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Centro di ricerca sulla geografia,
le risorse naturali, l'energia,
l'ambiente e le reti

RENEWABLE GAS OBSERVATORY – RGO

GREEN – Bocconi University

FINAL REPORT ON THE RESEARCH ACTIVITIES IN THE SECOND HALF OF 2021

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1. INTRODUCTION

The analysis carried out during the first year of activity of the RGO (Renewable Gas Observatory) made it clear that the an increased use of biomethane would, at the same time, significantly contribute to the use of renewable sources and to the reduction of the GHG emissions in the transport and other economic sectors. The 2 March 2018 Decree undoubtedly contributed to the development of the biomethane market, nevertheless, biomethane national production still remained far from the target set by the legislator, due to the economics of the value chain, very often not supported by the level of granted incentives.

Other variables that limited the expansion of the market were represented by:

- the complexity of the authorization process and local oppositions;
- the exclusion of the maritime transport from the incentive scheme;
- the fact that incentives were limited to the transport sector.

Though development margins are currently considerable, and estimated, according to RGO analysis, equal to at least 4.5 billion cubic meters per year, the comparison between production costs and revenues/incentives showed that only the production of biomethane from a few raw materials (e.g. sludges and FORSU, and, in general, feed stocks with negative supply costs) and/or in medium-large plants is economically feasible.

Assuming a barely policy-driven market development it was hence possible to estimate a consumption of approximately 1.5 Bcm by 2030 in coherence with the legislator target. A technology driven scenario, based on the economic and environmental competitiveness of biomethane, and on the historical dynamics of investments in production capacity, yielded the same demand level clearly demonstrating the pivotal role of incentives in the development of the market, but, at the same time the possibility of a greater deployment in case of more favourable public promotion conditions.

In any case the assumed consumption level would already make it possible to achieve the 70% of transport decarbonisation foreseen by the European Union by 2030.

For all these reasons the analysis unveiled how It would be extremely appropriate, in order to fully grasp the unique opportunity that biomethane presents both under the environmental and circular economy point of view to:

- make the incentive system more effective, with reference to raw materials with higher procurement costs, and pervasive, so as to allow the agricultural sector to fully exploit its potential both in terms of growth and contribution to emissions reduction/renewable energy penetration;
- include the maritime transport sector among those benefiting from the incentives;
- incentivize not only the production but also the consumption of biomethane, with price and non-price measures, in order to ensure a development of demand in line with that of supply;
- provide for natural gas mobility, in case of biomethane blending, for the same support provided for electric vehicles.

Most recently, both the normative and energy context have significantly changed.

The activity of the second year of the RGO was therefore aimed at reconsidering, on the basis of the changed context conditions, the perspectives of development of the biomethane market in Italy in medium-long term.

2. THE NEW ECONOMIC, ENERGY, ENVIRONMENTAL AND NORMATIVE CONTEXT

The second semester of 2021 was characterized by significant changes at various levels. The new European commitments in terms of GHG emission reductions will require huge incentives and private investments for which the role of sustainable finance will be decisive.

Global economic growth is expected to moderate from 2021 to 2022, and to further slow in 202. Record high commodity prices, in fact, begun curbing the activity of many European energy intensive industries. The price of natural gas in Europe, which stood at 20 €/MWh at the beginning of 2021, went beyond 100 €/MWh at the end of the year, and the signals coming from the futures market are not encouraging. Such an amazing increase led to an increase in electricity prices especially in those countries, such as Italy, where natural gas has a high weight on the generation mix. Also final gas prices experienced an unprecedented increase in 2021 as regards both CNG and LNG: Compressed Natural Gas marked an increase of 73% between June and December 2021. The increase in the price of LNG was even higher and equal to about 116% along the same period.

In June 2021 the Commission issued the first Taxonomy Delegated Act containing the Technical Screening Criteria (TSC) to identify sustainable economic activity and, with a subsequent Integrative Delegated Act, classified natural gas activities as “transitional”, provided that they are compliant with very restrictive criteria. In November 2021 the European Parliament finally embedded the second Renewable Energy Directive (RED II) introducing a new incentive system for biomethane with no destination constraints, and foreseeing the respect of sustainability criteria to gain access to the incentives themselves. Criteria are set in terms of both land use change provisions and of GHG reductions enabled by the use of biomethane, and differentiated according to the destination and the entry into operation of the production plants.

Such criteria might not be in line with the current Italian digestion mixes and, hence, require significant efforts in terms of both quantification and compliance.

Biomethane production plants coming into operation between 15 December 2021 and 31 December 2022, can alternatively access the incentive mechanism established by the Minister for Economic Development's decree of 2 March 2018.

The new system of incentives is currently under development and is based on a capital contribution on the investment costs (from the funds of the PNRR) and an incentive tariff (FiT), the both for a duration of 15 years and calculated in accordance with procedures set out in the Decree itself.

Incentives are differentiated according to the size of the plants, the used feedstocks and between new plants and reconversions; they granted by means of tender procedures in which production capacity quotas are made available periodically. The latter are for the most dedicated to the retrofitting of existing biogas plants.

The context in which the activity of the RGO is carried out has undergone significant changes during the second semester of 2021 under many points of view.

The post-pandemic economic recovery continued in spite of non-negligible inflation pressures coming from the amazing increase in the price of energy.

The European Commission adopted the Taxonomy first Delegated Act and set the new GHG emissions reduction target at 55% below the 1990 levels by 2030. It also announced the near inclusion of the maritime sector in the ETS scheme and the creation of a new market for emissions for the building and road transport sectors.

The Italian parliament finally embedded the second Renewable Energy Directive (RED II) and a new incentive system for biomethane production and release in consumption, with no destination constraints, is under development to reach, in addition to the one established in March 2018 for the transport sector, the new 2.5 Bcm biomethane production target by 2030.

2.1 THE ECONOMIC CONTEXT

The economic, health and political context that Europe, as well as the whole world, is experiencing is unprecedented and is the product of a series of factors that are intimately linked:

- the pandemic;
- the consequent economic recession;
- the recovery and the shock of energy prices;
- the consequent inflation;
- the Ukrainian crisis.

Table 1 – GDP growth in the World: historical data and forecasts

GDP annual growth rate %	2021	FORECASTS	
		2022	2023
WORLD	5.9	4.4	3.8
Advanced economies	5.0	3.9	2.6
USA	5.6	4.0	2.6
EUROZONE	5.2	3.9	2.5
<i>Germany</i>	2.7	3.8	2.5
<i>France</i>	6.7	3.5	1.8
<i>Italy</i>	6.2	3.8	2.2
<i>Spain</i>	4.9	5.8	3.8
JAPAN	1.6	3.3	1.8
UK	7.2	4.7	2.3
CANADA	4.7	4.1	2.8
Other advanced	4.7	3.6	2.9
Emerging market and developing countries	6.5	4.8	4.7
ASIA	7.2	5.9	5.8
RUSSIA	4.5	2.8	2.1
LATIN AMERICA	6.8	2.4	2.6
MIDDLE EAST and CENTRAL ASIA	4.2	4.3	3.6
SUB-SAHARAN AFRICA	4.0	3.7	4.0
SOUTH AFRICA	4.6	1.9	1.4

Source: International Monetary Fund, 2022.

All these factors could slow the implementation of the European Green New Deal¹ and the fight against climate change.

With the publication of the Fit for 55 package² the Union has in fact committed itself to reducing GHG emissions by 50% by 2030 and becoming the first group of zero-emission countries by 2050, thus assuming a world leadership role in the fight against climate change.

In order to finance the ecological transition, however, huge investments will be required in which the role of sustainable finance will be decisive.

¹ https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541

² https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_it

According to the International Monetary Fund sustained economic recovery was recorded in almost all countries in 2021. In the European Union industrial production substantially recovered pre-Covid levels despite the amazing increases in the prices of energy, and more in general, of all raw materials, lately leading to a certain inflationary pressure that is putting at risk the continuation of the economic growth itself.

Global growth is expected to moderate from 5.9 in 2021 to 4.4 percent in 2022, almost one percentage point and a half lower for 2022, largely reflecting forecast markdowns in the largest economies, while GDP growth in 2023 is expected to further slow.

Europe follows the pattern with an average growth rate of 3.9% for 2022 compared to the 5.2% of 2021 and the 2.5% for 2023.

Record high commodity prices begun curbing the activity of many European energy intensive industries and analysts started comparing the current gas crisis to the 1973 oil shock.

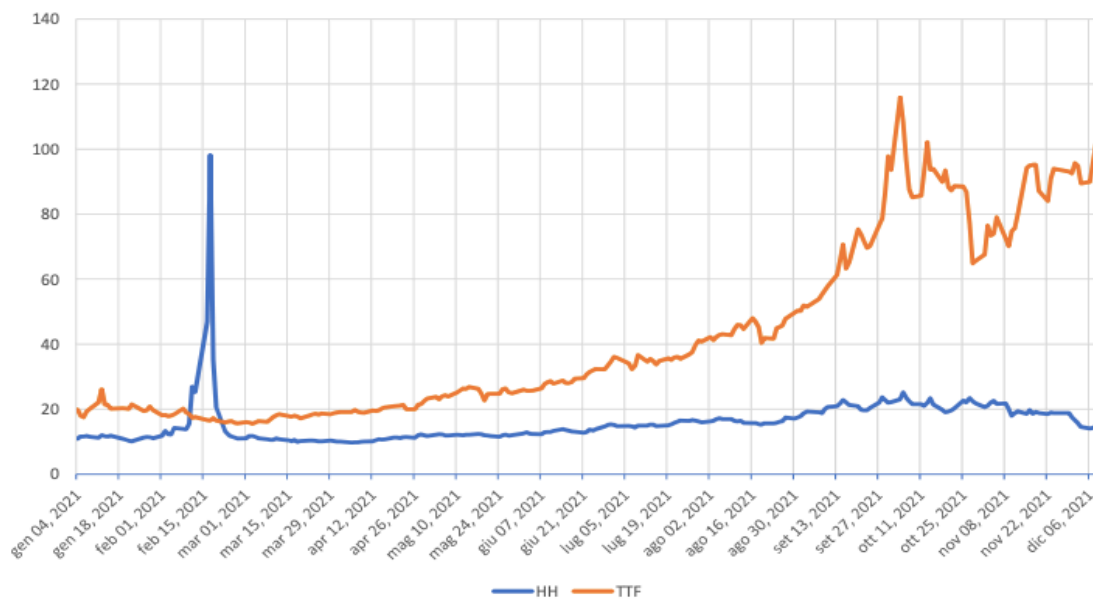
2.2 THE ENERGY CONTEXT

Recently, the need for a rapid and effective energy transition has been back in vogue following the aforementioned incredible increase in energy prices in the aftermath of the post-pandemic economic recovery.

