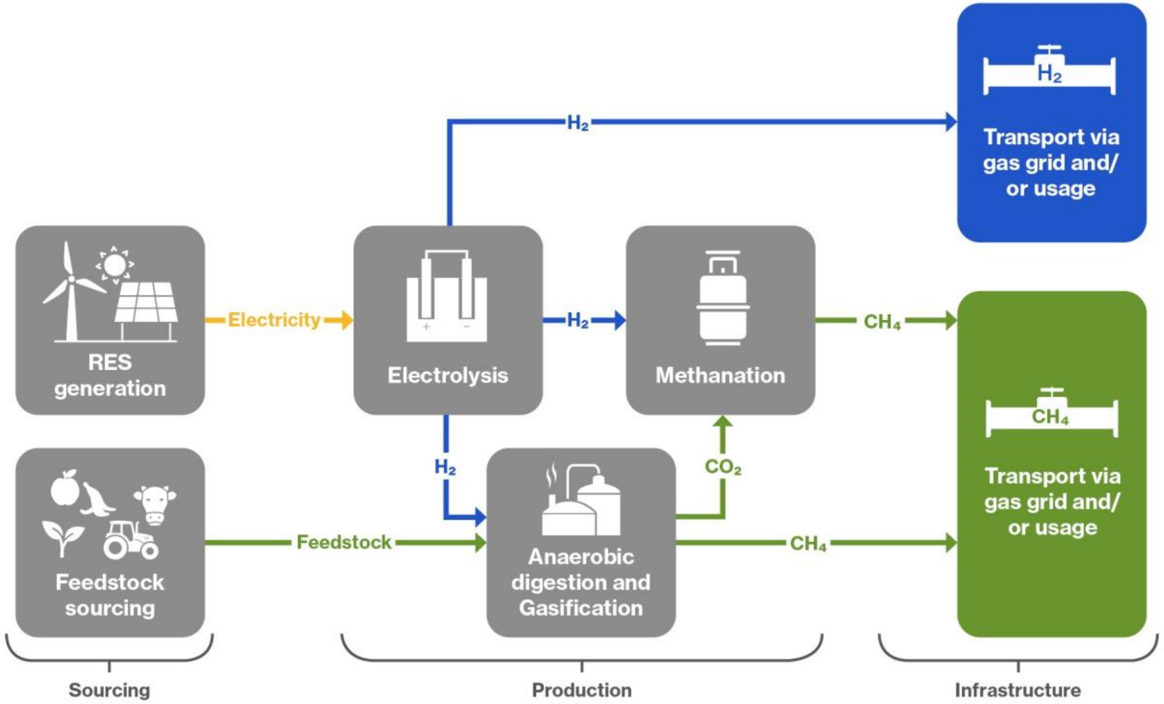
- **~70 Mha** of agricultural marginal land in Europe, of which **5-21 Mha** could be available for sustainable energy crops
- **~ 2 Mha** contaminated land in Europe could unlock further potential
- Utilising 10 Mha for bioenergy crops could realise an additional **25 bcm/yr** biomethane
- Bringing these types of land into productive use can also bring benefits to the soil and biodiversity, or help restore soils through phytoremediation (for contaminated land)

Cast seaweed


Source: COASTAL Biogas

- ‘Cast seaweed’ is naturally deposited on the beach and represents a promising future sustainable feedstock for biomethane production
- Using cast seaweed brings many co-benefits, such as mitigating eutrophication impacts, reducing fugitive GHG emissions and improving water quality in coastal areas
- Solrød industrial scale biogas plant (Denmark), successfully co-processing ~2,000 tonnes of cast seaweed per year since 2015
- Significant future potential exists given that only a very small share of the available cast seaweed is currently being collected (and used)

Renewable methane



- Renewable methane production can facilitate energy system integration
- Renewable H_2 can be combined with biogenic CO_2 to produce renewable methane directly <u>or</u> injected into biogas plant to increase overall plant yield
- Potential to increase overall biomethane yield by up to 66%
- Several notable industry initiatives including: BIOMETHAVERSE demonstrators and Nature Energy’s biological methanation plant

Takeaways

1

Biomethane production potential 111 bcm for Europe in 2040 (101 bcm for EU-27). Directly support efforts to meet the proposed **2040 Climate Target**

2

A potential of 74 bcm is estimated for **anaerobic digestion** in 2040 for Europe, increasing to 99 bcm in 2050

3

A potential of 37 bcm is estimated for **thermal gasification** in 2040 for Europe, increasing to 67 bcm in 2050

4

More biomethane potential can be unlocked by looking at additional feedstocks and technologies

Thank You

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Achieving the 2040 Climate Target Economically

Daan Peters

Managing Director

Common Futures

EBA
European Biogas Association

Biomethane for cost-effective emission abatement by 2040

Common Futures study for EBA

April 2024

Study goal & scope

Biomethane production

Biomethane in primary steel production

Biomethane in dispatchable electricity

Conclusions

Analysing biomethane in new end-uses: dispatchable power and primary steel

Biomethane is **easily stored** and has a seamless transition pathway in gas-consuming sectors.

As production volumes increase, new uses become relevant:

Dispatchable power

Today, biogas produces electricity locally in CHPs. In the future, it becomes increasingly relevant to use biomethane in gas-fired power plants to ensure a reliable climate neutral electricity system.

