

## BIOMETHANE FICHE – Germany (2021)

### BIOMETHANE PRODUCTION, POTENTIALS AND PATHWAYS

Biomethane is upgraded (purified) biogas to the quality of natural gas (methane). Currently, biogas is dominantly used for the production of electricity and heat in CHP plants.

Biogas/biomethane is 100% of domestic origin and has cross-sectoral effects.

Upgrading of biogas in the EU started in 2011. In 2021, total biomethane production in the EU27 was 3.5 bcm. REPowerEU has biomethane as one of the short and medium-time measures to reduce natural gas imports by boosting biomethane production to 35 bcm by 2030.

### BIOGAS / BIOMETHANE IN GERMANY (DATA FROM 2021)

- Energy balances (Eurostat) record production of 8.35 bcm of biogases, without distinguishing the type.
- Biogases make 9.6% of gas supply.
- The 8.35 bcm of biogases are used to produce electricity, either in electricity only or CHP plants (78%), whereas Final energy consumption (15%) had agriculture & forestry (7%), commercial & public services (4%), and households (3%) as main consumers.
- European Biogas Association (EBA) reports<sup>1</sup> 7.9 bcm of biomethane produced in 2021 (85% in biogas plants and 15% in 238 biomethane plants, out of which 199 run on agricultural substrates: these are the mainstay of the German biomethane sector, just as agriculture-based biogas plants form the cornerstone of Germany's biogas production). The main end-use application of biomethane is electricity generation.
- Biomethane use in transport is emerging (< 1%), given the limited CNG (compressed natural gas) vehicle fleet.
- Natural & bio Gas Vehicle Association (NGVA Europe) reports supply of 60% biomethane for transport at 821 (868<sup>2</sup>) CNG stations for Germany in 2020<sup>3</sup>. There were 3,769 CNG filling stations in the EU27 in 2022.

<sup>1</sup> [EBA Statistical Report 2022 | European Biogas Association](#)

<sup>2</sup> [CNG Europe | Map of Natural Gas Vehicle \(NGV\) Compressed natural gas \(CNG\) filling stations in Europe, Mappa Stazioni di rifornimento di metano, Landkarten Methantankstellen erdgastankstellen](#)

<sup>3</sup> <https://www.ngva.eu/medias/2510-biocng-in-2020-new-data-proves-rapid-growth-of-biomethane-in-transport/>

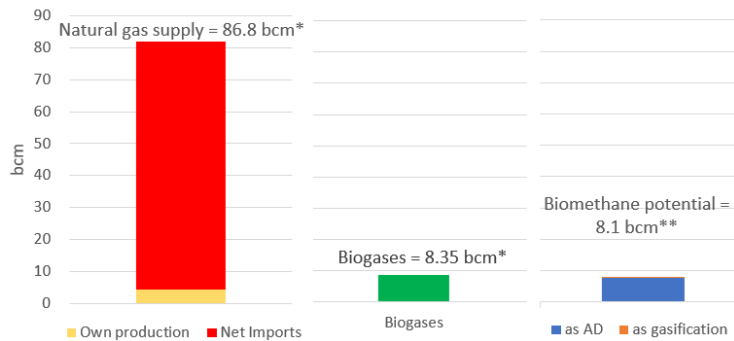


Figure 1 Comparison of current natural gas supply, biomethane production and potential in Germany (2021) (sources: Eurostat: Energy Balances, 2022\*; Guidehouse: Gas for Climate Report 2022\*\*)

Biomethane has two production pathways:

- **Anaerobic digestion (AD)** produces biogas and digestate (fermented organic matter, similar to slurry) as a local source of nutrients and GHG emission mitigation option for land management.
  - Macro and micro nutrient composition of digestate depends on the feedstock used for AD<sup>4</sup>
  - Digestate contains phosphorus (0.2-1.5 kg/t) that is on the list of critical raw materials for the EU<sup>5</sup>.
- **Gasification** produces biogas and biochar (carbonized organic matter, similar to charcoal) as a land-based carbon removal option (IPCC, 2019) and soil amendment.

To maximize the multisectoral value of biomethane, byproducts must be recognized and valorized.



Industry estimates Germany's potential as 8.1 bcm (7.8 bcm from AD and 0.3 from gasification) by 2030 (Figure 2).

Considering the sustainable potential, Germany could be the 2<sup>nd</sup> MS among the EU27.

Germany consumes 1,372 kt and 108 kt of nitrogen and phosphorus fertiliser<sup>6</sup> that could be partially replaced by digestate.

Electricity, gas, steam & air conditioning emit a third the total GHG emission source by economic activity (211.4 MtCO<sub>2eq</sub>)<sup>7</sup> in Germany, which can be tackled by boosting biomethane production, in addition to digestate use as a local source of nutrients.