The reference goes in particular to the natural gas crisis and the consequent colossal increases in electricity prices. A crisis which, while driven by one-off factors, has an undeniable structural character to be sought in the fundamentals of the market.

On the demand side, the tightening of environmental legislation has generated a hunger for gas in many countries including those of Far East Asia which compete for supplies with Western countries. The latter are in fact unable to meet demand due to the collapse of mining investments in the Oil & Gas sector.

Figure 1 – Natural gas prices in Europe and in the US in 2021 (TTF³ vs HH⁴)



Source: authors' elaborations on ICE and EIA data, 2022.

³ Title Transfer Facility.

⁴ Henry Hub.

At the same time, and our country is an example of this, the construction of generation capacity from renewable sources is experiencing a period of worrying stagnation: the 2021 auctions for the allocation of capacity quotas have in fact shown very disappointing results, many of them have even gone almost completely deserted.

The price of natural gas, which stood at 20 €/MWh in Europe at the beginning of 2021, underwent an unprecedented escalation in the following months.

The average monthly price recorded on the Dutch spot market TTF went from 45 to 67, 90 and 84 €/MWh in the months of August, September, October and November respectively, recording a spike of 117 euros in October.

After a decline in early November, it started to rise again and at the beginning of December it was back above 100 €/MWh.

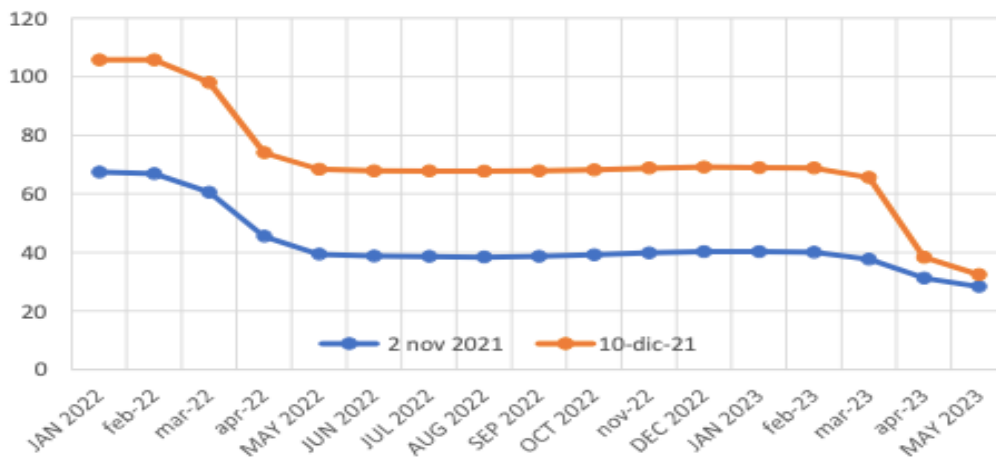
In January 2022, it was close to 140 €/MWh, and the prospects, given the geopolitical situation, are not exciting.

The situation was completely different in the USA which can count on a large internal production. As regards the expected price evolution, the signals coming from the market are not encouraging.

On the futures market, between the beginning of November and 10 December 2022 the average expected price of gas in the EU for the next 18 months has significantly increased (2022 average: 77 €/MWh instead of 46 €/MWh).

Also the return to lower values in spring 2023 is expected to be somewhat higher and the effect of the Ukrainian crises are yet to come.

Figure 2 - Natural gas futures prices at TTF (€/MWh)

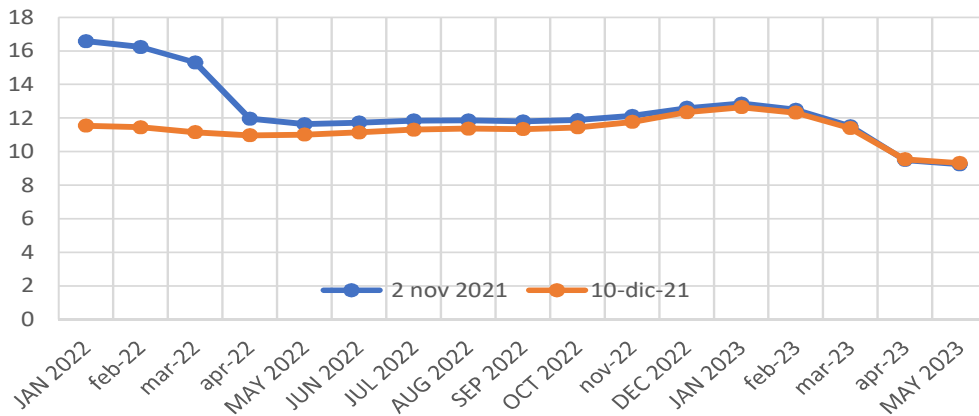


Source: authors' elaboration on ICE data.

In the United States, on the other hand, the average price expected for 2022 has decreased, albeit slightly (13 € / MWh instead of 11.4 € / MWh, at constant exchange rates).

Furthermore, the price in the USA always remains much lower than in Europe (4-6 times).

Figure 3 - Natural gas futures prices at HH (€/MWh)



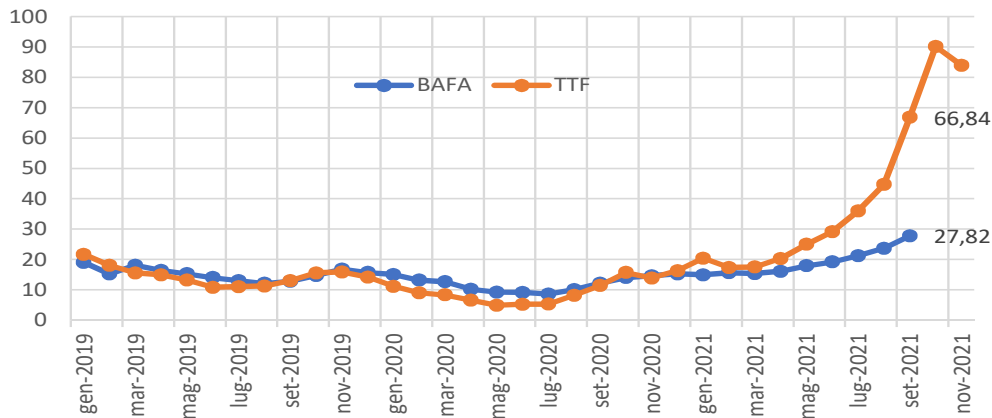
Source: authors' elaboration on HH data.

The price shock emphasized the importance of long-term contracts as a means to flatten the gas import price and to avoid unexpected spikes.

Even the latest German data referring to September 2021, though revealing that the price of indexed imports is rising, highlighted that the divergence between the TTF and BAFA price was becoming impressive and that the situation of the last two years has been reversed.

The incredible increase in gas prices has led to an increase in electricity prices especially in those countries, such as Italy, where natural gas has a high weight on the generation mix.

Figure 4 – Gas average monthly price: TTF vs BAFA

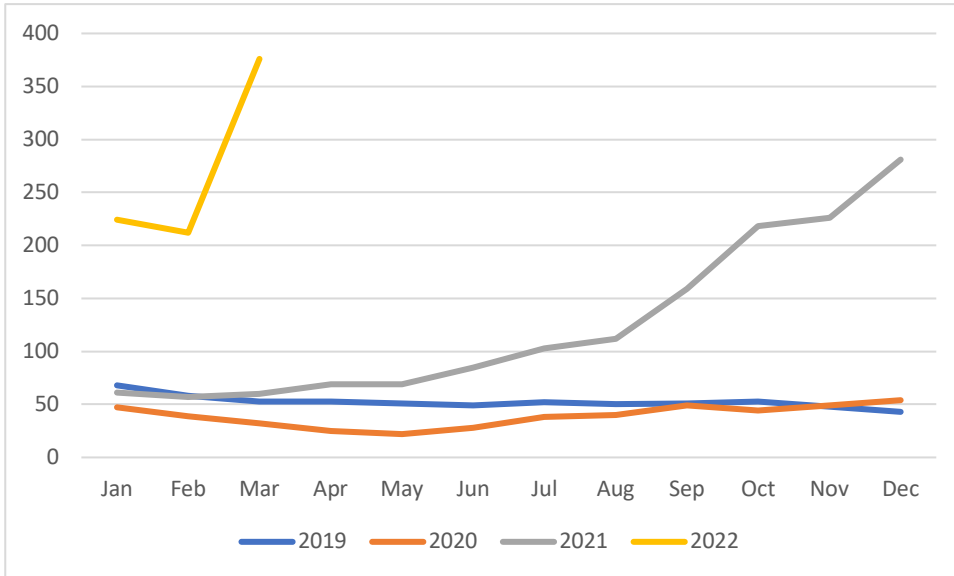


Source: authors' elaboration on ICE and Eurostat data.

The Italian PUN (Prezzo Unico Nazionale) that was around 50 €/MWh in both 2019 and 2020 has started increasing since April 2021 reaching 280 €/MWh in December of the same year.

In the first two months of 2022 the price was above 200 €/MWh while in March it reached the unprecedented value of 376 €/MWh.