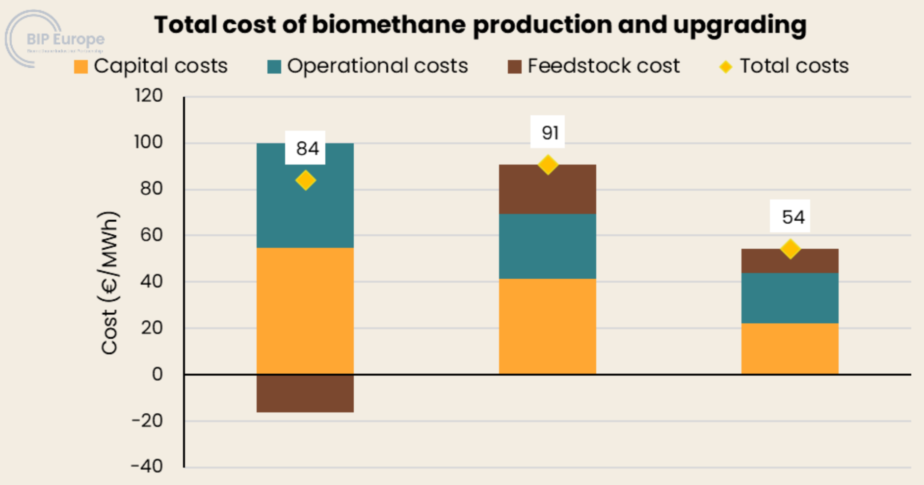
Primary steel

Strategies to switch from coal-fired production to gas fired steel production are largely based on hydrogen. Biomethane is relevant too, not just as fuel but also as renewable carbon feedstock.

Marginal Abatement Cost Curves to compare biomethane with other abatement options including hydrogen

Existing, authoritative studies used as a basis for inputs:

- TYNDP used for energy technology costs and electricity generation capacities
- PBL 2021 used for cost and energy consumption in primary steel production
- BIP 2023 study used for biomethane cost



Category	2 (all)	2 (non-public)	4
Biogas (m³/h)	500 - 1300	500 - 1300	>2000
Biomethane (m³/h)	300 - 780	300 - 780	>1200
Biomethane (MW)	3 - 8	3 - 8	>14
Submission types	All feedstocks	Excluding public feedstocks*	All feedstocks

Study goal & scope

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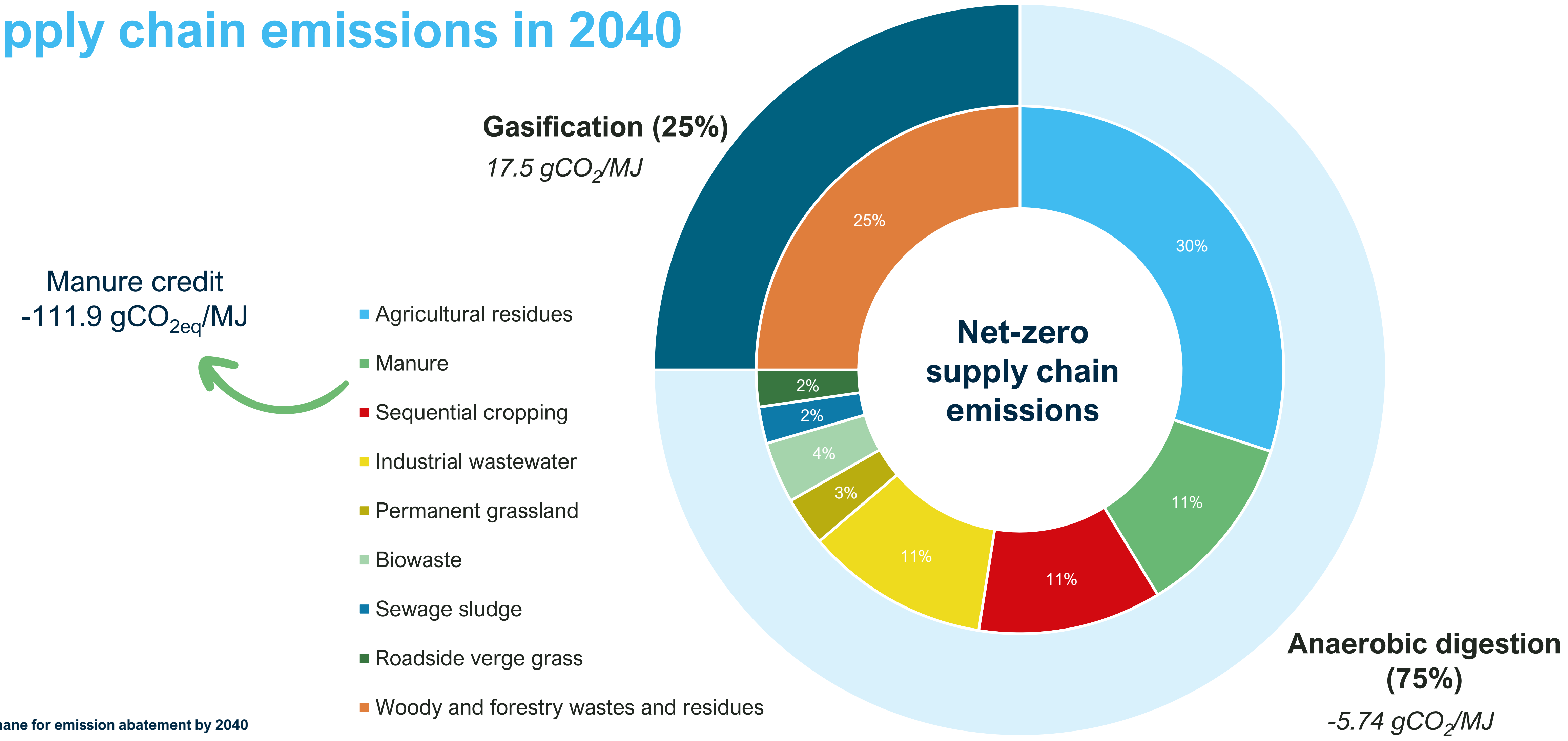
Biomethane can have net zero supply chain emissions in 2040