Figure 2 Biogas/biomethane potential in bcm, by feedstock for Germany (inner pie gasification and outer circle AD) (source: Guidehouse: Gas for Climate Report, 2022)

About 4% (~15.8 bcm) of the total natural gas supply in EU was used for non-energy purposes, dominantly for synthesizing nitrogen-based fertilizers, in addition to the energy input needed to support the production process. Combining biomethane production with a strong support of using digestate as a local source of nutrients would have multiple benefits for the reduction of natural gas imports.

<sup>4</sup> As a rule of thumb, 1 ton of digestate contains 2.3-4.2 kg of N; 0.2-1.5 kg of P and 1.3-5.2 kg of K.

<sup>5</sup> [EUR-Lex - 52023PC0160 - EN - EUR-Lex \(europa.eu\)](https://eur-lex.europa.eu/eur-lex.do?uri=CELEX:52023PC0160-EN)

<sup>6</sup> [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental\\_indicator\\_-\\_mineral\\_fertiliser\\_consumption#Analysis\\_at\\_country\\_level](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_mineral_fertiliser_consumption#Analysis_at_country_level)

<sup>7</sup> [File:Greenhouse gas emissions by economic activity, 2021 \(thousand tonnes of CO2 equivalents\).png - Statistics Explained \(europa.eu\)](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Greenhouse_gas_emissions_by_economic_activity,_2021_(thousand_tonnes_of_CO2_equivalents).png_-_Statistics_Explained_(europa.eu))

## NATURAL GAS (NG) SUPPLY AND CONSUMPTION OF GERMANY (2021)

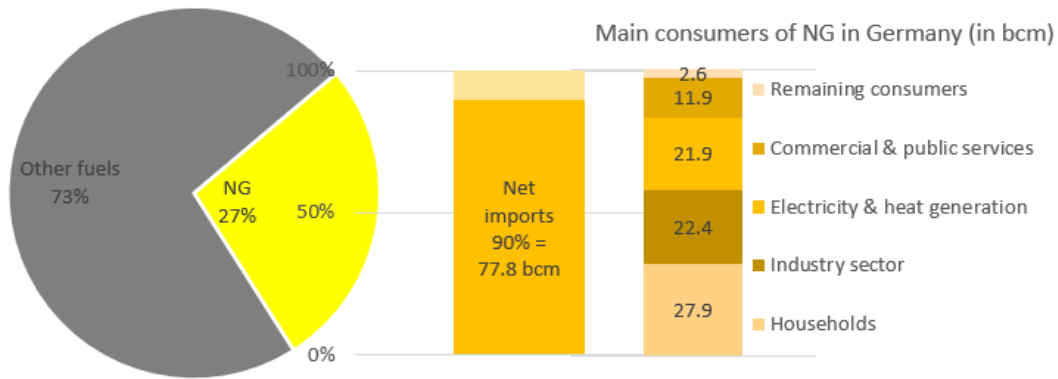


Figure 31 Natural gas share in total energy supply, origin and main consumers for Germany (2021) (source: Eurostat: Energy Balances, 2022)

- NG makes 27% of the total energy supply (TES) of Germany, out of which 90% (77.8 bcm) is imported.
- Roughly, NG is used 96% for energy purposes and 4% for non-energy purposes (synthetic fertilizers).
- In Germany, NG is mainly consumed in final energy consumption (73%) with households (32%) and industry (26%) as main consumers. About 25% of NG is used in production of electricity, either in electricity only or CHP plants.

### Key messages for biomethane in Germany:

- Sustainable biomethane potential is close to the current production of biogases in Germany.
- In 2021, Germany produced about a third of the total EU27 biomethane production.
- Germany has already integrated biogas electricity in grid balancing.
- A programme to repower biogas CHP plants, without ancillary grid balancing service, to biomethane, either as a single upgrading point or a cluster with a centralised upgrading unit close to the grid injection or industry consumer.
- Transition from food & feed feedstock to sequential cropping and digestate use (like the Italian BiogasDoneRight concept) would increase the impact on GHG emission savings of already operational biogas and biomethane plants.
- Grass-based biorefineries to produce protein with AD biogas would be beneficial for Germany's feedstock composition.
- Given the feedstock profile, a ripple effect would be created by pairing biomethane production with the industrial wastewater treatment facilities to achieve short supply chains with biogenic CO<sub>2</sub> and biomethane use in industry (ETS sector) or heavy-duty vehicles linked to the industry operation (transport sector).
- Germany has infrastructure to start supplying biomethane to transport in the existing 868 CNG filling stations.