Figure 5 - Italian electricity price in €/MWh (PUN) – 2019/2022

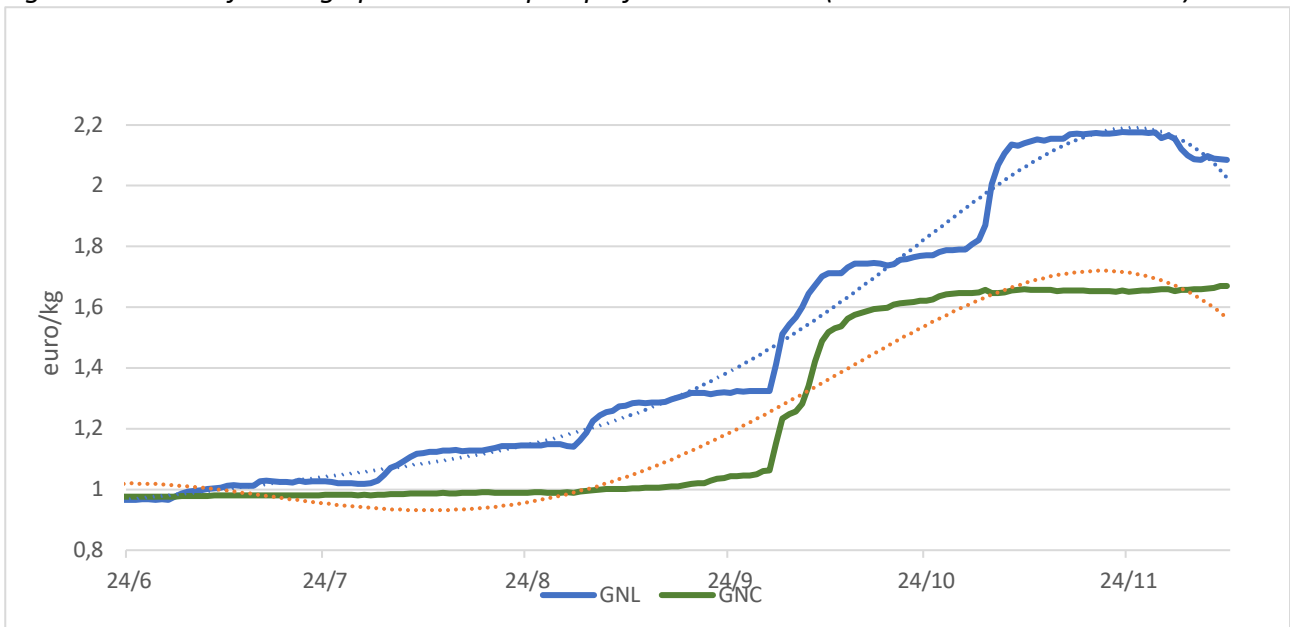


Source: authors' elaboration on GME data.

Also final gas prices experiences an unprecedented increase in 2021 as regards both CNG and LNG: Compressed Natural Gas market an increase of 73% between the 24th of June and the 9th of December 2021.

The increase in the price of LNG was even higher and equal to about 116% along the same period.

Figure 6 - Trend of average prices at the pump of LNG and CNG (24 June - 9 December 2021)



Source: MISE fuel price observatory, 2021.

2.2 THE NORMATIVE CONTEXT

The Commission's proposal⁵ to cut greenhouse gas emissions by at least 55% below 1990 level by 2030 sets Europe on a responsible path to becoming climate neutral by 2050⁶ (2050 Long Term Strategy)⁷.

Based on a comprehensive impact assessment, the Commission has proposed to increase the EU's ambition on reducing greenhouse gases and set this more ambitious path for the next 10 years. The assessment shows how all sectors of the economy and society can contribute, and sets out the policy actions required to achieve this goal.

The 2030 Climate Target Plan was delivered, together with a series of legislative proposals, on 14 July 2022. The package⁸ proposes in particular to revise several pieces of EU climate legislation, including the EU ETS⁹, Effort Sharing Regulation, transport and land use legislation, setting out in real terms the ways in which the Commission intends to reach EU climate targets under the European Green Deal.

In particular the Fit for 55 Package foresaw:

- the decrease of the emissions overall limit and the increase of the annual rate of reduction within the ETS system and the inclusion of the maritime sector in the system;
- the establishment of a separate emissions trading system for the distribution of fuel for road transport and fuel for buildings;
- the penetration of RES by 40% by 2030 and the setting of specific targets for their use in the transport, heating and cooling, buildings and industry sectors;
- the obligation to reduce emissions from new passenger cars by 55% starting from 2030 and by 100% starting from 2035 compared to 2021 levels;
- the DAFI directive review;
- incentives for the use of sustainable marine fuels with the setting of a maximum limit on the greenhouse gas content of the energy used by ships calling at European ports;
- the revision of the Energy Tax Directive according to a Pigouvian logic in order to promote clean technologies and eliminate the obsolete tax exemptions and reduced taxation rates that currently encourage the use of fossil fuels.

As for the emission standards for vehicles the EC significantly strengthened the 2030 abatement CO₂ target also for new vans from -31% to -50%, both relative to the 2021 baseline. In addition, the package introduces a new 2035 CO₂ target set at -100% for new cars and vans, again relative to the 2021 baseline. The 2025 CO₂ target remains unchanged at -15% for both new cars and vans. Target values remain dependent on the average mass of a manufacturer's new vehicle fleet, i.e. for heavier vehicles, higher absolute CO₂ emission levels are granted. The penalty for non-compliance with the CO₂ targets remains unchanged as well, at a level of €95 per vehicle and per gram/km of CO₂.

⁵ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0562&from=EN>

⁶ https://ec.europa.eu/clima/eu-action/climate-strategies-targets/2050-long-term-strategy_en

⁷ https://ec.europa.eu/info/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-long-term-strategies_en

⁸ Known as Fit for 55 package.

⁹ Emission Trading Scheme.

Greenhouse gases emissions abatement will occur by means of an enhanced energy efficiency and an increased contribution of renewable energy sources to the European energy balance.

As stated in Directive (EU) 2018/2002¹⁰ of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency, to meet the new EU 2030 climate target energy efficiency needs to be prioritized. To step up its efforts, the European Commission put forward, in July 2021, a proposal for a new Directive on energy efficiency¹¹ promoting 'energy efficiency first' as an overall principle of EU energy policy, and ensuring an additional reduction of energy consumption of 9% by 2030 compared to the 2020 reference scenario projections. This 9% additional effort corresponds to the 39% and 36% energy efficiency targets for primary and final energy consumption respectively.

Following the same logic, as part of the package to deliver on the European Green Deal, the Commission proposed a revision¹² of the current 2018/2011/EU Directive on the promotion of renewable energy sources (s.c. RED II) increasing their penetration target from the current 32 to 40%.

The decarbonization strategy can hence be summarized as follows:

- reduction of energy consumption by means of efficiency;
- electrification of (remaining) energy consumption where feasible;
- production and use of renewable electricity;
- direct use of renewable energy sources (heat and cool production) where electrification is not possible.

It is clear that to achieve climate neutrality by 2050 huge incentives as well as private capitals will be needed to finance the ecological transition.

According to McKinsey¹³ capital spending on physical assets for energy and land-use systems in the net-zero transition between 2021 and 2050 would amount to about \$275 trillion, or \$9.2 trillion per year on average, an annual increase of as much as \$3.5 trillion from today.

2.3.1 THE EUROPEAN TAXONOMY

The EU taxonomy¹⁴ is a classification system, establishing a list of environmentally sustainable economic activities.

It could play an important role in helping the EU scale up sustainable investment and implement the climate energy targets.

It represents a cornerstone of the EU's Sustainable Finance Action Plan¹⁵, which came out in 2018, and remains a crucial part of the EU's new sustainable finance strategy, will provide companies, investors and policymakers with appropriate definitions for which economic activities can be considered environmentally sustainable under the principles of "Sustainable Contribution" and "Do

¹⁰ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2002&from=EN>

¹¹ https://eur-lex.europa.eu/resource.html?uri=cellar:a214c850-e574-11eb-a1a5-01aa75ed71a1.0001.02/DOC_1&format=PDF

¹² https://eur-lex.europa.eu/resource.html?uri=cellar:dbb7eb9c-e575-11eb-a1a5-01aa75ed71a1.0001.02/DOC_1&format=PDF

¹³ <https://www.mckinsey.com/business-functions/sustainability/our-insights/the-net-zero-transition-what-it-would-cost-what-it-could-bring>

¹⁴ Regulation (EU) 2020/852 (Taxonomy) on the establishment of a framework to facilitate sustainable investment

¹⁵ <https://www.greenfinanceplatform.org/policies-and-regulations/european-commissions-action-plan-financing-sustainable-growth>

No Significant Harm) to the six underlying objectives consisting in Climate change mitigation; Climate change adaptation; the sustainable use and protection of water and marine resources; the transition to a circular economy; Pollution prevention and control; the protection and restoration of biodiversity and ecosystems.

At the moment only the two climate objectives are live in the sense that just the technical screening criteria for

these objectives are captured in the EU's Climate Delegated Act¹⁶.

Art. 8 of the Taxonomy Regulation requires companies subject to the Non-Financial Reporting Directive (NFRD, 2014/95/EU¹⁷) to publish information on the alignment of their business with the taxonomy starting from 2022.

Undertakings falling within the scope of the Directive¹⁸ and financial market participants that offer financial products in the EU will be required to publish their first Taxonomy Eligibility Report in 2022, covering the financial year 2021 while expanded disclosure will be required from 2023.

The taxonomy currently encompasses 88 eligible economic activities.

Among the 25 energy activities 8 are concerned with the production/use of renewable gases.

Together with "Enabling" activities "Transitional activities" are a subcategory of environmentally sustainable economic activities under the Taxonomy. They are activities that cannot yet be replaced by technologically and economically feasible low-carbon alternatives but contribute to climate change mitigation and offer a pathway to meeting Paris Agreement global warming mitigation commitments.

Table 2 – Renewable fuels in the EU Taxonomy

Activity number	Activity description
4.7	Electricity generation from renewable non-fossil gaseous and liquid fuels
4.8	Electricity generation from bioenergy
4.13	Manufacture of biogas and biofuels for use in transport and of bioliquids
4.14	Transmission and distribution networks for renewable and low carbon gases
4.19	Cogeneration of heat/cool and power from renewable non-fossil gaseous and liquid fuels
4.20	Cogeneration of heat/cool and power from bioenergy
4.23	Production of heat/cool from renewable non-fossil gaseous and liquid fuels
4.24	Production of heat/cool from bioenergy

Source: authors' elaboration.