Three different ways to create negative emissions with biomethane

1 Soil Organic Carbon Accumulation (SOC)

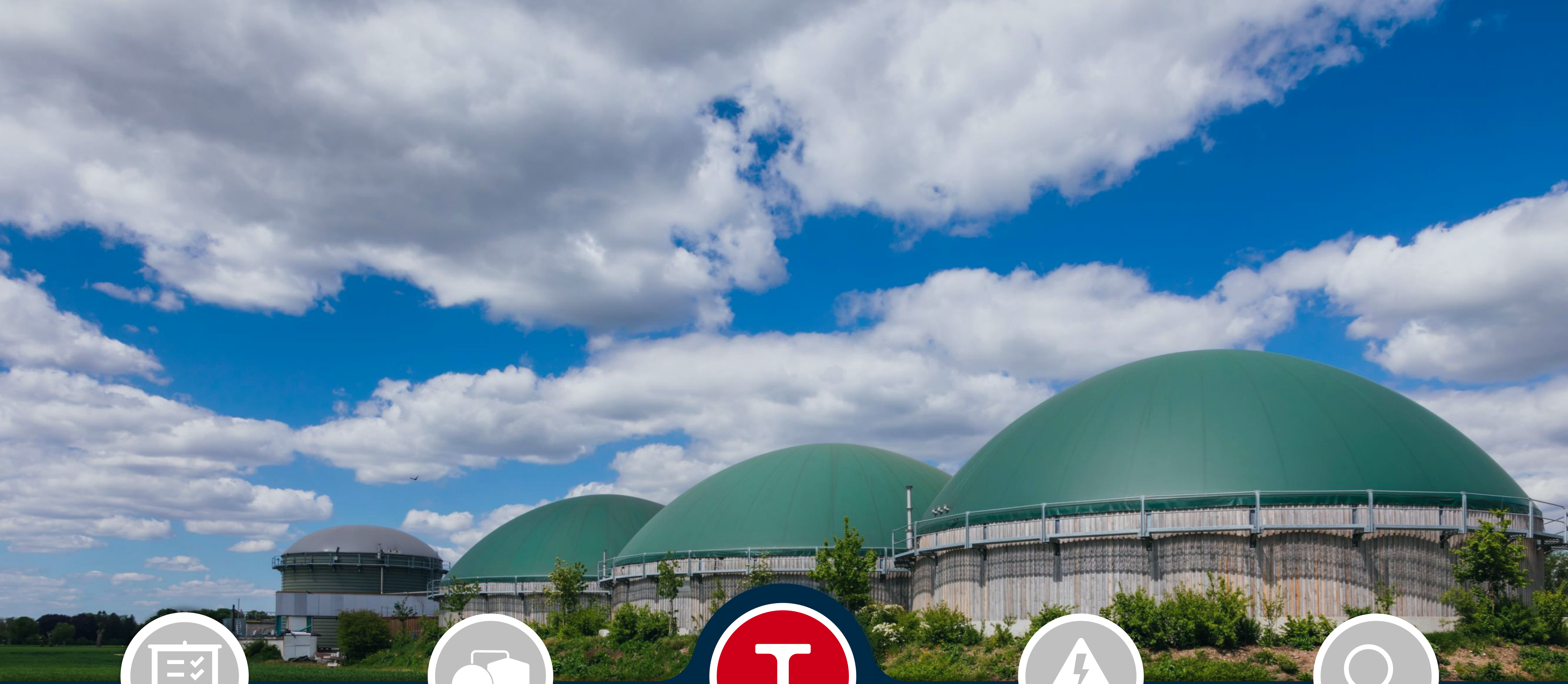
- Increasing the carbon content of degraded soils
- Low tillage practices & cover crops
- **Assumed only with sequential cropping.**

2 Pre-combustion Carbon Capture and Storage

- Biogenic CO_2 captured & stored from **biogas upgrading process**
- Logistics from biomethane plant to storage required & potentially limiting

3 Post-combustion Carbon Capture and Storage

- Biogenic CO_2 captured & stored **following biomethane combustion**
- Logistics potentially limiting
- High concentration, high volume and high running hours desirable



Study goal & scope

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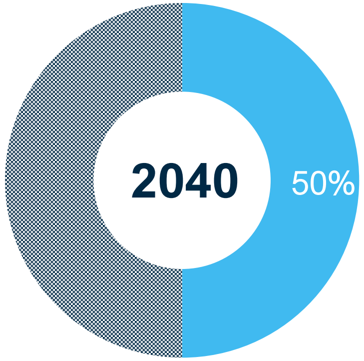
Primary steel production will require renewable gases to provide significant emission reductions



