Gas Distributors GD4S For Sustainability

Gas grids: a key enabler of decarbonisation

GD4S' commitment to deliver on the European Green Deal

June 2021

Foreword

In full recognition of the challenges that we, GD4S, as distribution system operators (DSOs) face, including most recently the Coronavirus pandemic, our imperative is to ensure that decarbonisation remains central to the rebuilding and growth of the European Union (EU) economy. Climate change and environmental damage, such as the loss of biodiversity, are major threats for our shared future. The EU has a leading position to play in counteracting this, as highlighted in the European Green Deal.

As operators of key energy infrastructure across Europe, Gas Distributors for Sustainability (GD4S) is committed to playing its part in building a sustainable EU economy today, which will be carbon-neutral by 2050. Working together, we can deliver a climate neutral EU. GD4S is committed to contributing to the decarbonisation of the economy by making the necessary investments to ensure that gas grids are ready for clean energy sources, such as renewable gases including, in the longer term, hydrogen. Our operations must evolve and adapt to integrate new gases in order to partner with local authorities in their energy transition.

GD4S is committed to raising awareness of the benefits of gas grids and renewable gases on the journey towards a cleaner economy. Action on delivering ambitious EU policies on decarbonisation and designing the right mechanisms for climate action are urgently required. GD4S is therefore calling on EU institutions to consider all energy sources, including renewable gases, in facilitating delivery of our decarbonisation targets, as they have the ability to deliver on these goals in a cost-effective manner.

It is crucial to align ambitious climate targets and economic recovery post-Coronavirus. The European Green Deal must be a priority, and existing energy infrastructure is an important asset that policymakers should leverage to achieve the EU's climate and renewable energy targets, while promoting economic growth in various sectors (including transport, industry and agriculture). The fight against climate change requires the joint efforts of all EU Member States, but it is important to acknowledge that different countries have different starting points, and not all measures and objectives can be achieved in the short/ medium term without significant costs and social impacts. In keeping with a key premise of the European Green Deal, a just transition is essential in deciding and implementing decarbonisation policies.

GD4S supports Europe's decarbonisation ambition in ensuring that the transition towards carbon-neutrality is economically sustainable, socially inclusive and maintains security of supply.

"GD4S is committed to raising awareness of the benefits of gas grids and renewable gases on the journey towards a cleaner economy."

The decarbonisation of Europe's energy system expands the role of gas and the existing gas infrastructure, with the integration of renewable gases into the network. GD4S firmly believes that natural gas (during the transition period) and renewable gases (including biomethane and renewable hydrogen) will remain part of Europe's energy mix. Gas can decrease greenhouse gas emissions, in particular in power generation, as it will gradually replace more carbon-intensive coal- and lignite-fired power generation.

GD4S believes that gas grids' adaptation to incorporate increasing shares of renewable gases (biomethane, synthetic methane and renewable hydrogen) is essential to achieve the net-zero emissions scenario outlined in the European Green Deal:

- Renewable gas potential, based on mature technologies, offers a credible and affordable solution to meet EU climate ambition;
- Renewable gases are able to decarbonise not only the typical gas end-user segments (heating, industrial processes) but also energy consumption in other sectors, including electricity production, road, rail and waterway transport;
- Biomethane production supports the circular economy model, by reducing waste disposal and ensuring additional revenue for farmers;
- Biomethane is a key enabler of the decarbonisation of agriculture and food production;
- Renewable gases contribute to energy system integration by combining energy vectors including electricity and gas and sectors such as agriculture, heating and transport;
- Renewable gases play a significant role in reducing energy dependence from foreign sources, thus enhancing the EU's energy independency and security of supply;
- Renewable gases help tackle methane emissions due to their decarbonisation benefits.

Together, the members of GD4S will support the EU in achieving a net-zero emissions continent by 2050. Gas grids can contribute towards and facilitate a successful, cost-efficient climate and energy transition in Europe.