They only qualify as transitional activities under certain conditions:

¹⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R2139&from=EN>, this Act will be amended in the future as criteria become stricter over time, in line with a net zero pathway for 2050.

¹⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0095&from=IT>

¹⁸ Which will be significantly enlarged by the new under development Corporate Sustainability Reporting Directive (CSRD).

- their greenhouse gas emission levels correspond to the best performance in the sector or industry;
- they must not hamper the development and deployment of low-carbon alternatives;
- they must not lead to a lock-in of carbon-intensive assets considering the economic lifetime of those assets;
- the technical screening criteria for these activities will need to ensure that these transition activities have a credible path toward climate neutrality.

With a Complementary Climate Delegated Act¹⁹, the Commission included the following gas activities in the transitional category:

- Electricity generation from fossil gaseous fuels;
- High-efficiency co-generation of heat/cool and power from fossil gaseous fuels;
- Production of heat/cool from fossil gaseous fuels in an efficient district heating and cooling system.

While recognizing in particular that natural gas will continue to play an important role in terms of consumption and generation until 2030, after which it is expected to decline to 2050, and that the function of natural gas-fired electricity generation will change and will increasingly be a facilitator for the spread of renewable electricity and stable supply, the Commission set stringent criteria for natural gas activities to be considered as transitionally eligible:

- gas facility should switch fully to renewable or low-carbon gases by 31 December 2035 in order to accelerate the transition from high-emitting energy sources, such as coal, to renewable or low-carbon gases;
- any new gas-based power/heat plant (or refurbished combined heat and power plant or heat/cool plant) is either below the technology-neutral 100g CO₂/kWh life-cycle emission threshold (i.e. using Carbon Capture and Storage technologies) or meets the following conditions and obtains a construction permit by 2030: renewables are not available at sufficient scale; direct emissions are below 270gCO₂e/kWh or, for the activity of electricity generation, their annual direct GHG emissions must not exceed an average of 550kgCO₂e/kW of the facility's capacity over 20 years.

In the latter case, the activity must meet a set of further cumulative conditions:

- it replaces a facility using solid or liquid fossil fuels;
- the activity ensures a full switch to renewable or low-carbon gases by 2035;
- a regular independent verification of compliance with the criteria is carried out.

As regards the co-generation of heat and power and heating/cooling activities, for every new natural gas-fired plant to be built, a coal-fired plant with the same capacity has to be removed for the technical screening criteria to be complied with. Regarding the power generation, the capacity of the gas-fired plant cannot exceed the capacity of the coal-fired plant by more than 15%.

¹⁹ Adopted on February 2, 2022.

2.3.2 THE RED II EMBEDMENT DECREE

On 4th November 2021 the Council of Ministers definitively approved the legislative decree²⁰ implementing Directive 2018/2001, on the promotion of the use of energy from renewable sources (RED II).

The main novelties of the Decree can be summarized as follows:

- a new incentive system based on a feed-in tariff is recognized to biomethane without destination constraints;
- sustainability criteria are set in terms of both in terms of land use change provisions and of GHG reductions enabled by the use of biomethane differentiated according to the destination and the entry into operation of the production plants;

More in particular, the decree introduces changes in the incentive mechanism for biomethane, unifying the incentive regardless of uses, referring to a specific subsequent decree.

Article 11, Chapter 3, in Title II states that the biomethane produced or injected into the natural gas national transport network is incentivized through the payment of a specific tariff ensuring the producer the same level of incentive for the biomethane in the transport sector and in other uses, including those for the production of electrical and thermal energy in industrial cogeneration plants, also in connection with district heating networks and heat networks and excluding thermoelectric non-cogeneration uses. The energy authority shall define the methods by which the incentive is covered by the natural gas bill.

Article 14, Chapter 4 of Title II also states that the Minister of Ecological Transition shall regulate the granting of the PNNR benefits mentioned in *Mission 2, Component 2, Investment 1.4, "development of biomethane according to criteria to promote the circular economy*.

Article 42, Chapter II in Title V states that, in order to benefit from the support schemes, biofuels, bioliquids and biomass fuels must comply with:

- "sustainability criteria" aimed at avoiding that biofuels, bioliquids and biomass fuels from agriculture are produced involving lands with a high biodiversity value, high carbon stocks and at granting that fuels obtained from forest biomass derive from biomass collected in countries implementing monitoring and preservation legislative systems and respecting given criteria relating to land-use, land-use change and forestry – LULUCF;
- "GHG reduction criteria" according to which the use of biofuels, bioliquids and biomass fuels ensures a reduction of GHG emissions of at least:
 - 50% for biofuels, biomethane or biogas used in transport and bioliquids produced in plants operating by 5 October 2015 or before that date;
 - 60% if the plants came into operation between 6 October 2015 and 31 December 2020;
 - 65% in the case of plants that entered into operation from January 1, 2021;
 - 70% and 80% for electricity, heating and cooling from biomass used in plants that entered into operation from January 1st 2021 to December 31st 2025, and from January 1st 2026, respectively;
- "efficiency criteria" relating to capacity, thermal capacity and BAT.

Sustainability and efficiency criteria do not apply to biofuels, bioliquids and biomass fuels produced from waste and residues other than residues from agriculture, aquaculture, fisheries and forestry.

²⁰ Legislative Decree 199/2021.

Article 44, Chapter II of Title V states that the reduction of greenhouse gas emissions deriving from the use of biofuels, bioliquids and biomass is calculated in one of the following ways:

- whether Annex VI, Part A or B, for biofuels and bioliquids, and Annex VII, Part A for biomass fuels, set a standard value for the reduction of greenhouse gas emissions associated to the production chain and if the value for these biofuels or bioliquids calculated according to Annex VI, part C, point 7, and for biomass fuels calculated according to Annex VII, part B, point 7, is equal to or less than zero, said standard value is used;
- the real value calculated according to the methodology defined in Annex VI, part C, for biofuels and bioliquids, and in Annex VII, part B for biomass fuels, is used;
- a value resulting from the sum of the factors of the formulas set out in Annex VII, part B, point 1 is used, where the disaggregated default values set out in Annex VII, part C, can be used for some factors and the actual values calculated according to the methodology defined in Annex VII, part B, they are used for all other factors.

Both sustainability and GHG reduction criteria do not apply to biofuels, bioliquids and biomass fuels produced from waste and residues other than residues from agriculture, aquaculture, fisheries and forestry all economic operators belonging to the production chain shall adhere to the national sustainability certification system or to a voluntary certification system.

For the recognition of the enhanced energy contribution (double counting) economic operators provide the information demonstrating compliance with the sustainability and GHG provisions granting that in the biofuel production process raw materials and biofuel at the end of the production process must be actually used as fuel in the transport sector.

The presence of a "standard savings" value avoids the need for operators, which is very burdensome from an organizational, bureaucratic and economic point of view, to calculate the sustainability of their own batches of biomethane from time to time, thus giving the certainty necessary to determine the economic sustainability of investments. Nevertheless, the raise to 65% for the reduction of greenhouse gas emissions criteria for plants entering into operation after 2021 raises more than one perplexity about the possibility of reconciling the regulatory provisions with the characteristics of the plants that currently produce biogas in Italy.

Article 46, Chapter I in Title VI establishes that the GSE provides for the issue, management of the register, transfer and electronic cancellation of the GOs and that each GO corresponds to 1 MWh of produced energy.

The GO is given to the RES energy producer: for biomethane plants incentivized according to the decree of 2 March 2018, the GOs are issued to the producer but at the same time freely transferred to the GSE which assigns them through competitive procedures.

2.3.3 THE DRAFT DECREE RELATING TO INCENTIVE IN THE FIELD OF BIOMETHANE PRODUCTION AND CIRCULAR ECONOMY PRACTICES

Since last November, a draft of the Decree which will have to regulate the new incentive scheme for the production of biomethane from agricultural by-products and organic waste from separate collection has been available.

The provision has the purpose of supporting the production of biomethane fed into the natural gas network for transport and other uses and the implementation of circular economy interventions in

line with the investment support measures envisaged by the National Recovery and Resilience Plan (PNRR).

The decree develops from the following presuppositions:

- the five specific objectives contained in the PNRR:
 - a) promoting the conversion of existing agricultural biogas plants, also with an increase in production capacity, towards the production of biomethane injected into the natural gas network;
 - b) guaranteeing support for the construction of new plants for the production of biomethane injected into the natural gas network;
 - c) encouraging the spread of agroecological practices in the biogas production phase and of innovative low-emissivity systems for the distribution of digestate with a reduction in the use of synthetic fertilizers;
 - d) promoting the replacement of obsolete and low-efficiency mechanical agricultural vehicles with more efficient vehicles fuelled with biomethane;
 - e) promoting investments in efficiency of plants for the production of biogas;
- the necessity of specific incentives to be granted in case of compliance with specific sustainability, environmental protection and polluting emissions criteria and to be allocated for the 40% (capital incentive) to the realization of biomethane plants in the southern regions;
- the opportunity to link the new incentive measures without a specific destination constraint, with the incentives contained in the Ministerial Decree of 2 March 2018;
- nationally produced biomethane could significantly improve security of supplies and represent a key tool in the decarbonisation of sectors that are difficult to electrify or hard to abate;
- the need to define an organic framework for incentive measures for the development of biomethane, pursuing circular economy development criteria.

According to Article 1 only interventions completing the construction of the admitted works by 30 June 2026 have access to incentives (par. 3) and biomethane production plants that come into operation after the date of entry into force of this decree and within 31 December 2022, can alternatively access the mechanism established by Article 6 of the Minister for Economic Development's decree of 2 March 2018 (par. 4).

The new incentive scheme mirrors the one used in the electricity factor insofar as Article 3 in paragraph 1 states that newly built biomethane production plants and agricultural plants for the production of electricity with biogas to be converted to biomethane production are granted an incentive consisting of:

- a capital contribution on the investment costs within the limits of the maximum eligible investment cost and according to the given percentages;
- an incentive tariff applied to the net production of biomethane for a duration of 15 years and paid from the date of entry into operation of the plant, calculated in accordance with procedures set out in the Decree itself.

