

Setting Biomethane Up for Success Biogas PowerOn

September 27-28



Daniel Mercer

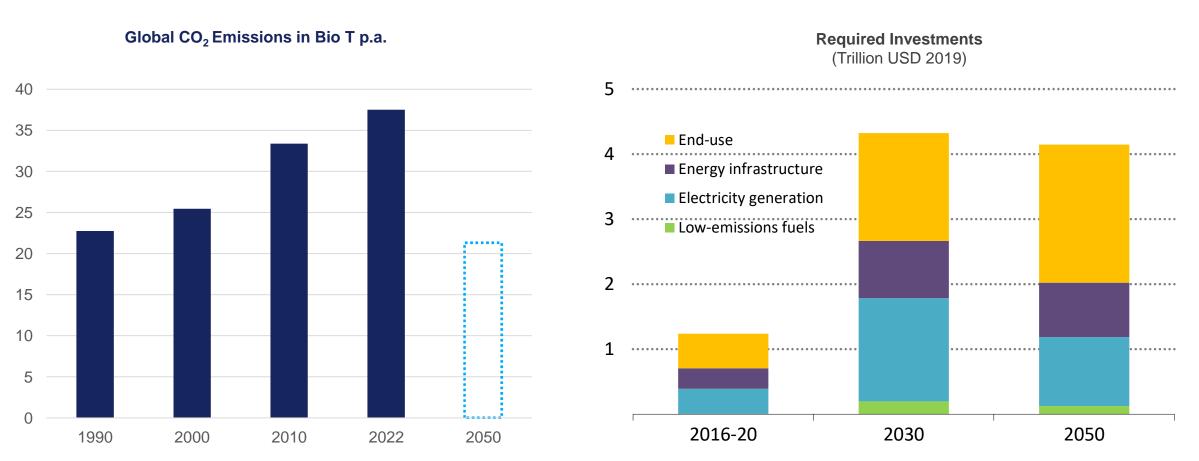
Head of Business Development

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ENGLE's view on the regulatory context of biomethane in the energy transition

Emissions & Energy – IEA's Net Zero (Global View)

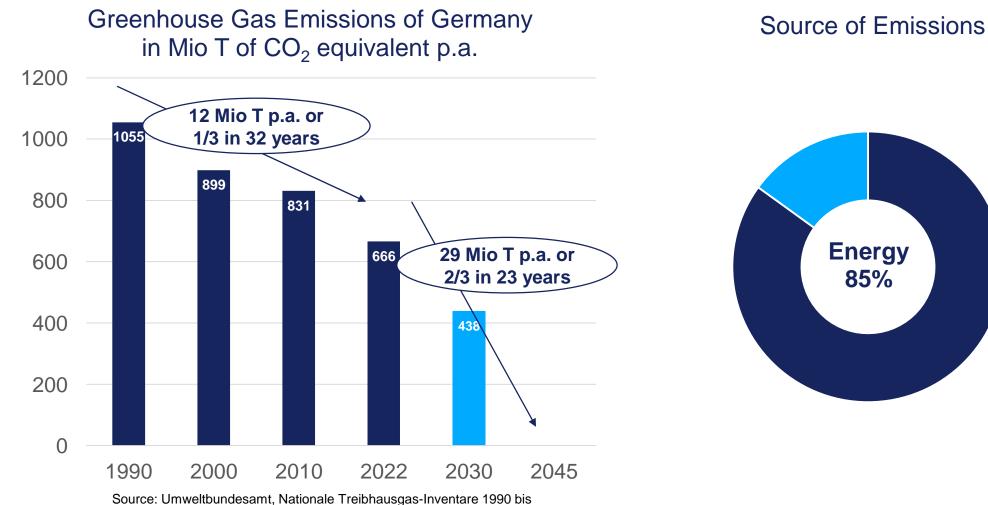


Source: International Energy Agency (2021), Net Zero by 2050, IEA, Paris

Source: Global Carbon Project; Expert(s) (Friedlingstein et al. (2022)) Source: Enerdata