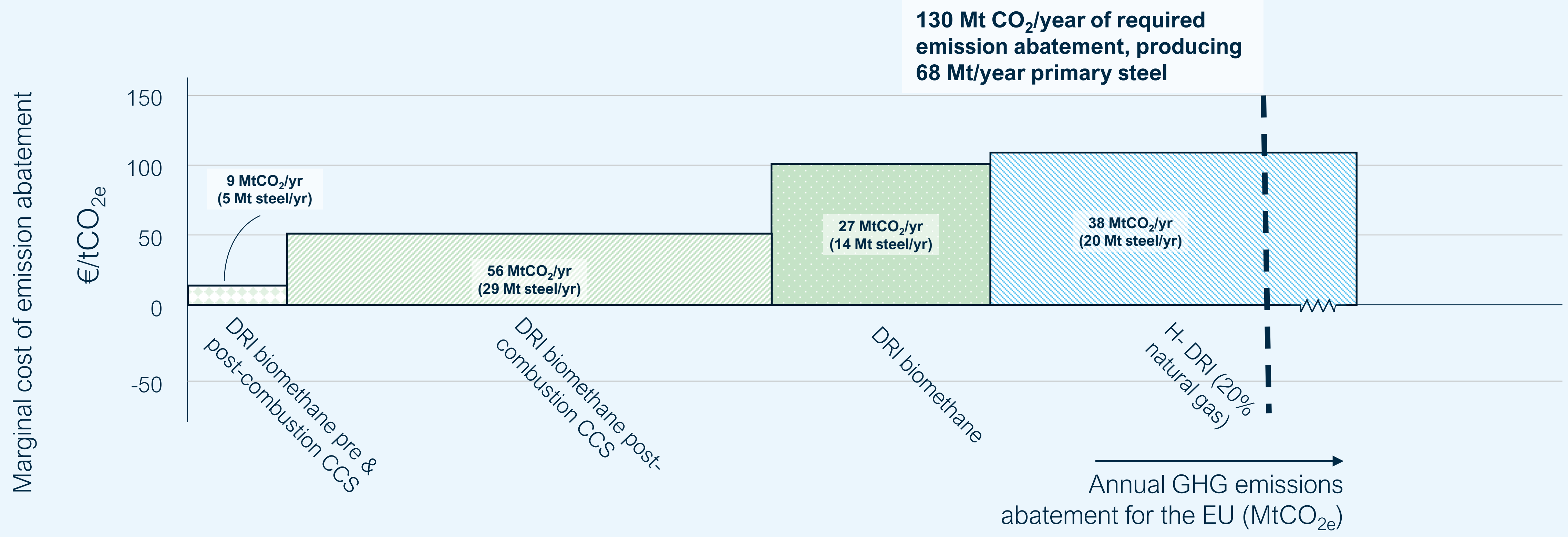
Primary steel is expected to cover 50% of the EU steel market in 2040.

- Down from 57% today.
- Amounts to ~68 Mt steel

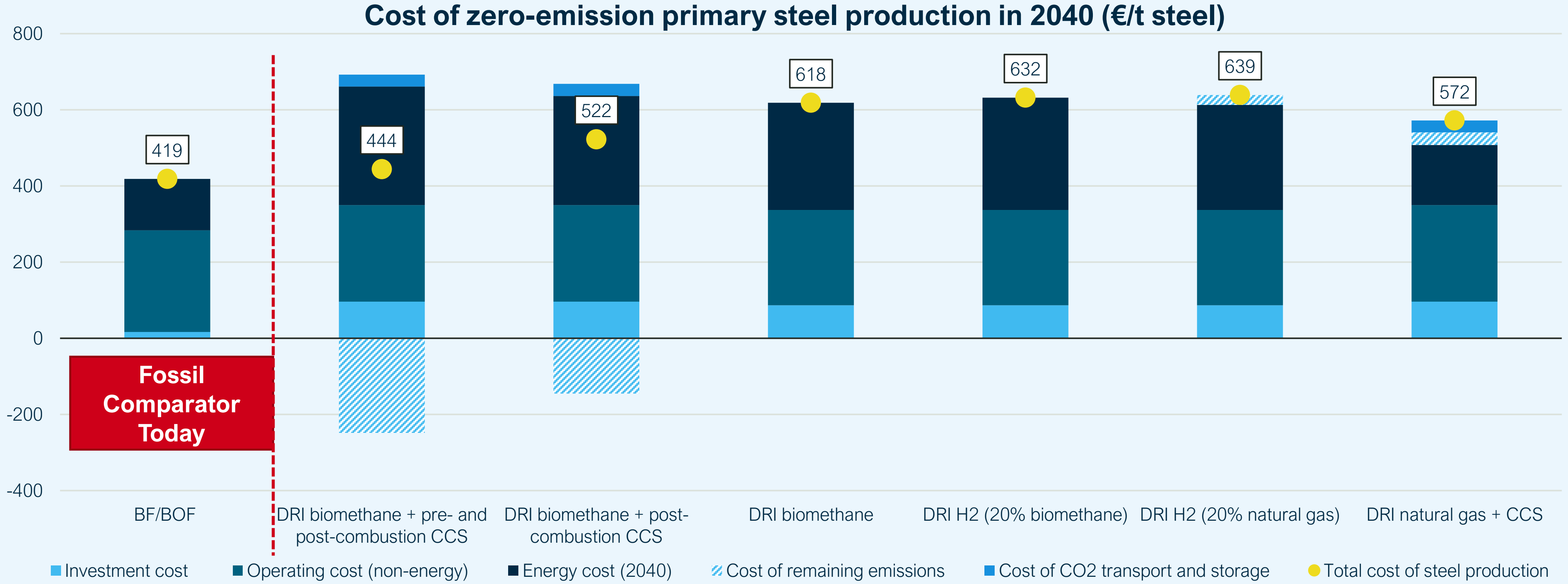
Traditional **coal based production** in a Blast Furnace and Basic Oxygen Furnace (BF/BOF) *is being replaced* with **gas fired steel production** in a Direct Reduced Iron (DRI) shaft with an Electric Arc Furnace (EAF)

Abatement routes focus on **renewable gas and CCS** opportunities.