Access to the incentives takes place following the award of public competitive procedures in which production capacity quotas are made available periodically.

According to Article 4 plants admitted to the competitive procedures must be compliant with one of the following two sustainability requirements (par. 1):

- the plant produces biomethane to be used in the transport sector from feedstock used for the production of advanced biofuels achieving a GHG emission reduction of at least 65%;

- the plant produces biomethane to be consumed in other sectors achieving a GHG emissions reduction of at least 80%.

Access to the procedures is allowed up to the achievement of a maximum quantity of producibility assigned to transport sector equal to 1.1 billion cubic meters per year, including that envisaged in implementation of the D.M. 2 March 2018 (par. 4). Only plants producing biomethane to be used in different sectors are admitted to the procedures once the 1.1 Bcm threshold has been reached (par. 5) for further 2.5 Bcm.

Table 3 – Biomethane capacity contingents 2022 - 2025

Type of intervention	2022	2023	2024	2025	TOTAL
Existing plants conversion	46,722	74,536	97,300	17,900	236,458
New plants in the southern regions	17,410	9,672	9,672	1,934	38,689
Other new plants	26,115	14,509	14,509	2,902	58,034
Total (Smc/h)	90,248	98,717	121,481	22,736	333,182 (2,6 Bcm)

Source: Decree 199/2021.

The incentive system is based on quota mechanism. In particular, as stated by Article 5, production capacity quotas are annually made available in the competitive procedures (par.1), with at least two procedures per year with an opening period of 60 days (par. 2).

The Decree sets the tariff for the procedures that will be carried out in 2022 specifying that it will be reduced by 2% per year for the subsequent years.

Auctions are awarded on the basis of the discount offered by competitors on the above-mentioned tariff. The discount cannot be lower than 2% and cannot be higher than 50%.

Capacity contingent are differentiated by:

- years;
- existing plant;
- new plants in the southern regions
- other new plants.

The intention of the legislator to foster the development of the biomethane market by the conversion of existing biogas plants clearly emerges if considering the amount of different capacity contingents.

Article 7 states that plants with capacity up to 250 Smc/h injecting biomethane into the networks with third party connection obligation, may request the payment of the due rate in the form of a feed-in-tariff. In such cases, the guarantees of origin are issued and simultaneously transferred free of charge to the GSE and are considered in the availability of the latter, who assigns them through competitive procedures.

The feed-in-tariff, as defined in Article 2, is equal to the reference tariff, reduced by the discount percentage offered in the tender, including the economic value deriving from the sale of natural gas as well as the value of the guarantees of origin, while the reference tariff, as defined in the same Article is the reference rate used as basis of the auction.

For bigger plants (production capacity exceeding 250 Scm/h), as well as for all production plants that inject biomethane into natural gas networks other than networks with third party connection obligations, the rate due is paid in the form of a premium tariff.

The latter is defined in Article 2 as the rate equal to the difference between the reference rate reduced by the discount percentage, the average monthly price of natural gas and the average monthly price of the GOs. If the difference is negative, the GSE requests the producer to return or pay the relative amounts.

Table 4 – Biomethane reference tariffs

Feedstock	Biomethane production capacity	Reference tariff in €/MWh New plants	Reference tariff in €/MWh Reconverted plants
Raw materials different from solid organic urban waste	$C_p < \text{or} = 100 \text{ Scm/h}$	95 – 115	86 – 105
	$100 \text{ Scm/h} < C_p < \text{or} = 250 \text{ Scm/h}$	90 – 110	80 - 100
	$250 \text{ Scm/h} < C_p < \text{or} = 500 \text{ Scm/h}$	85 – 100	77 - 91
	$C_p > \text{or} = 500 \text{ Scm/h}$	75 - 85	68 - 77
Solid organic urban waste	Any capacity	33 - 40	n.a.

Source: Decree 199/2021.

As for the investment contribution, Article 8 states that the following eligible expenses are considered:

- the costs of construction and efficiency of the plant such as the infrastructures and machinery necessary for the management of the biomass and the anaerobic digestion process, for the storage of digestate, the construction of the biogas purification plant, the transformation and conservation of the biomethane and CO₂, the construction of systems and equipment for the company's self-consumption;
- exhaust gas monitoring and oxidation infrastructures and fugitive emissions monitoring equipment;
- the costs of connection to the natural gas network;
- the costs for the purchase or acquisition of computer programs functional to the management of the plant;
- *costs of design, construction management, testing, consultancy, feasibility studies, purchase of patents and licenses, connected to the realization of the aforementioned investments, up to a maximum overall amount of 12% of the total eligible expenditure.*

Also in this case the contribution varies according to:

- whether the biomethane is obtained from urban organic waste or other raw material;
- the capacity of the production plant.

Article 9 clarifies that, for plants that benefit from the all-inclusive tariff, the GSE guarantees the withdrawal of the biomethane injected into the network with third party connection obligations and the transfer of the biomethane to the PSV (par.1), while for plants that benefit from the premium tariff, the biomethane supply contracts are stipulated directly by the producer and acquired by the GSE for the purposes of verification of compliance with the requirements of destination of use certified by means of the GOs ((par. 3).

The GSE, according to the guarantees of origin cancelled in the transport sector, assigns an equivalent number of certificates of release in consumption (CIC) to the «obliged subjects» for the fulfilment of the respective mandatory quotas (par. 5).

Table 5 – Biomethane capital incentives

Feedstock	Biomethane production capacity	Maximum investment specific cost in €/Smc/h	Maximum investment specific cost in €/Smc/h	% of capital contribution
		New plants	Reconverted plants	
Raw materials different from solid organic urban waste	$C_p < \text{or} = 100 \text{ Scm/h}$	33,000	7,600	40
	$100 \text{ Scm/h} < C_p < \text{or} = 250 \text{ Scm/h}$	29,000	7,600	40
	$250 \text{ Scm/h} < C_p < \text{or} = 500 \text{ Scm/h}$	20,000	11,600	40
	$C_p > \text{or} = 500 \text{ Scm/h}$	13,000	11,600	40
Solid organic urban waste	Any capacity	45,000	n.a.	20

Source: Decree 199/2021.

According to Article 16 the GSE collects, on an annual basis, data on production costs of biomethane in order to provide the Ministry for the ecological transition with quantitative information for the possible revision of the value of the incentive tariffs (par. 5).

The amounts recognized by the GSE under the form of the incentive tariff for biomethane injected into the network to be used in the transport sector, net of revenues deriving from the sale of biomethane and revenues deriving from the sale of guarantees of origin, are charged on obliged subjects (par. 7).

The amounts recognized by the GSE under the form of the incentive tariff for biomethane injected into network for other uses are covered by means of the gas tariff components (par. 8).

3. THE CURRENT MARKET SITUATION

Increasing gas prices could negatively affect the already decreasing performance of natural gas- fueled cars showing diminishing sales trends since 2019, though the market share seems to hold.

As for biomethane the producibility was approximately 133 and 243 Mmc/year in 2020 and 2021 respectively, reaching the 22% of the maximum limit of 1.1 Bcm allowed by the 2018 Decree.

The GSE provided incentives for about 103 Mcm and physically withdrew and placed on the market more than 93 Mcm, for a total value of approximately 29 M€.

At the end of 2021 there were 54 plants with almost 913,000 Scm/day of capacity booked on the national gas transport network.

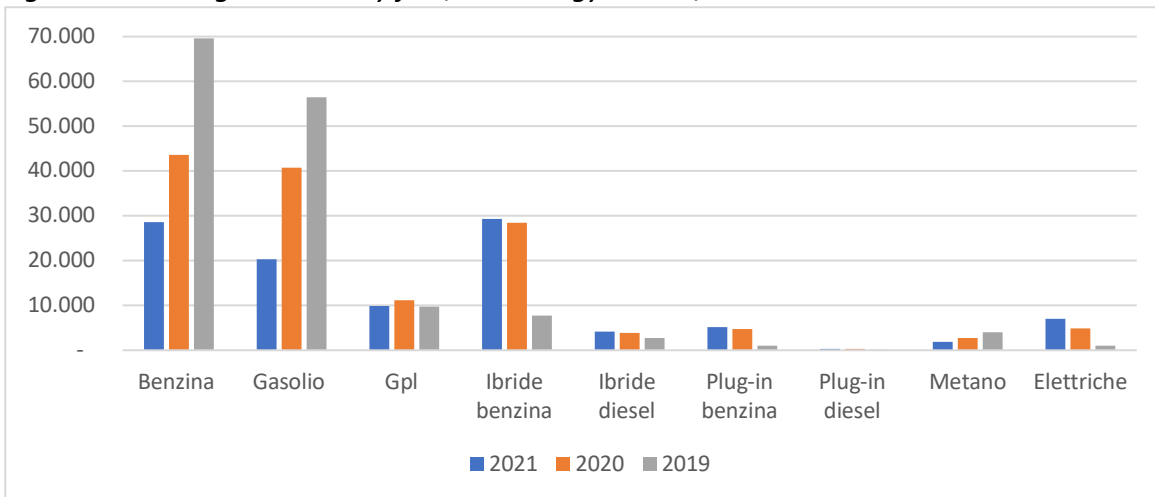
The majority of facilities remains located in the North, but plants are becoming more evenly distribute in our country thanks to new initiatives located in the Centre and in the South.

Biomethane production reached about 170 Mcm at the end of 2021 and was concentrated for over 50% in four plants located in the North.

The most of production came from the organic portion of solid urban waste followed by animal slurries and agriculture residues.

Increasing gas prices could negatively affect the already decreasing performance of natural gas-fueled cars showing diminishing sales trends since 2019 together with diesel and gasoline fueled vehicles. On the contrary electric, hybrid gasoline, gasoline plug-in and hybrid diesel cars recorded significant sale increases.