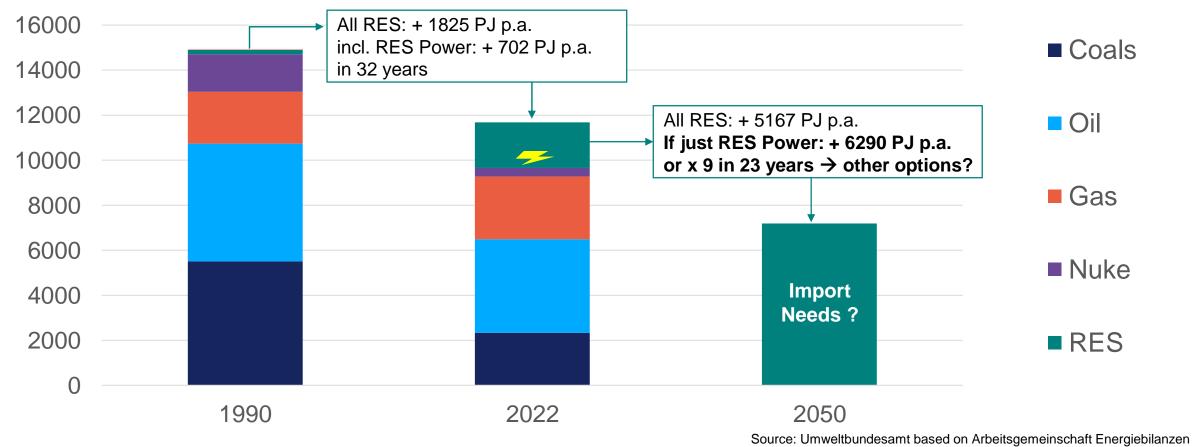
Emissions – Huge reduction efforts required Example of Germany



2021 (of 03/2023), for 2022 preleminary data (of 15.03.2023)

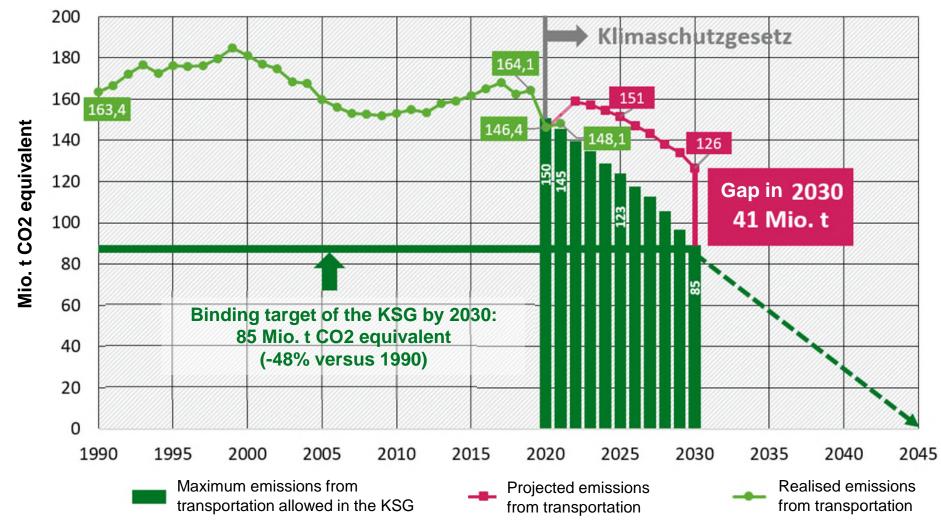
Energy – Massive changes in use & RES installation Example of Germany

Primary Energy Supply of Germany in PJ p.a.





German GHG-Emissions in Transportation according to the Climate Protection Act (Klimaschutzgesetz or KSG)





Gas has a key role to play in the energy transition

No single technology can be the solution to delivering a secure and affordable energy transition, gas has a key role to play.

The transition is **unachievable** without gas

In France, replacing gas by electricity would mean adding:

150 GW¹ equivalent to **90 nuclear reactors** x2 of transmission lines Strong **tailwinds** for gas decarbonization

Supporting mechanisms through ...