Biomethane use gives the lowest cost abatement routes for primary steel production



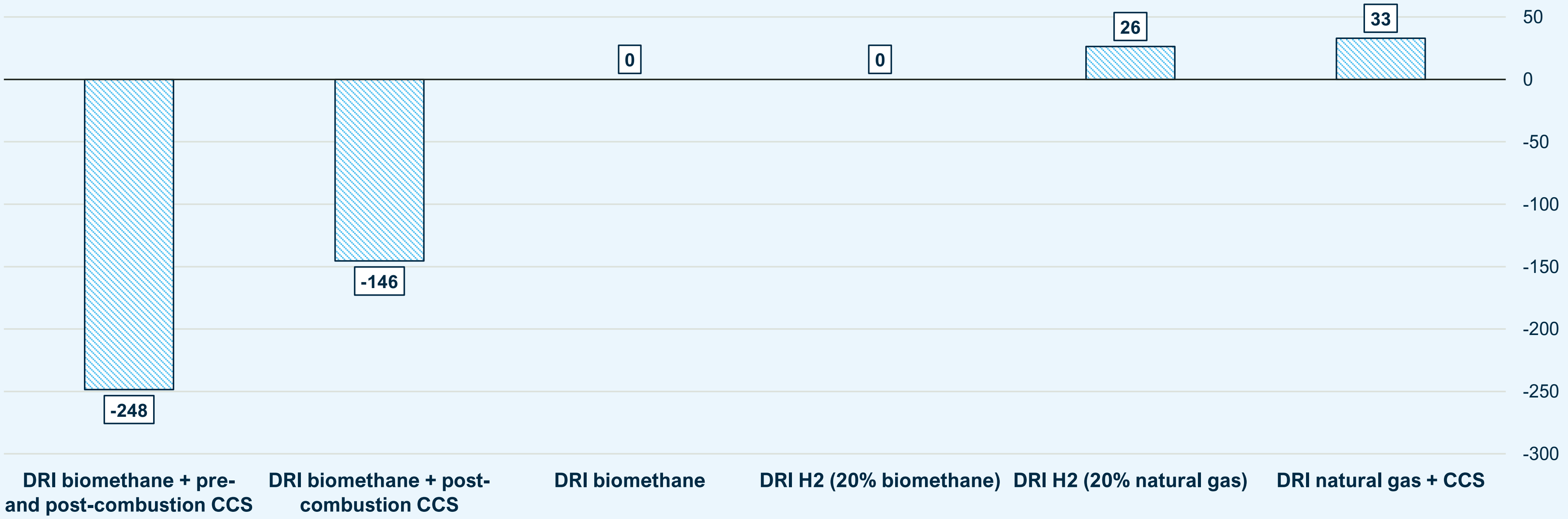
Fuel costs and the value of negative emissions are the biggest cost differences between abatement routes



* All calculations are done per tonne of hot rolled coil steel, keeping the same scope as in the PBL (2021) report.

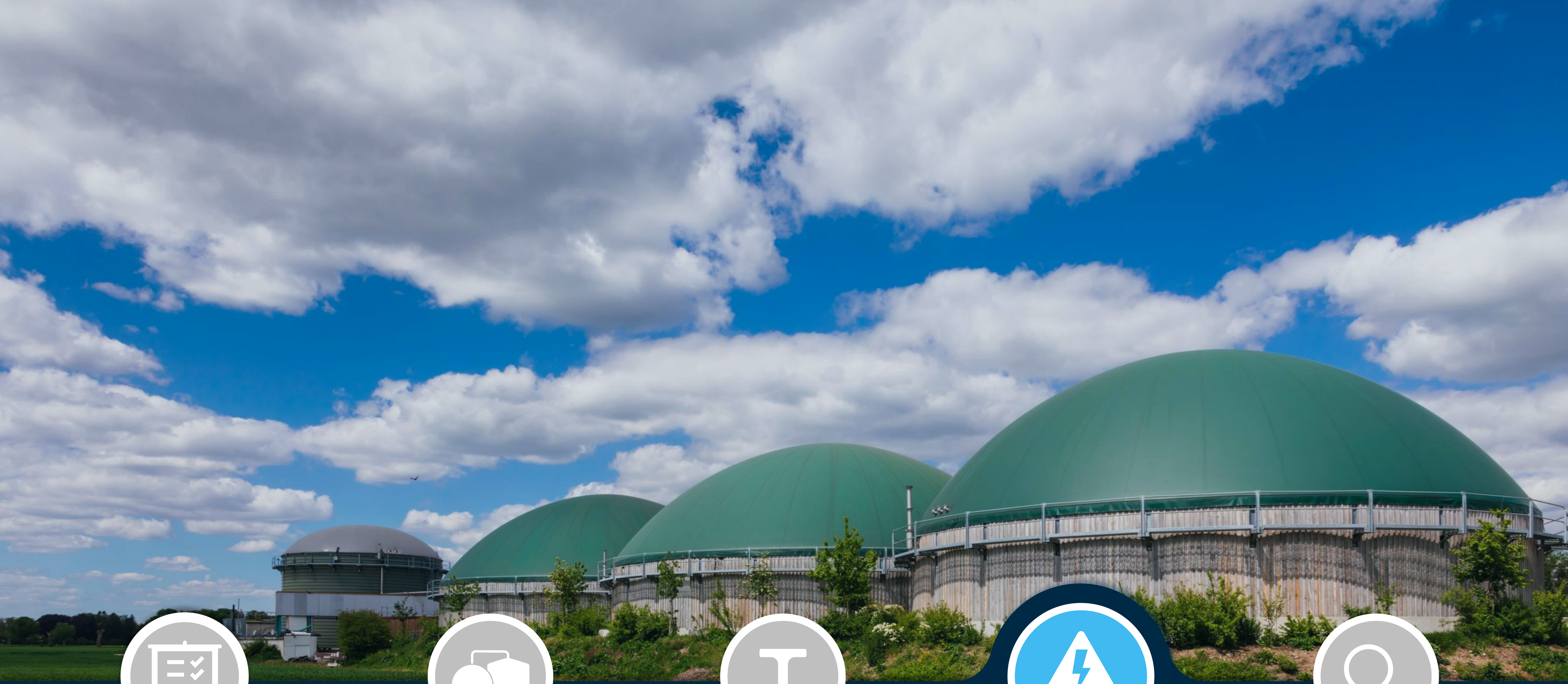
Biomethane use with CCS in steel production creates additional with negative emissions

