BIOMETHANE FICHE – Portugal (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 PORTUGAL (DATA FROM 2021)

- Energy balances (Eurostat) record production of 0.1 bcm of biogases, without distinguishing the type.
- Biogases make 1.8% of gas supply.
- 0.1 bcm of biogases are mainly used to produce electricity, either in electricity only or CHP plants (92%).
- European Biogas Association (EBA) reports[1] 0.07 bcm of biogas produced in 2021 (100% in 63 biogas plants).
- There are no records of biomethane production in Portugal.
- No records on biomethane use in transport.
- CNG Europe reports 11 CNG stations for Portugal, out of 3,769 in the EU27, in 2022[2].

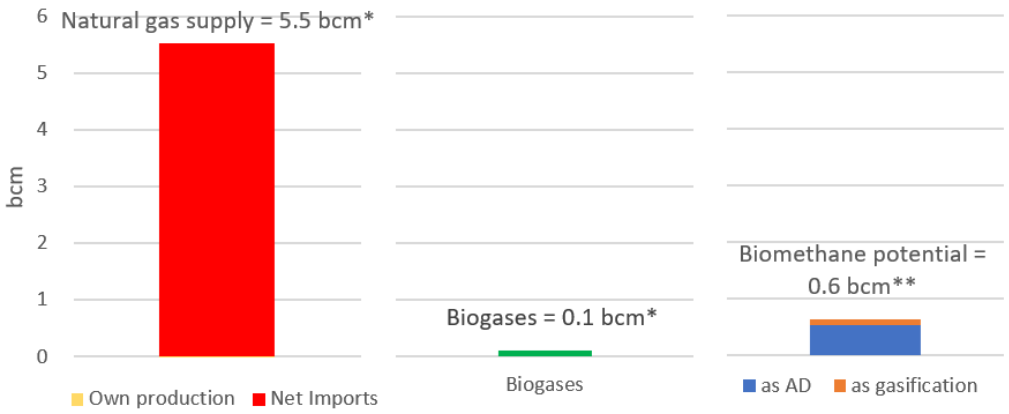


Figure 1 Comparison of current natural gas supply, biomethane production and potential in Portugal (2021) (sources: Eurostat: Energy Balances, 2022; Guidehouse: Gas for Climate Report 2022**)*

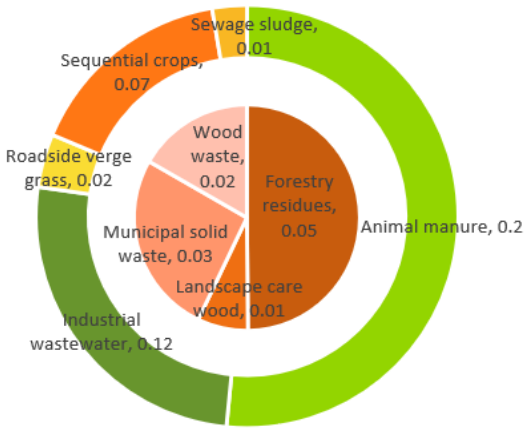
[1] EBA Statistical Report 2022 | European Biogas Association

[2] CNG Europe | Map of Natural Gas Vehicle (NVG) Compressed natural gas (CNG) filling stations in Europe, Mappa Stazioni di rifornimento di metano, Landkarten Methantankstellen erdgastankstellen

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[3]
  - Digestate contains phosphorus (0.2-1.5 kg/t) that is on the list of critical raw materials for the EU[4]**.**
- **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 Portugal's sustainable biomethane potential as 0.6 bcm (0.5 bcm from AD and 0.1 from gasification) by 2030 (Figure 2).

Considering the potential, Portugal could be a middle-sized EU27 biomethane market but with a major impact on the national level.

Portugal consumes 105 kt and 18 kt of nitrogen and phosphorus fertiliser[5] that could be partially replaced by digestate.