- RepowerEU: 380 TWh of biomethane in 2030, ambition doubled since last year
- **€25bn** of investments at EU level in hydrogen by 2030 ... and urgent need from industry

The alliance of molecules and electrons



Biomethane production in Europe

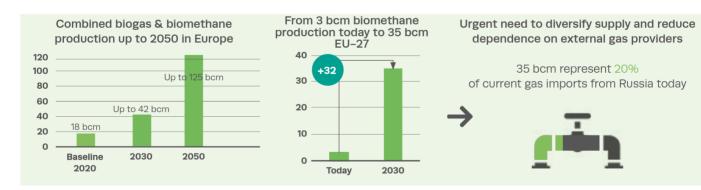
Growth perspectives

Before REPowerEU

□ The European Commission sets strong decarbonization targets (-55% of GHG by 2030) while leaving each Member State defining its own strategy regarding the development of biomethane 1G/2G and e-methane.

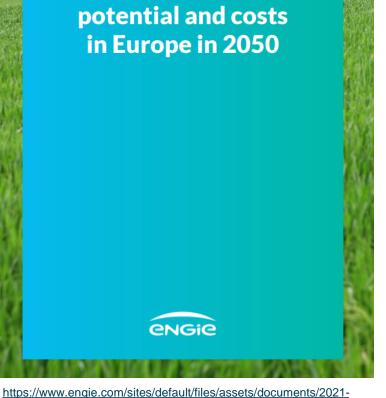
After REPowerEU

European ambition: production of 35 bcm of biomethane by 2030



European Commission's Executive Vice-President, Frans Timmermans, and the Commissioner for Energy, Kadri Simson, have launched the Biomethane Industrial Partnership (BIP, public-private partnership) in September 2022

Geographical analysis of biomethane potential and costs in Europe in 2050



07/ENGIE 20210618 Biogas potential and costs in 2050 report 1.pdf

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ENGIE's views on the European biomethane market

Biomethane Market Prices

The biomethane market is currently not mature, therefore no market price references exist as such in Europe or in any European country.

Biomethane production costs vary widely in Europe are currently between ~80 and ~160 €/MWh, with a sharp increase seen in the last year mainly due to inflation, materials and energy prices.

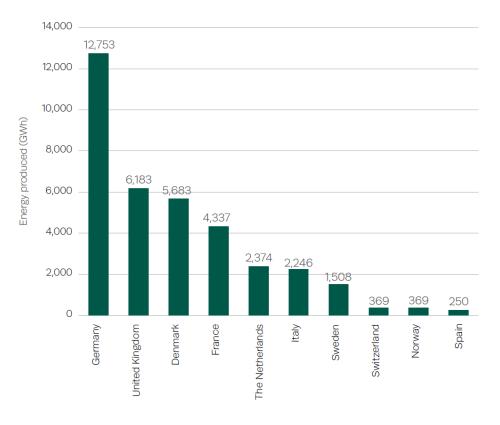
The wide range is due to several parameters related to each biomethane production plant, among which: the size of the plant, the type of feedstocks used, the way to dispose of the digestate, the sale of the CO_2 , the equipment used, the energy prices, the existing subsidies, etc. These in turn were influenced by local regulatory conditions.



Current production of biomethane in Europe

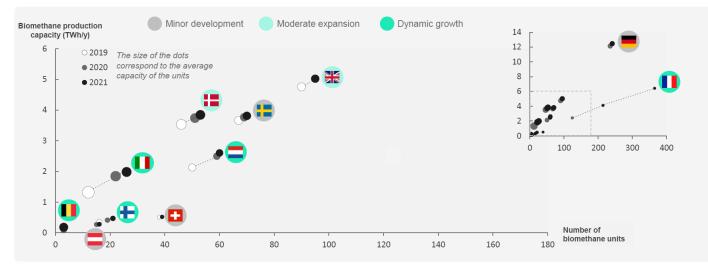
Countries not at the same stage of development

Biomethane production per country in descending order (GWh), top 10 countries (EBA Statistical Report 2022)



Not all countries are experiencing the same dynamic in the development of biomethane production:

- stabilizing in Germany, Austria, Switzerland and Sweden, where minor developments are observed.
- France, the Netherlands, Italy, and Finland are experiencing strong growth, followed in a lesser degree by the United Kingdom and Denmark.
- Note that there is still no biomethane production capacity currently available in Poland



Evolution of biomethane plants number and capacity over 3 years (SIA Partners - European Biomethane Benchmark - May 2022)