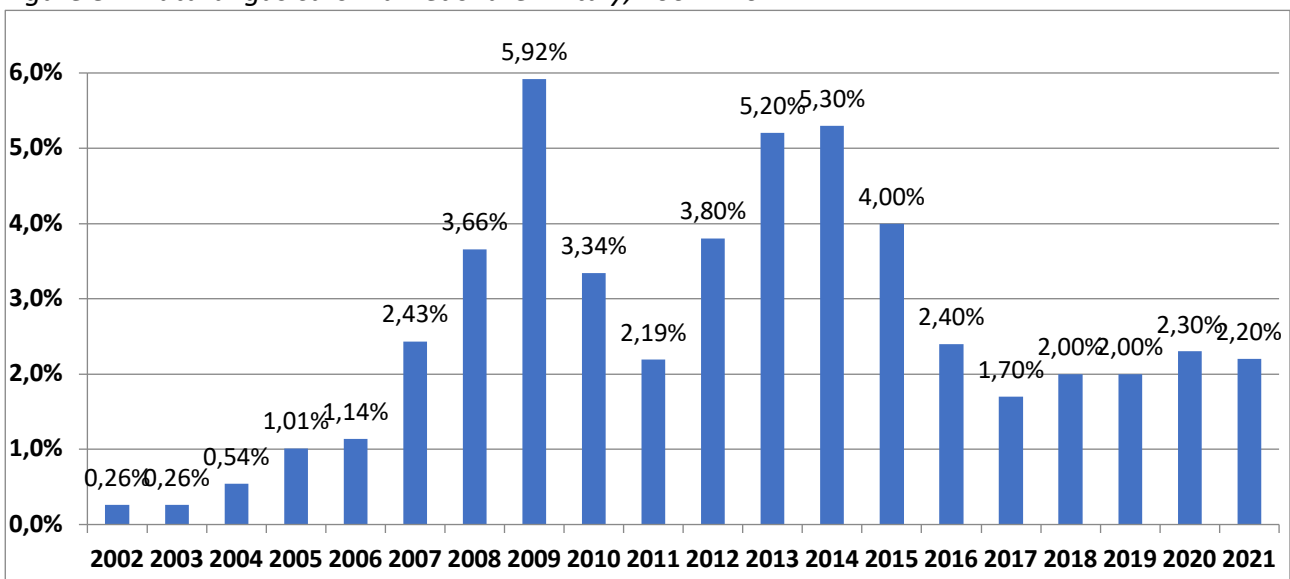
Figure 7 – Car registrations by fuel/technology – 2019/2021



Source: authors' elaborations on ACI data.

The market share of the CNG car seems to hold (2.2%) despite the aforementioned reduction in registrations). In particular, it was exponentially increasing between 2002 and 2009. Subsequently, given the stop to incentives, the trend was substantially fluctuating: after a significant collapse that brought the share of registrations on the total to about 2% in 2011, there was an uninterrupted recovery until 2014 (5.3%). Between 2015 and 2017 there was a substantial decline compared to a certain stability in the last 4 years in which the share stood at around 2%.

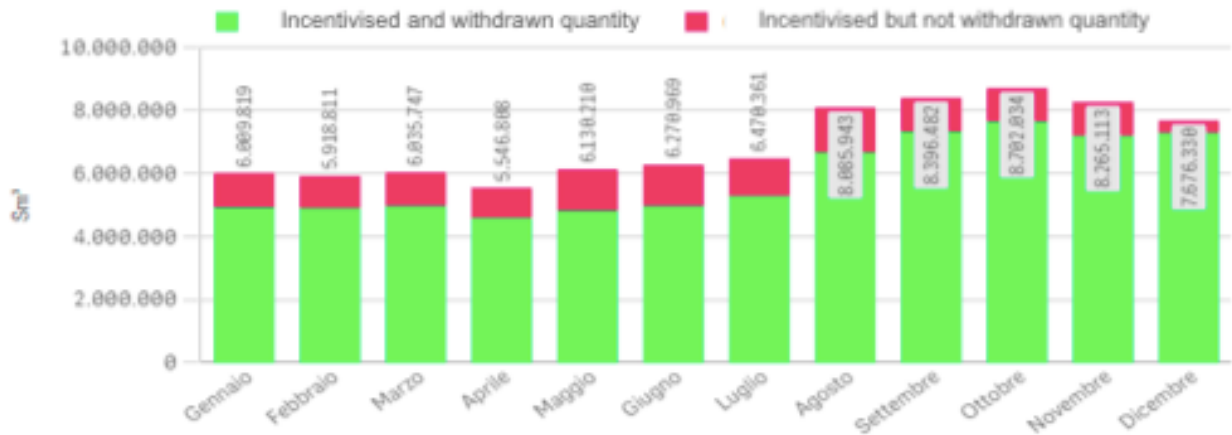
Figure 8 – Natural gas cars market share in Italy, 2002 - 2021



Source: authors' elaborations on ACI data.

In the period January-December 2020, the producibility was approximately 133 Mmc/year, 12.1% of the maximum limit of 1.1 Bcm allowed by the 2018 Decree.
 In the period January-September 2021 producibility increased to about 243 Mmc/year, reaching in this way the 22% of the above-mentioned threshold.

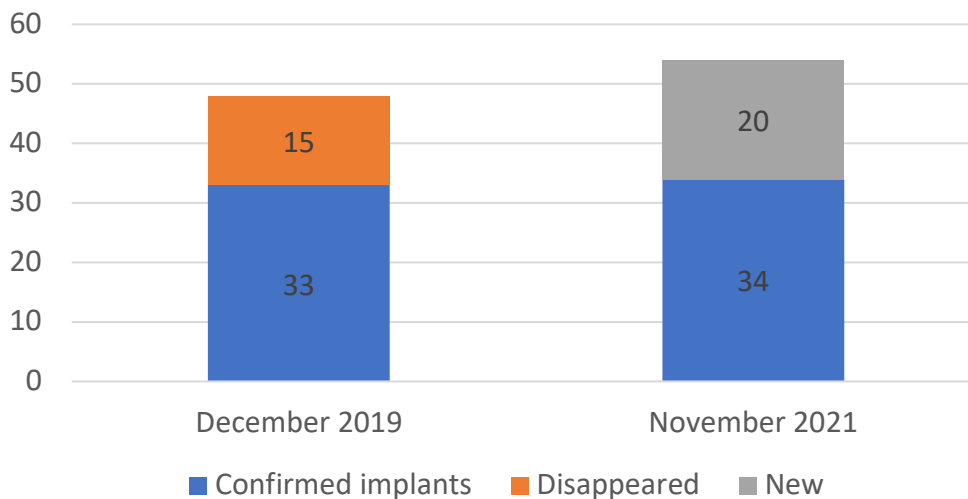
Figure 9 - Advanced biomethane physically withdrawn by GSE compared to incentivized production



Source: authors' elaborations on GSE data.

In particular the GSE provided incentives for about 103 Mcm and physically withdrew and placed on the market more than 93 Mcm, including the quantities withdrawn from plants that had not yet received incentives (9.2 Mcm produced by plants with a signed letter of intent that have requested physical withdrawal from the GSE), for a total value of approximately 29 M€.
 At the end of 2021 there were 54 plants with almost 913,000 Scm/day of capacity booked on the national gas transport network.

Figure 10 – Accepted offers: number of plants



Source: authors' own elaboration on SNAM's data, 2021.

The situation on the supply side therefore shows a clear improvement compared to the end of 2019, compared to which there are 15 plants that have disappeared from the group of those connected to the network and 20 new plants as resulting from the data provided by Snam.
 Under the geographical point of view, despite the majority of facilities remains located in the North,

plants are becoming more evenly distributed in our country thanks to new initiatives located in the Centre and in the South.

In particular plants located in the Centre of Italy moved from 2 to 5, while facilities located in the South increased from 16 to 18.

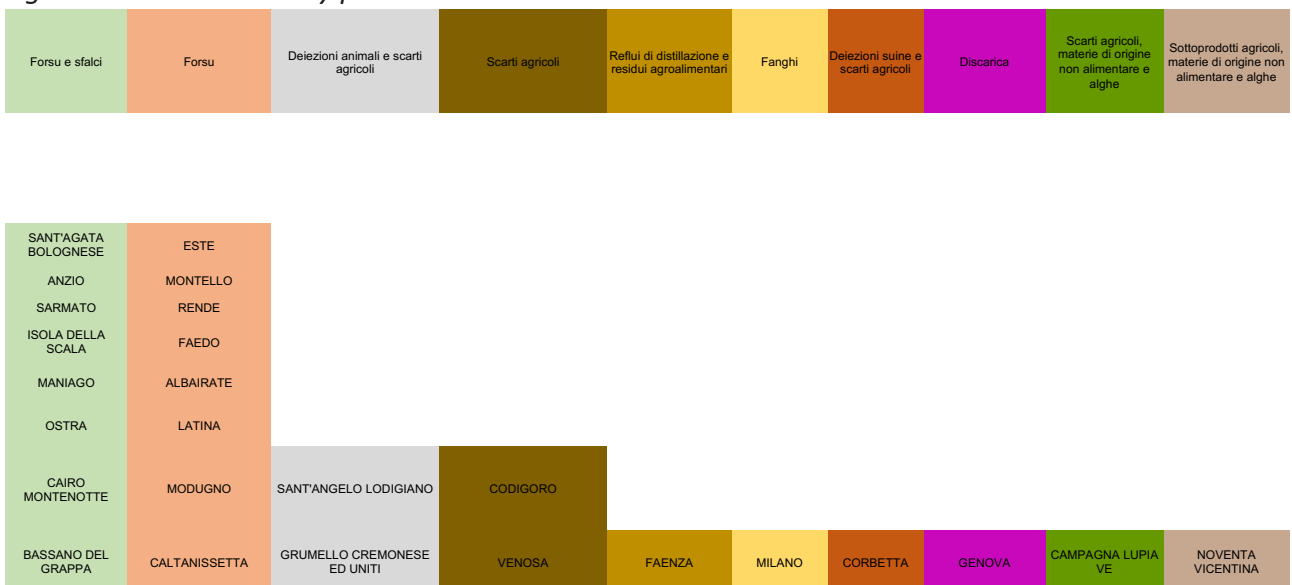
As regards production, at the end of 2021 it reached about 170 Mcm and was concentrated for over 50% in four plants located in the North.

Figure 11 – Biomethane production in 2021

Source: authors' own elaboration on different sources data, 2021.