Value of negative emissions and cost of remaining emissions (€/t steel)



Biochar used in all scenarios

2040 Carbon price: **€269/t CO_2**



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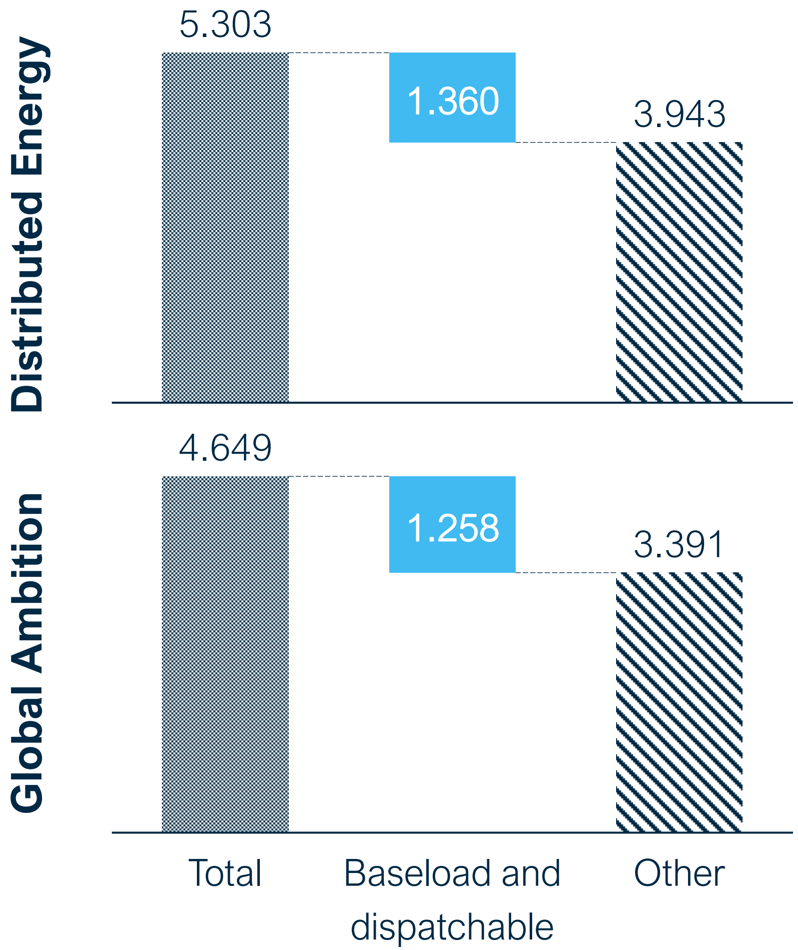
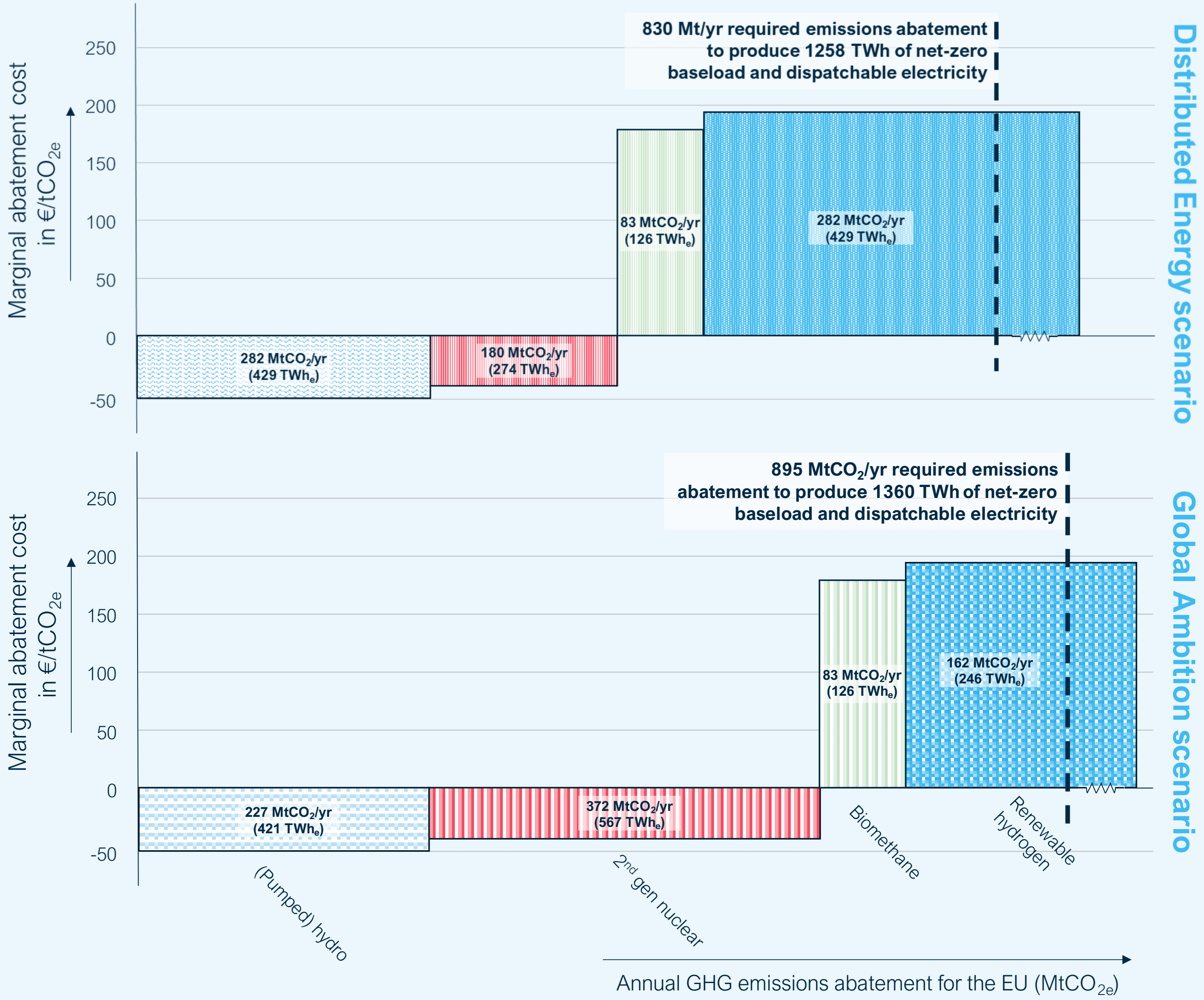
TYNDP 2024 low carbon power mix for 2040 assumed as the basis for our analysis, gas-fired power plays an important role