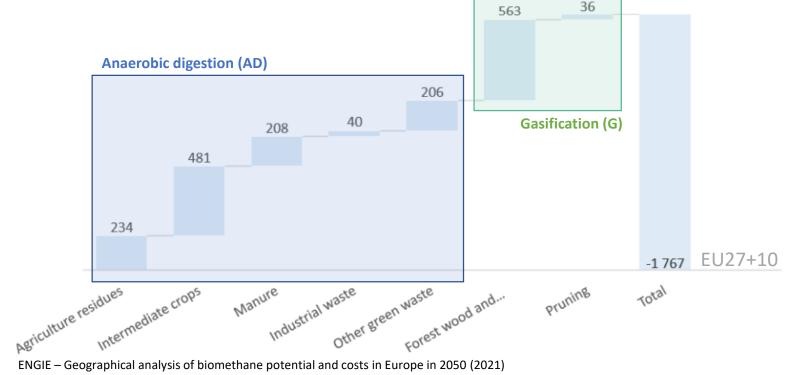
Biomethane potential in Europe in 2050

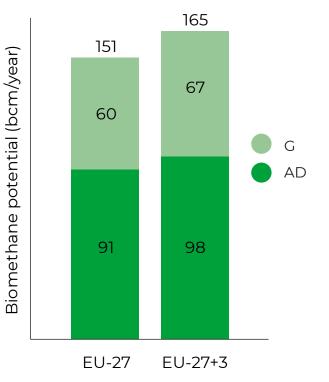
per feedstock types

1100 TWh of biomethane through anaerobic digestion (current and most mature technology) in case of full development of sequential crops with a mobilization rate at 100%

600 TWh of biomethane through gasification technologies

EBA - Gas for Climate Biomethane production potentials in the EU July 2022

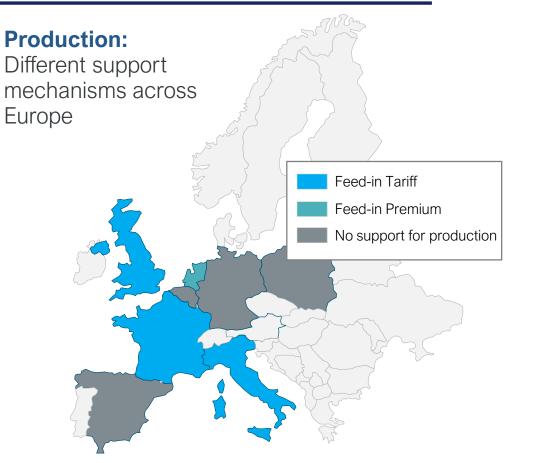




ENGIE – Geographical analysis of biomethane potential and costs in Europe in 2050 (2021)



Market supply support



Most relevant support schemes in place for the development of biomethane production in countries in which ENGIE is active

State support can come in the form of **capital grants** (e.g. Italy) and/or **price support mechanisms** (e.g. Italy, France, UK,...). These supports are only available when injecting biomethane into the grid. <u>Direct biomethane transport to an industrial facility never allows to receive subsidies in any country.</u>

Price support mechanisms often varies depending on the type of biomethane plant (size, type of feedstocks, etc.) and sometimes prevent the producer to access guarantees of origins (e.g. France).

Price support mechanisms Some countries like Spain or Germany have decided not to support production, relying on the demand side

ENGIE is currently developing **both subsidized and unsubsidized** biomethane production projects, depending on the local contexts



Market demand support

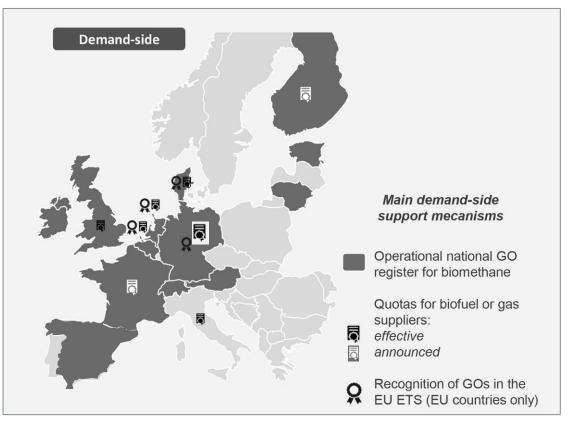
Trading of guarantees of origin and proofs of sustainability

Nascent Market based on :

- Guarantees of origin traded on national registries
- Proofs of sustainability guaranteeing all the elements of the chain such as feedstock, carbon intensity, etc.

