BIOMETHANE FICHE – Italy (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 ITALY (DATA FROM 2021)

- Energy balances (Eurostat) record production of 2.3 bcm of biogases, without distinguishing the type.
- Biogases make 3.3% of gas supply.
- 2.3 bcm of biogases are dominantly used to produce electricity, either in electricity only or CHP plants (98%).
- Biomethane in transport is not recorded.
- European Biogas Association (EBA) reports higher production than Eurostat: 2.47 bcm of biogas were produced in 2021 (91% in 1800 biogas plants and 9% in 27 biomethane plants). Italy is considered as one of the fastest biomethane markets in Europe. In August 2022, the European Commission approved a 4.5-billion-euro scheme to support biomethane production in Italy. It is anticipated that 4 bcm biomethane per year can be produced by 2026 with the allocated funds.
- CNG Europe reports 1,063 CNG stations for Italy, out of 3,769 in the EU27, in 2022[1].

[1] 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

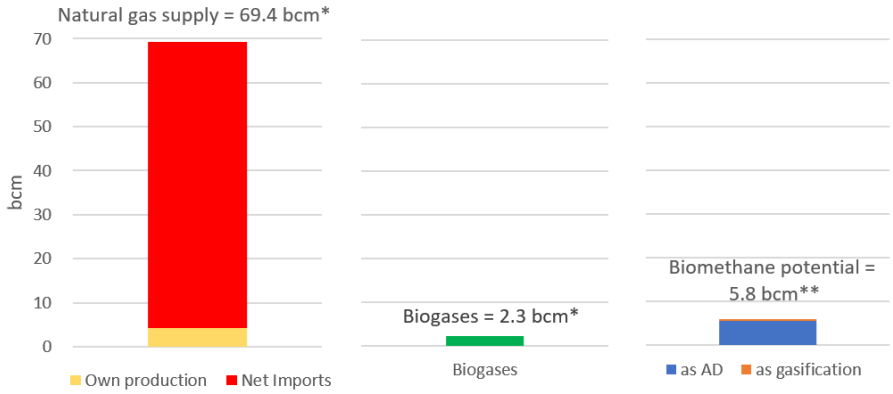
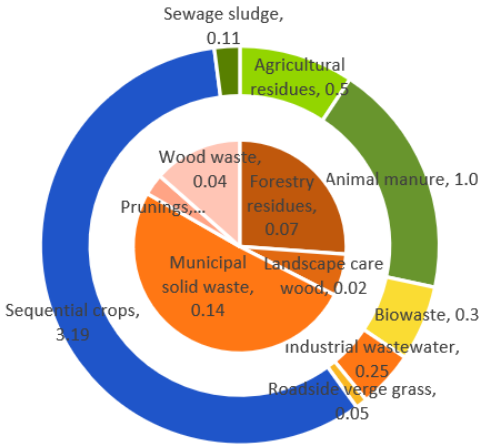


Figure 1 Comparison of current natural gas supply, biomethane production and potential in Italy (2021) (sources: Eurostat: Energy Balances, 2022; Guidehouse: Gas for Climate Report 2022**)*

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[2]
  - Digestate contains phosphorus (0.2-1.5 kg/t) that is on the list of critical raw materials for the EU[3]**.**
- **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 Italy's sustainable biomethane potential as 5.8 bcm (5.5 bcm from AD and 0.3 from gasification) (Figure 2) by 2030.

Considering the sustainable potential, Italy is the 4th MS among the EU27.

Italy consumes 573 Mt and 98 Mt of nitrogen and phosphorus fertiliser[4] that could be partially replaced by digestate.

In Italy, Manufacturing and Electricity, gas, steam and air conditioning supply are the main GHG emission sources by economic activity with 53% (166 $MtCO_{2eq}$)[5], which can be tackled both with integrating biomethane production and use as well as biogenic CO_2 use in agri-food industry (ETS and non-ETS sectors).

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

[2] 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.
[3] EUR-Lex - 52023PC0160 - EN - EUR-Lex (europa.eu)
[4] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_mineral_fertiliser_consumption#Analysis_at_country_level
[5] 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 ITALY (2021)

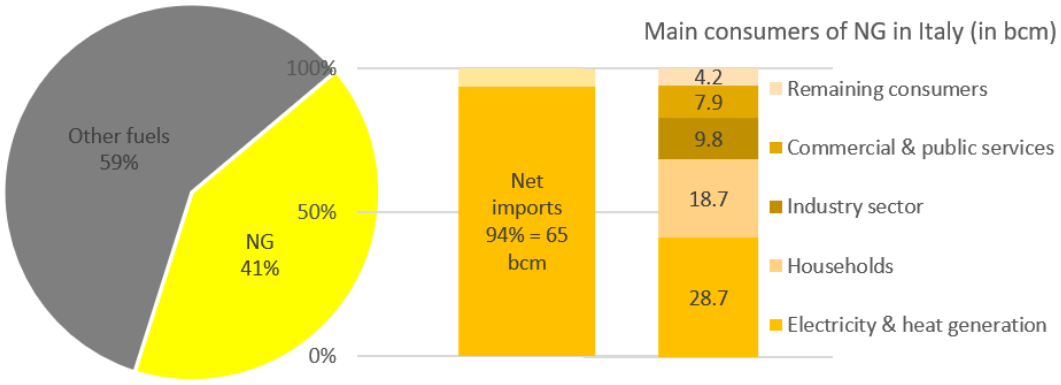


Figure 3 Natural gas share in total energy supply, origin and main consumers for Italy (2021) (source: Eurostat: Energy Balances, 2022)

- NG makes 41% of the total energy supply (TES) of Italy, out of which 94% (65 bcm) is imported.
- Roughly, NG is used 99% for energy purposes and 1% for non-energy purposes (synthetic fertilizers).
- The main NG consumption sectors in Italy is production of electricity, either in electricity only or CHP plants (41%), followed by households (27%), industry (14%) and commercial & public services (11%) in final energy consumption.

Key messages for biomethane in Italy:

- Italy has ability to replace about 9% of the current NG imports with biomethane.
- Italy has infrastructure to supply biomethane to transport in the existing 1,063 CNG filling stations.
- To have full effect of biomethane production on the green transition, biomethane production support is to be linked with the agri-food industry along the value chain to avoid transportation costs and feedstock loss, with local digestate application, renewable CO_2 and biomethane use in industry (ETS sector).
- Transition from food & feed feedstock to sequential cropping and digestate use is on-going given the Italian BiogasDoneRight concept which increases the impact on GHG emission savings and green transition of already operational biogas and biomethane plants.
- Italy 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.
- Italy is a good practice example for developing national biomethane market.