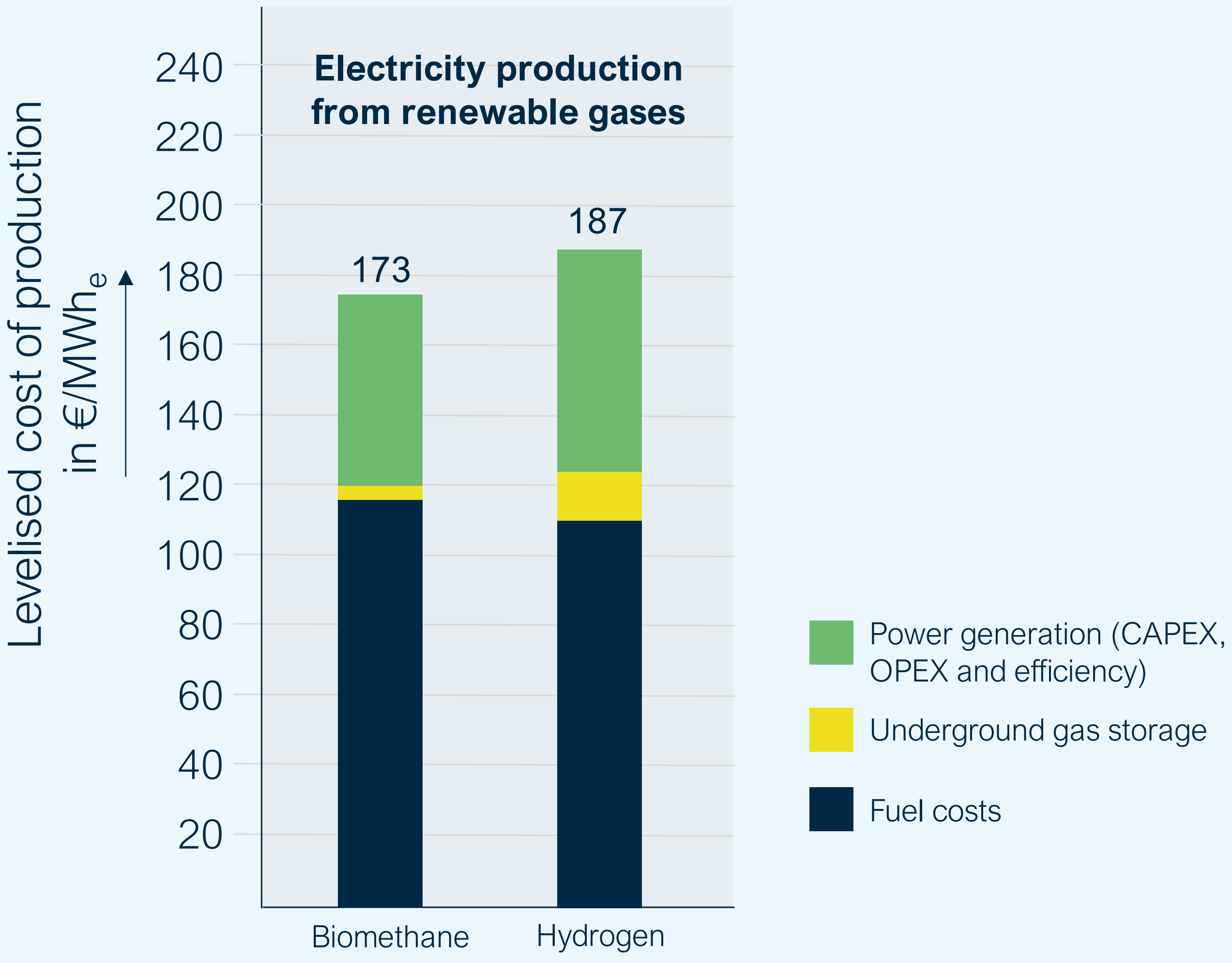
- Hydropower and existing nuclear are the least-cost sources of baseload electricity but limited in capacity and flexibility.
- Seasonal dispatchable deployment of batteries is prohibitively expensive.
- Therefore gas-fired power plants are expected to play an important role (372 – 555 TWh_e in TYNDP scenarios). This is assumed to be provided by either hydrogen or biomethane.