Consolidation of the market on-going:

- Creation of all remaining national registries and interconnection
- Simplification of trades of the bundle guarantees of origin and proofs of sustainability



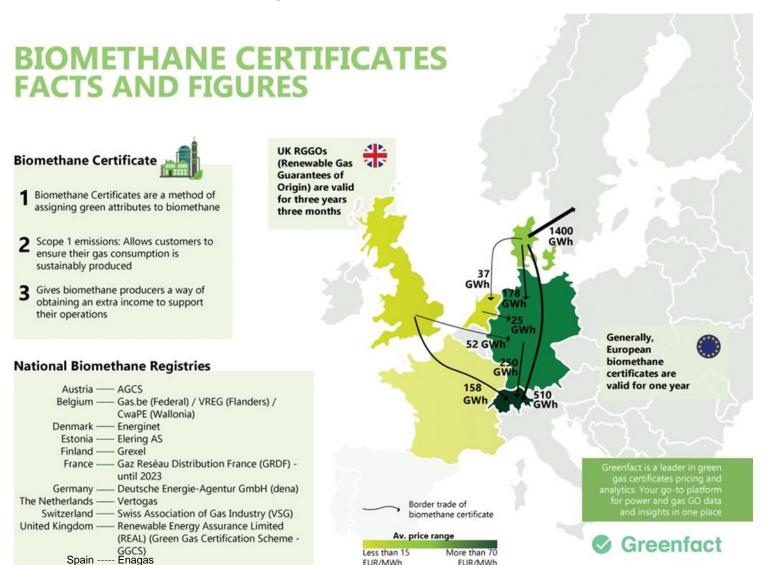
SIA Partners – European Biomethane Benchmark – May 2022 https://portal.greenfact.com/Page/all-about-biomethane-certificates

Focus on biomethane certificates/ Guarantees of Origins

Biomethane certificate prices vary from country to country, depending on many factors such as subsidies from the government and feedstocks used to produce biomethane, etc.

Indicative price ranges of biomethane certificates from Greenfact's database and market sources (late-2021):

- France: 2-5 EUR/MWh •
- UK: 7 – 12 EUR/MWh •
- NL: ٠
- 9 12 EUR/MWh Denmark: 10 - 20 EUR/MWh
- Germany: 40 - 60 EUR/MWh
- 70 100 EUR/MWh Switzerland: ۲



EUR/MWh

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https://portal.greenfact.com/Page/all-about-biomethane-certificates

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EUR/MWh



ENGIE's ambition for the development of biomethane in Europe

The ENGIE Group

Global Presence



RENEWABLES

3.9 GW added capacity in 12M vs 3 GW in 2021

37,9 GW of installed capacity end of 2022

Signature of +2 GW Green PPAs

Ocean Winds **awarded** 8 GW of offshore wind (Scotland, NY, California)

96 400 Employees

NETWORKS

1st gas infrastructure operator in Europe (networks in transport & distribution, underground storage and LNG terminals)

More than 250 000 km of gas distribution network and 5 600 km of power transmission networks worldwide