Manufacturing and Other services, water supply & construction are the main two GHG emission sources by economic activity with 54% (26.1 $MtCO_{2eq}$)[6] in Portugal, which can be tackled both by manure management in anaerobic digestion and application of digestate on soil (land management).

Figure 2 Biogas/biomethane potential in bcm, by feedstock for Portugal (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.

[3] 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.
[4] EUR-Lex - 52023PC0160 - EN - EUR-Lex (europa.eu)
[5] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_mineral_fertiliser_consumption#Analysis_at_country_level
[6] File:Greenhouse gas emissions by economic activity, 2021 (thousand tonnes of CO2 equivalents).png - Statistics Explained (europa.eu)

NATURAL GAS (NG) SUPPLY AND CONSUMPTION OF PORTUGAL (2021)

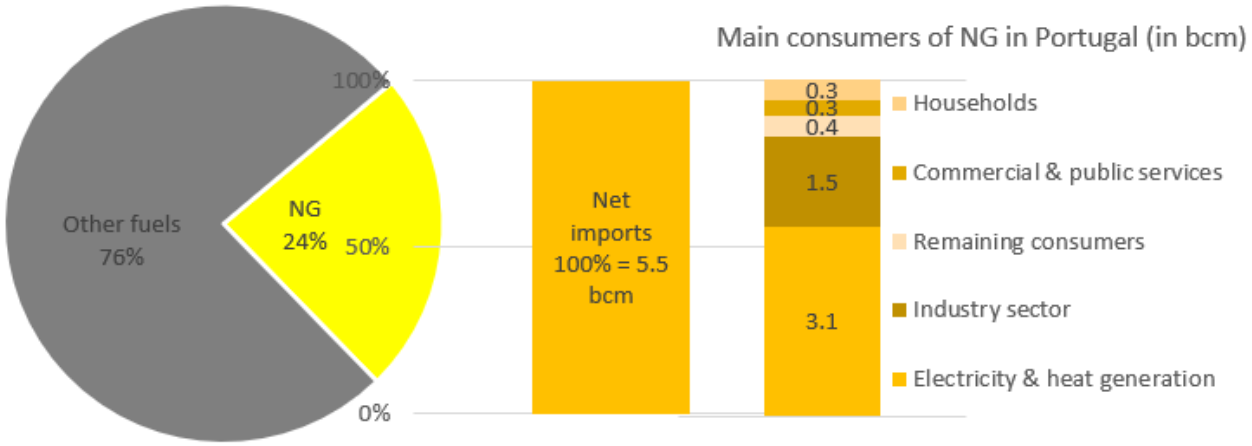


Figure 3 Natural gas share in total energy supply, origin and main consumers for Portugal (2021) (source: Eurostat: Energy Balances, 2022)

- NG makes 24% of the total energy supply (TES) of Portugal, out of which 100% (5.5 bcm) is imported.
- Roughly, NG is used 99% for energy purposes and 1% for non-energy purposes (synthetic fertilizers).
- The main NG consumption sectors are production of electricity (60%), either in electricity only or CHP plants, and industry (26%).

Key messages for biomethane in Portugal:

- Portugal has ability to replace about 11% of current NG consumption (imports) with biomethane.
- Current number CNG filling stations are not sufficient to have a larger uptake of biomethane in transport.
- 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_2 and biomethane use in industry (ETS sector) or heavy-duty vehicles linked to the industry operation (transport sector).
- A programme for repowering biogas CHP plants to biomethane, either as a single upgrading point or a cluster with a centralised upgrading unit close to the grid injection or industry consumer, with digestate use as a local source of nutrients.
- Promoting the Italian BiogasDoneRight concept, adapted to local features, where biomethane is produced from manure, agri-residues and sequential cropping, including digestate use, would increase the impact on GHG emission savings and green transition of the agri-food industry.
- To have full effect of biomethane production on the green transition, biomethane production is to be linked with agri-food industry (the […] largest sector as NG consumer, and the […] largest GHG emitting production activities in Portugal) to avoid transportation costs and feedstock loss, with digestate and renewable CO2 use in bioeconomy.