As regards feedstocks, whose importance has been emphasized by the sustainability and GHG emissions reduction criteria foresaw in the RED II embedment decree, a preliminary analysis enabled us to assess how the most of production comes from the organic portion of solid urban waste followed by animal slurries and agriculture residues, often in blend, while sewage sludges, landfill gas, seaweeds and other materials are less commonly used.

Figure 12 – Feedstocks by plants



Source: authors' own elaboration on different sources data, 2021.

4. THE PLANT DATABASE

Since Snam and GSE provide official data just with reference to allocated transport capacity and amount of incentivized biomethane and there is no other accessible statistical source that provides detailed updated information on ongoing projects the RGO activated, during the second semester of 2021 a stable census of biomethane plants on the national territory.

A data base will be built including existing, under construction and planned plants and containing numerous information such as entry point, capacity, company that manages the plant, construction company, date of entry into operation, investment cost, used substrate, amount of substrate, presence of a CO₂ capture system, amount of recovered CO₂, possible use of part of the biogas produced for electricity generation, quantity of produced soil improver, biomethane production, technology, presence of pertinent distribution and/or liquefaction plant, biomethane destination, eventual GSE withdrawal, other information.

Detailed information about single plant are not officially available.

The Italian transport system operator (SNAM) publishes data basically relating to the capacity booked on the network while the Gestore dei Servizi Energetici (GSE) periodically publishes and updates:

- a sc “counter”, aimed at monitoring the achievement of the maximum limit set by the 2018 Decree;
- the rankings with the list of plants admitted to the incentive;
- an information bulletin on allowed installations.

There is no other accessible statistical source that provides detailed updated information on ongoing projects.

For this reason and with the purpose to monitor the development of the market on the supply side, the RGO activated, during the second semester of 2021 a stable census of biomethane plants on the national territory.

This activity is considered of fundamental importance to:

- have a precise idea of the evolution of the production capacity available at national level with the indication of the different used feedstocks;
- estimate, also from a perspective point of view, the current and future extension of the market;
- verify the impact of the incentive measures;
- make comparisons concerning the dynamics of market development at the international level.

The starting point for the building of the RGO biomethane plants database will be represented by SNAM data relating to:

- the existing biomethane plants connected to the national transport network (with details of those connected to third party networks) but just in terms of capacity at the entry point: https://www.snam.it/it/trasporto/Processi_Online/Capacita/informazioni/capacita-trasporto/Capacita_trasporto/01_Entrata_uscita/01a/01a_Elenco.html
- the upcoming activation points for biomethane with an accepted offer (also in this case just capacity and locality are provided): https://www.snam.it/it/trasporto/Processi_Online/Allacciamenti/procedure-moduli/nuovi-punti-consegna-biometano/biometano.html

The first data relates to existing plants connected to the grid;

The second relates to plants for which connection to the grid should be imminent (under construction);

For existing plants already connected to the network the website provides:

- the entry point;
- any connection to a third party network;
- the nominal transportation capacity, the booked one, and the residual (available) capacity.

For the second category provided information relate to:

- REMI cabin number;
- transportation capacity at the entry point in Scm/day;
- the municipality, the province, and the region of localization.

There is no information on the operating company, nor on the characteristics of the plant.

In order to carry out a census of the plants, it is therefore necessary to undertake a further analysis. The latter will be based on the collection and systematization of information available on the web, as regards both:

- *existing plants;*
- *under construction plants.*

As regards planned plants, the collection of information will be more complex and data will be less reliable also due to the discrepancy between different sources of information and inaccessible corporate sites.

Greater problems could be encountered in the census of plants not connected to the networks.

At the moment the mapping of the plants belonging to the first category is being completed.

The information provided for each of them is the following:

- entry point;
- capacity;
- company that manages the plant;
- construction company;
- date of entry into operation;
- investment cost;
- used substrate;
- amount of substrate;
- presence of a CO₂ capture system;
- amount of recovered CO₂;
- possible use of part of the biogas produced for electricity generation;
- quantity of produced soil improver;
- biomethane production;
- technology;
- presence of pertinent distribution and/or liquefaction plant;
- biomethane destination;
- eventual GSE withdrawal;
- other information (*plant upgrading in progress, M&A dynamics, local opposition problems, etc.*).

Subsequently, the mapping of plants being connected to the network (under construction plants) and of planned plants will be carried out.

5. THE IMPACTS OF THE NEW INCENTIVE SCHEME ON THE BIOMETHANE CHAIN ECONOMICS: PRELIMINARY ANALYSIS

According to the incentive mechanism under development, for new plants, the capital contribution would range from 4 to 10 €/MWh, while the reference tariff would range from 33 and 115 €/MWh.

As a whole, the contribution/revenue that could be obtained from the release for consumption of one MWh of biomethane would therefore be between 37 and 125 €/MWh.

For urban waste fueled plants in particular, the draft Decree provides for the recognition of a capital contribution, equal to 20% of the eligible investment, and an incentive - to be assigned through auctions - for the duration of 15 years, ranging from 33 to 40 €/MWh.

The maximum specific cost recognized for the investment is € 45,000/Scm/h, or for example for a plant capable of producing up to 500 Scm/h a maximum cost of 22.5 M€.

By contrasting the revenues obtainable from the new supporting scheme to the production cost range estimated in the RGO 2020 analysis it is possible to argue that the new incentive system, though more favourable as regards the upper end of the incentive interval if compared to the 2018 supporting scheme (+ 51%), remains below the upper end of our estimated production cost range, raising a question relating to the effective scope of the decree in terms of market development.

For existing biomethane plants the capital contribution would range from 2 to 4 €/MWh, while the reference tariff ranges from 68 and 105 €/MWh. As a whole, the contribution/revenue coming from existing and reconverted biogas plants could therefore be between 70 and 109 €/MWh. Also in this case, considering effective reconversion costs, the capital contribution recognized by the new incentive scheme could cover a percentage included in the range of 8 – 28% of real incurred costs.

As seen in the previous paragraphs, according to the new support scheme the incentive for biomethane production consists of two components:

- capital contribution;
- operating contribution.

The both vary according to:

- whether the biomethane is obtained from urban organic waste or other raw material;
- the capacity of the production plant.

For new plants:

- the capital contribution ranges from 4 to 10 €/MWh.
- the reference tariff ranges from 33 and 115 €/MWh.

As a whole, the contribution/revenue that can be obtained from the release for consumption of one MWh of biomethane is therefore between 37 and 125 €/MWh.

For urban waste fueled plants in particular, the draft Decree provides for the recognition of a capital contribution, equal to 20% of the eligible investment, and an incentive - to be assigned through auctions - for the duration of 15 years, ranging from 33 to 40 €/MWh.

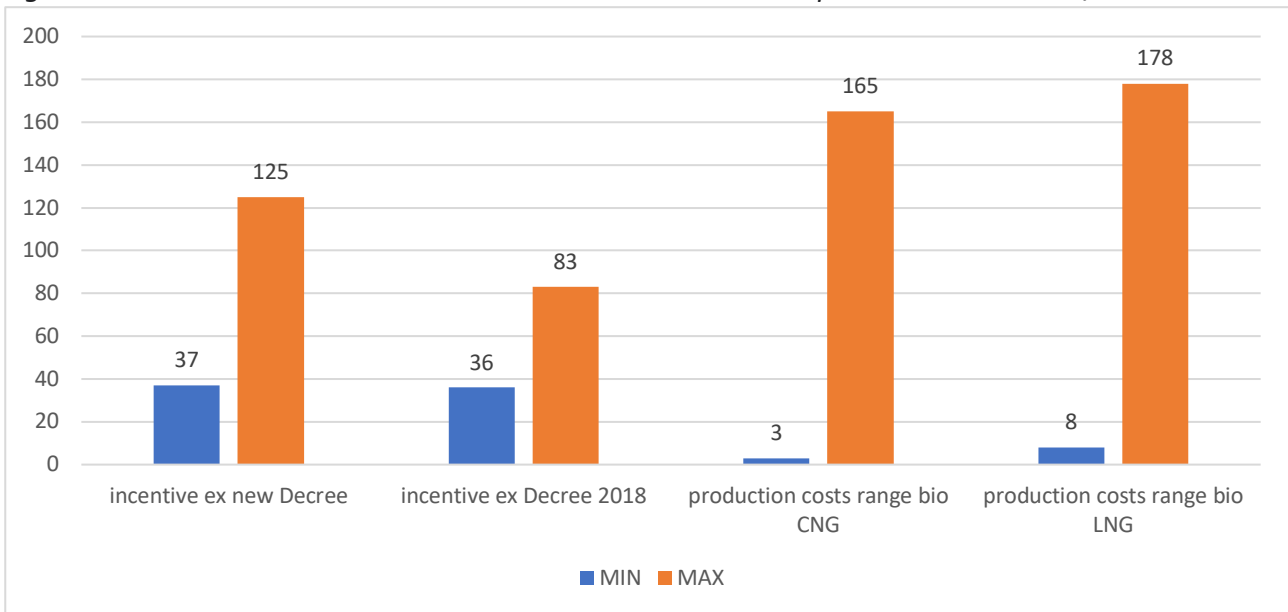
The maximum specific cost recognized for the investment is € 45,000/Scm/h, or for example for a plant capable of producing up to 500 Scm/h a maximum cost of 22.5 M€.

By contrasting the revenues obtainable from the new supporting scheme to:

- those granted by Decree 2 March 2018;
- the production cost range estimated in the RGO 2020 analysis;

it is possible to argue that the new incentive system guarantees a higher remuneration for the biomethane produced in new plants compared to the previous system (*Decree of 2 March 2018*), given that, in the face of the substantial invariance of the minimum obtainable incentive, the upper end of the incentive interval undergoes a significant increase (51%).

Figure 13 – Biomethane old and new incentives vs biomethane production costs in €/MWh



Source: authors' own elaboration on different statistical and normative sources.

Nevertheless, the latter remains below the upper end of our estimated production cost range, raising a question relating to the effective scope of the decree in terms of market development.

5.1 THE RECONVERSION OF EXISTING BIOGAS PLANTS

The new incentive scheme provides for both a capital contribution and a feed-in-tariff (FiT) also for existing biogas plants in order to favor their conversion to biomethane production.