1st operator of biomethane production sites in France



EBIT of € 9.0 bn

FLEX GEN & RETAIL

2nd global freshwater producer

€ 93.9 bn revenue

60 GW of installed production capacity

22 million BtoC contracts in 5 main countries



S&P BBB+

ENERGY SOLUTIONS

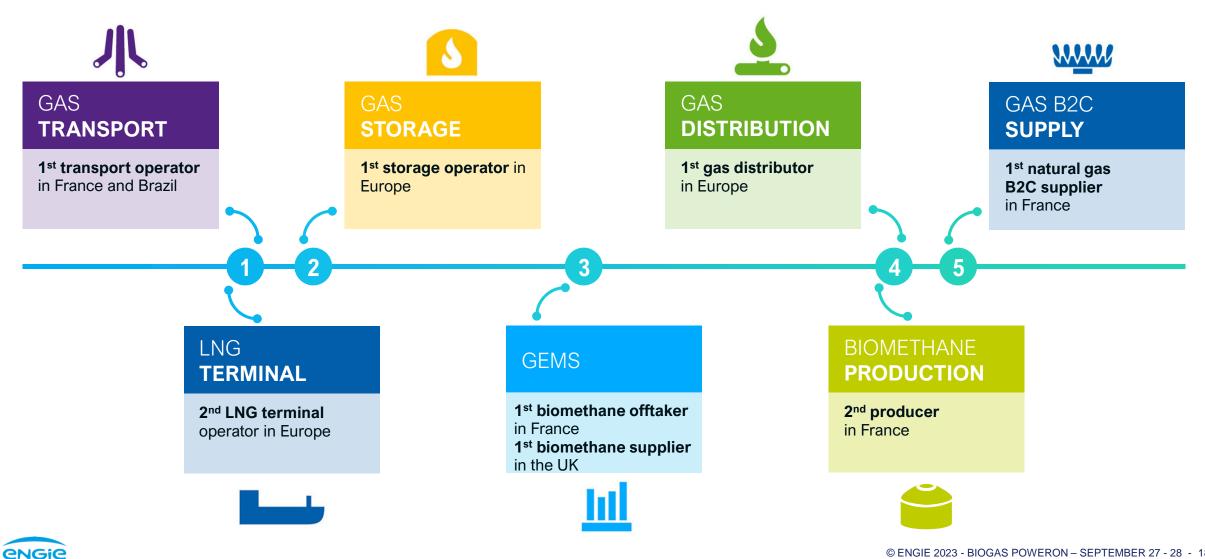
1st cooling network operator in the world

More than 65.000 energy assets operated within buildings worldwide

23 GW of decentralized energy installed capacity

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ENGLE is a key player in the energy gas value chain



ENGLE's biomethane production ambition in Europe

Pipeline of projects in all targeted European countries



10 TWh of biomethane production capacity in Europe by 2030

€3bn invested in the production of renewable methane (biomethane, e-methane) by 2030

1 TWh of projects currently in development in Europe

8 countries targeted so far

Wide range of biomethane plants in terms of size and types of feedstocks depending on local contexts

50 TWh yearly of biomethane capacity **connected** to the gas grid in France by 2030

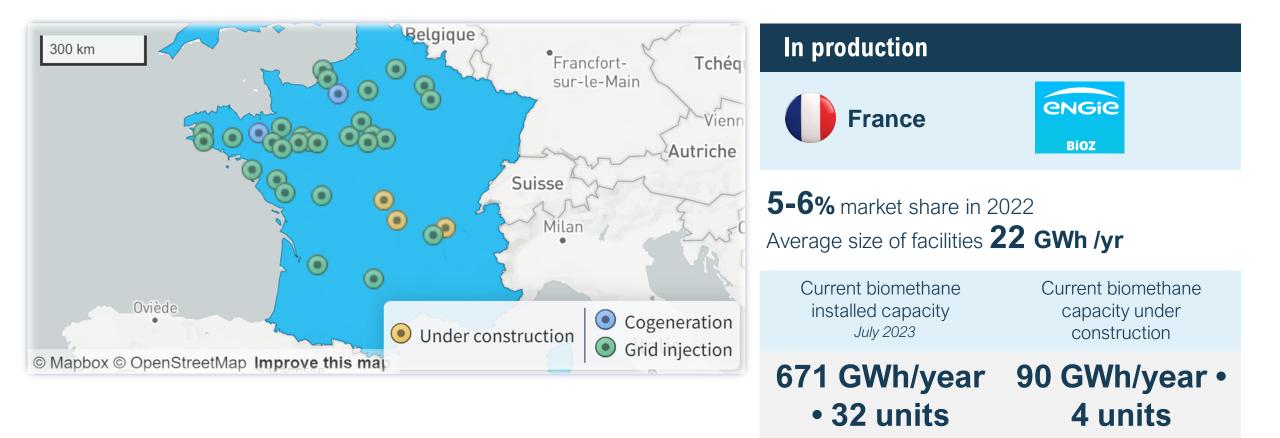
30 TWh yearly **sold** in Europe to ENGIE gas customers by 2030