The value of biomethane in dispatchable power

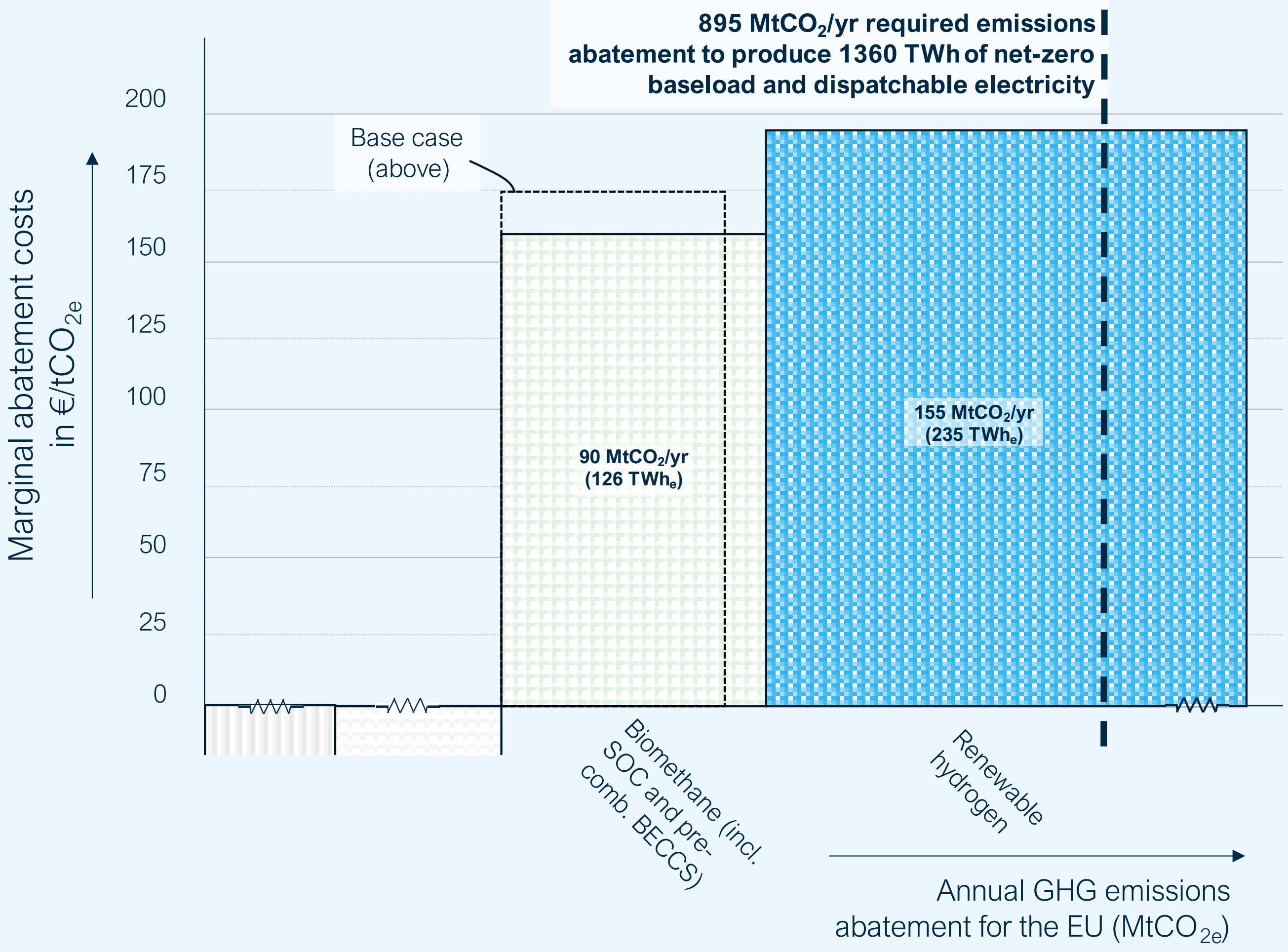
Biomethane is a lower cost option than H_2 for providing dispatchable power



The most significant cost disparity between the two renewable gases lies in underground gas storage



Negative emissions created from biomethane production can reduce the marginal abatement costs and increase emission reduction



Study goal
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Conclusion

MAC curves show biomethane has a key role in the 2040 energy system, especially when negative emissions are considered

1. **2040 biomethane** can come with **zero supply chain emissions**

2. **Biomethane production & use enables the creation of negative emissions**

3. Biomethane use **in primary steel production brings the lowest abatement cost** as biomethane is an emission free fuel, while also being a **much needed source of carbon**

4. **Dispatchable power** from gas-fired power plants comes at the **lowest abatement cost when biomethane is used instead of hydrogen, with the cost of storage a deciding factor.**

Q & A Moderation & Conclusions

Giulia Cancian

Secretary General
European Biogas Association

EBA
European Biogas Association

We want to hear from you!

Insert you question in the Q&A &
upvote your favorite question(s)!

WEBINAR

Dig Deep!

Biomethane scale-up in figures: Mapping new plants and investments across Europe

June 2024

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