BIOMETHANE FICHE – Greece (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 GREECE (DATA FROM 2021)

- Energy balances (Eurostat) record production of 0.1 bcm of biogases, without distinguishing the type.
- Biogases make 2.3% of natural gas supply.
- 0.1 bcm of biogases are mainly used to produce electricity, either in electricity only or CHP plants (72%), whereas Final energy consumption (27%) had industry (17%) and commercial & public services (10%) as consumers.
- European Biogas Association (EBA) reports[1] 0.1 bcm of biogas produced in 67 biogas plants. No records of biomethane production in Greece. EBA reports on considerable potential for Bio-CNG and Bio-LNG supply in the Greek Islands and other remote areas, as a part of local decarbonisation plans.
- Biomethane use in transport is not recorded.
- CNG Europe reports[2] 27 CNG stations for Greece, out of 3,769 in the EU27, in 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

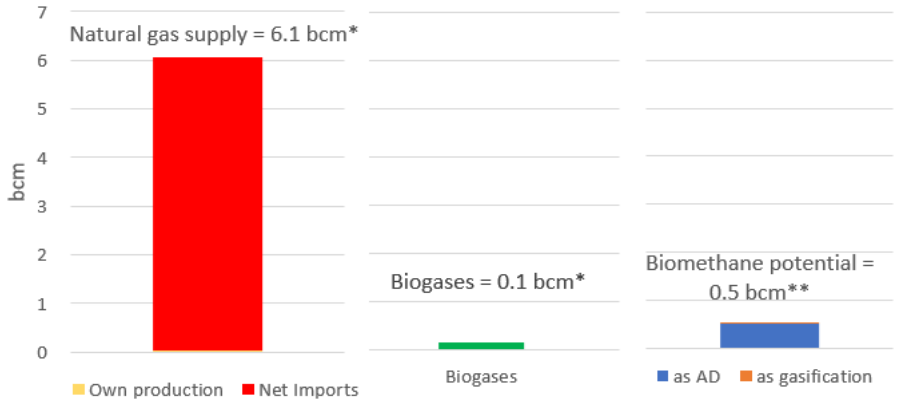

Figure 1 Comparison of current natural gas supply, biomethane production and potential in Greece (2021) (sources: Eurostat: Energy Balances, 2022; Guidehouse: Gas for Climate Report 2022**)*

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[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.

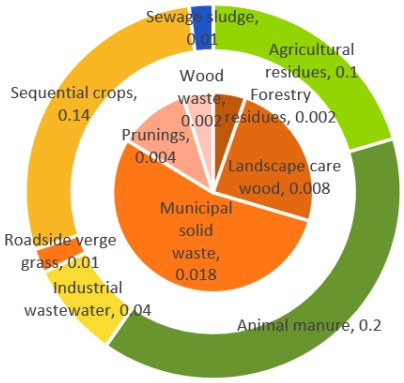

Figure 2 Biogas/biomethane potential in bcm, by feedstock for Greece (inner pie gasification and outer circle AD) (source: Guidehouse: Gas for Climate Report, 2022)

Industry estimates Greece's potential as 0.53 bcm (0.5 bcm from AD and 0.03 bcm from gasification) by 2030 (Figure 2).

Considering the sustainable potential, Greece could be a middle-sized biomethane market among the EU27.

Greece consumes 203 kt and 28 kt of nitrogen and phosphorus fertiliser[5] that could be partially replaced by digestate.

Energy supply and transportation & storage make 55% of the total GHG emissions by Greek economic activity with (42.9 $MtCO_{2eq}$)[6], which can be tackled both substituting natural gas supply with biomethane and biomethane use in transport sector.

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 GREECE (2021)

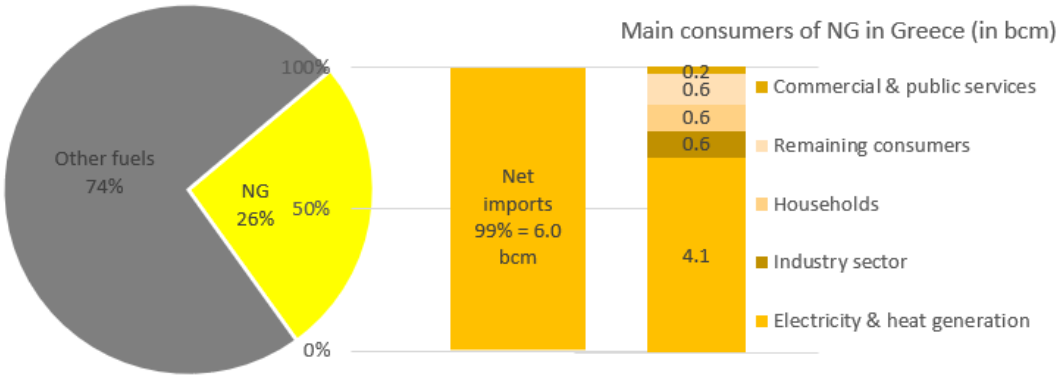

Figure 3 Natural gas share in total energy supply, origin and main consumers for Greece (2021) (source: Eurostat: Energy Balances, 2022)

- NG makes 26% of the total energy supply (TES) of Greece, out of which 99% (6 bcm) is imported.
- Roughly, NG is used 94% for energy purposes and 6% for non-energy purposes (synthetic fertilizers).
- The main NG consumption sectors in Greece are electricity production (68% in transformation input), and the main consumers industry and households (each 9%) in final energy consumption.

Key messages for biomethane in Greece:

- Greece has ability to replace about 9 % of current NG imports with biomethane.
- Current number CNG filling stations are not sufficient to have a larger uptake of biomethane in transport.
- To have full effect of biomethane production on the green transition, biomethane production support is to be linked with agri-food industry, to avoid transportation costs, use biomethane in the existing infrastructure and digestate use, helping the decarbonisation of both non-ETS and ETS sector.
- Given large potential for biomethane in sequential cropping, transition from food & feed feedstock to sequential cropping and digestate use (like the Italian BiogasDoneRight concept) would increase the impact on GHG emission savings and green transition of already operational biogas and (newly established) biomethane plants.
- Greece could additionally reduce NG import dependency by including its major synthetic fertiliser production capacities in improvement and marketing of digestate, or extract of macro-nutrients for bio-fertilisers.