ENGLE's biomethane production in France

through our subsidiary ENGIE Bioz

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ENGLE's biomethane production in France

Typical example of realization





Site of Coëvrons

- □ 21GWh/year, equivalent to the gas consumption of 1,900 households.
- □ injects 240 Nm3/h into the French gas network
- ~30,000 tons of feedstocks from local farms and agro-industries
- **21** partner farms
- \Box 4 800 tons of CO₂ avoided per year
- □ Surface: a couple of hectares

ENGIE's biomethane production in Europe

Example of realization: biomethane production

GZI North Star - Netherlands - 375 GWh/yr – COD: 2025

- Project located on a former gas purification site in Emmen (NL)
- Feedstock >600 000 tons per year (70% manure / 30% coproducts)
- Lowest carbon intensity with a target of ≤ 0 g equivalent CO₂/MJ.



GZI North Star

ebn

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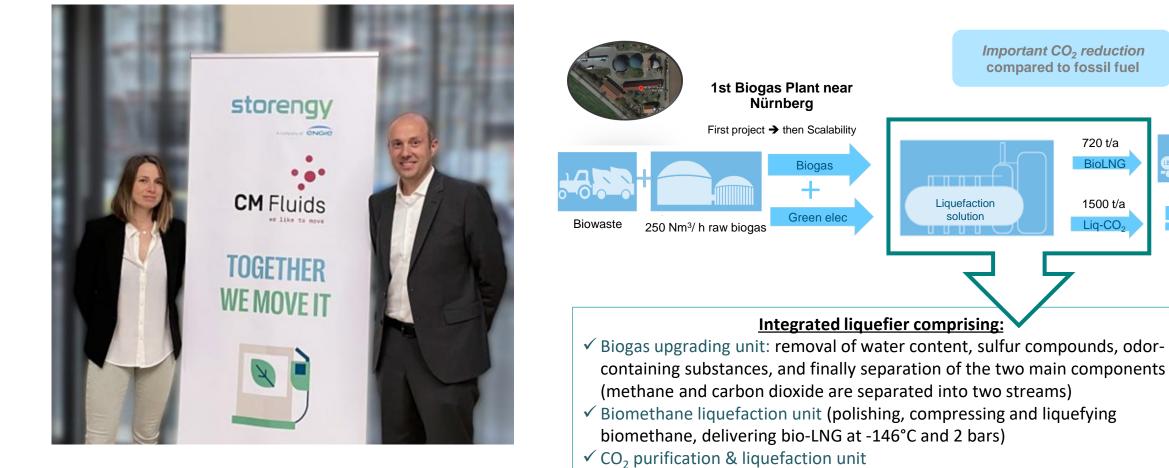


ENGLE's biomethane production in Europe

Example of realization: bioLNG production

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ENGIE and CM Fluids, a start-up and biogas specialist from Bavaria, have set up a partnership to produce liquid biomethane (bio-LNG) for use as a climate-neutral fuel for buses and lorries.



Important CO₂ reduction compared to fossil fuel

Liquefaction

solution

720 t/a

BioLNG

1500 t/a

Liq-CO₂

ENGLE's biomethane production in Europe

Example of realization: partnership with an industrial



CMA CGM world #4 for maritime transport

(+ air cargo & combined logistics). ~8 Mt of fuel/y for a 5 M TEU fleet. 56 G\$ turnover; 18 G\$ net result in 2021. Carbon neutrality by 2050.

Strategic partnership in November 2021

around decarbonized LNG (bioLNG from pyrogasification; e-methane).

Joint Development Agreement in July 2022 for an equity stake in SALAMANDRE project (Le Havre, France, 11 ktpa)

and for 200ktpa of decarbonized LNG by 2030 (2G-biomethane or e-methane)



ENGIE's biomethane supply ambition

Example of realization: long term partnership with Arkema

Arkema and ENGIE signed a 10-year biomethane supply contract from 2023 for 300 GWh per year

Thanks to this contract Arkema can significantly reduce the carbon footprint of its bioplastics produced in France