A preliminary analysis was carried out in order to assess the consistency of the incentive with the real reconversion costs.

The latter change according to the size of the plant, as well as the operation expenses.

Data were collected from different industrial statistical sources:

- Carbotech;
- Malmberg;
- MT Energie;
- Beil e Hoffstede;
- Enama;
- Linde;
- Air Liquide.

Considered costs were the following:

- **CAPEX = U + P + CRM + A**, with:
 - A (connection to the network)
 - CRM (REMI cabin)
 - P (gas pre-treatment)
 - U (upgrading)
- **OPEX = CRMm + CMRo + Um + Uo + Po**, with:
 - Po (pre-treatment operative costs)
 - Uo (upgrading operative costs)
 - Um (upgrading maintenance costs)
 - CRMo (REMI operation costs)

- CRMm (REMI maintenance costs)

Table 6 – Existing biogas plants reconversion costs

CONVERSION COSTS					
Capacity	MW	0,50	0,90	1,80	3,60
reconversion investment costs	unit	15,00	11,00	8,00	7,00
reconversion operation costs	unit	15	12	10	6
TOTAL RECONVERSION COSTS	UNIT				
€/MWh		30,00	23,00	18,00	13,00

Source: authors' own elaboration on different sources.

According to our analysis the average reconversion costs are included in the 13 – 30 €/MWh range. The capital incentive contribution varies according to the size of the plant.

In particular:

- the capital contribution ranges from 2 to 4 €/MWh.
- the reference tariff ranges from 68 and 105 €/MWh.

As a whole, the contribution/revenue that can be obtained from the release for consumption of one MWh of biomethane coming from existing and reconverted biogas plants is therefore between 70 and 109 €/MWh. As regards fixed costs the analysis shows that the capital contribution recognized by the new incentive scheme could cover a percentage of reconversion costs included in the range of 8 – 28% of real reconversion costs.

Table 7 – Biogas plants in Italy by size and substrate

BIOGAS PLANTS IN ITALY BY SIZE AND SUBSTRATE - 2020		
	Number	Av. Size (kW)
Biogas plant - electricity production	760	722
from waste	209	1253
from sludges	16	310
from animal slurries	215	319
from agriculture and forestry	320	667
Biogas plant - CHP	1441	627
from waste	177	739
from sludges	65	611
from animal slurries	441	400
from agriculture and forestry	758	734

Source: authors' own elaboration on different sources.

Operating gas plants in Italy are 2,201.

760 are dedicated to electricity production while the majority, 1441, are used for the combined heat and power production (CHP).

Table 8 – Capital incentive and reconversion costs comparison

	CAPACITY			
	C < 500 KW	501 KW < C < 1000 KW	1001 KW < C < 2 MW	2,001 MW < C < 4 MW
€/MWh				
Reconversion costs	30,28	23,44	17,64	12,71
Capital contribution ex draft decree November 2021	2,30	2,30	2,30	3,50
<i>percentage of incentive on costs %</i>	8	10	13	28

Source: authors' own elaboration on new incentive system draft Decree, 2021.

Among the former 320 facilities produce biogas from agriculture and forestry residues, 215 process animal slurries, 209 obtain biogas from wastes and the remaining 16 generate biogas using sewage sludges. Their average size amounts to 667, 319, 1253 and 310 kW respectively.

Among the latter 758 produce biogas for agriculture and forestry residues, 441 use animal slurries as main substrate, 177 obtain biogas from waste, and just 65 process sludges.

Their average size amounts to 734, 400, 739 and 611 kW.

It is hence possible to observe that the Italian biogas park plant is for the most made of small-medium production plants.

This means that almost all existing biogas plants would benefit, in case of reconversion to biomethane production, of the lowest class of incentives, accounting, for the capital incentive point of view, for just the 8 – 13% of real incurred costs.

The presented analysis has to be considered as purely indicative since the final version of the implementing decree will be issued within 180 days of the entry into force of the RED II decree, therefore by 15.06.2022.

6. THE IMPACT OF NATURAL GAS NEW PRICES ON BIOMETHANE PRODUCTION PROFITABILITY

Though the current price of natural gas in Europe (and in Italy) cannot be considered the reference price a simulation exercise, taking up the analysis proposed during the first year of activity of the RGO, for the production of biomethane from urban waste by varying the price of gas between 20 and 50 €/MWh was carried out.

The analysis demonstrated the limited significance of the price of gas on the convenience of building biomethane plants from FORSU under the incentive scheme foreseen by the 2018 Decree.

However, even the smaller plants (25 kton/a) that are not convenient with gas prices (and the other values for calculating revenues) come close to convenience with a gas price of 50 €/MWh. The impact of a significant increase in the price of fossil methane and, therefore, of biomethane, could instead be critical on the sales front.

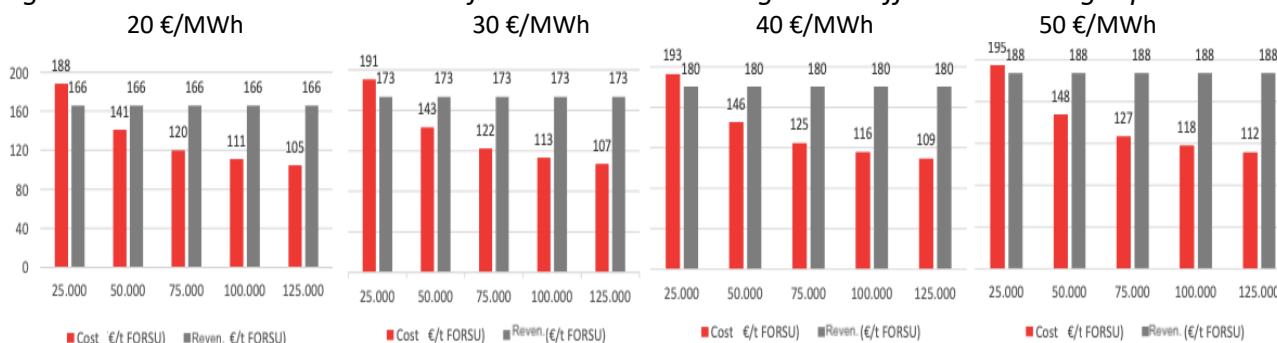
The increase in the price of natural gas has an obvious impact on the selling price of biomethane. From this point of view, therefore, the increase in the price of gas should increase the profitability of the business. However, it is necessary to keep in mind how the current price in Europe (and in Italy) cannot be considered the reference price.

It would therefore be a question of understanding what the dynamics of the price can be in the long term starting from the distinction between the one-off and the structural factors underlying the increase.

On the other hand, an excessive increase in the price of both fossil and renewable gas could negatively affect sales and end up crowding out the technology, compromising the development of the market.

In order to evaluate the impact of the price increase on the convenience of biomethane production, and taking up the analysis proposed during the first year of activity of the RGO, a simulation exercise for the production of biomethane from the organic portion of urban waste by varying the price of gas between 20 and 50 €/MWh, keeping all the assumptions presented in the previous year²¹ except for the purchase cost of electricity, which is also related to the increase in the price of gas, was carried out.

Figure 14 – Convenience in the sale of biomethane according under different natural gas prices levels



Source: authors' own elaboration.

An increase in the reference price of gas by 100% causes an increase in unit revenues of 8.7% (and an increase in costs between 2.5% and 4.5%). This demonstrates the limited significance of the price of gas on the convenience of building biomethane plants from FORSU.

However, even the smaller plants (25 kton/a) that are not convenient with gas prices (and the other values for calculating revenues) come close to convenience with a gas price of 50 €/MWh.

The impact of a significant increase in the price of fossil methane and, therefore, of biomethane, could instead be critical on the sales front.

²¹ And, hence, calculating revenues on the basis of the incentive scheme ex Decree 2 March 2018.

7. CONCLUSIONS

The necessity to speed up the energy transition, reflected in the new decarbonisation strategy of the European Commission, has been emphasized with unprecedented strength by the enduring raise in fossil energy prices that is putting at risk the post pandemic economic recovery.

In this context the Italian political decision-maker is showing a clear intention to focus more incisively on biomethane and, in particular, on the reconversion of the over 2,000 existing biogas plants. In fact the old incentive scheme as of Decree of 2 March 2018, that was limited to biomethane used in the transport sector, is being substituted by a new and wider biomethane support scheme with no destination constraints.

Biomethane producibility was approximately 243 Mcm/year in 2021 marking a significant increase from 2020, but representing just the 22% of the maximum limit of 1.1 Bcm allowed by the 2018 Decree.

Production reached about 170 Mcm at the end of 2021 and was concentrated for over 50% in four plants located in the North. The most of it came from the organic portion of solid urban waste followed by animal slurries and agriculture residues.

The new incentive system, aimed at obtaining an incremental biomethane production of 2.5 Bcm by 2026, will be extended to all production sectors, accordingly to the RED II embedment Decree, and will be characterized by:

- the systematic payment of a capital contribution;
- a guaranteed tariff which leads to revenues on average higher than those obtainable from the application of the old incentive system (Decree 2 March 2018).

Nevertheless, a preliminary analysis, seems to demonstrate how incentives might remain too low for a few productions depending on the size, on the substrate, or the mix of substrates used for the production of biogas, both for new and existing reconverted biogas plants.

Also the sustainability criteria necessary to gain access to incentives might not be completely in line with the current Italian digestion mixes and, hence, require significant efforts in terms of both quantification and compliance.

Moreover, the analyzed limited significance of the price of gas on the convenience of building biomethane plants under the incentive scheme foreseen by the 2018 Decree demonstrated that the increase in the price of fossil gas will have a limited impact on the profitability of investments in production capacity, while, on the contrary, the latter could be critical on the already decreasing vehicles sales, and represent a constraint to the further market development.

In order to understand the real scope of the new incentive Decree, whose final version is to be expected within the first half of June, a more detailed analysis, aimed at effectively understanding the type and number of plants that have characteristics and production costs compatible with the incentive, is hence required, with particular focus on the number of existing biogas plants that could be conveniently reconverted to biomethane production.

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