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Executive summary

This position paper provides a comprehensive overview of how gas grids will enable the achievement of EU and national decarbonisation commitments. We use case study examples to demonstrate gas DSO decarbonisation in action, and affirm GD4S' commitment to deliver on the European Green Deal.

Section 1 details how we can leverage the potential of renewable gases to reach climate neutrality. Leveraging renewable gases will further progress the decarbonisation transition, following the phasing-out of more carbon-intensive fossil fuels in recent years. Renewable gases (biomethane, renewable hydrogen and synthetic methane) offer a robust solution to meeting the EU's energy and climate objectives, with significantly reduced greenhouse gas emissions. The existing gas infrastructure can transport these new gases to different end users across the building, transport and industrial sectors, as well as others. This section outlines how the production of renewable gases provides numerous benefits to the environment and is an enabler for the development of a circular economy and sustainable agricultural practices.

Section 2 describes how we can leverage gas grids as an asset for decarbonisation and sector integration. It outlines how sector coupling between gas and electricity sectors will optimise energy infrastructure, demonstrating that all technology options should be treated on an equal basis and evaluated in terms of their decarbonisation potential and their costs. In addition, it details how a truly integrated energy system should maximise the utilisation of the existing distribution grid wherever possible, and deliver a decarbonised energy system at least cost and with least disruption to end users. Greater integration of renewable and low-emission energies, either in the form of electricity or gases, will result in an increasing weight of intermittent generation and necessitate the capacity to store and distribute the energy produced to consumption centres. Gas networks, due to their flexibility, are a key element in the execution of the energy transition. Finally, this section demonstrates how digitalisation of the gas grids can optimise the uses of renewable gases and improve efficiency.

Section 3 outlines GD4S' commitment to decarbonisation through methane emissions mitigation. The reduction of methane emissions is essential for the achievement of European environmental objectives. Gas DSOs are well aware of the contribution they can make and are determined to meet this challenge. This section outlines how improving data quality, digitalisation of the network, enhancing leak detection and repair, and roll-out of renewable gases will all help to reduce methane emissions. It also outlines the policy and regulatory measures required to support DSOs' efforts to reduce methane emissions.

"a truly integrated energy system should maximise the utilisation of the existing distribution grid wherever possible"

Finally, **Section 4** summarises key policy recommendations across the three areas outlined. The key recommendations, covered in more detail in the relevant sections, include the following:

Regarding renewable gases

- present clear definitions of renewable gases
- define an EU-wide target for renewable gases in the Internal Gas Market Directive or the Renewable Energy Directive
- establish a Guarantee of Origin (GO) framework for renewable gases at an EU level
- update the heating and cooling target in the Renewable Energy Directive
- revise the notion of "efficiency" within the Energy Efficiency, Ecodesign and Energy Performance of Buildings directives to recognise the benefits of hybrid systems
- develop and apply a life-cycle analysis or well-to-wheel methodology to calculate GHG emissions
- support both natural gas vehicles (NGVs) and bioNGVs in the scope of the upcoming revision of the Alternative Fuel Infrastructure Directive
- create the conditions for preferential tax treatment in the Energy Taxation Directive for NGVs/bioNGVs and fuels listed in the Alternative Fuels Infrastructure Directive
- facilitate the financing of renewable gas projects
- recognise the use of intermediate crops, and facilitate the use of all types of biowaste in the Renewable Energy Directive

Regarding gas grids

- recognise the value provided by gas grids in terms of seasonal flexibility and integration of renewable energies
- enable grid operators to accept increasing volumes of renewable gas by reviewing the rules regarding injection
- set up an EU gas DSO entity
- develop a framework for the coordinated planning of energy infrastructure by revising the Ten-Year Network Development Plan (TYNDP) process
- fund and support sector integration projects by revising the TEN-E Regulation
- remove regulatory barriers to sector integration
- give DSOs the right to invest in sector integration solutions
- enable a digitalised energy system
- include a new category for smart gas grids in the TEN-E Regulation

Regarding methane emissions' mitigation

- implement consistent emissions' mitigation measures by regulatory bodies at the EU level
- recognise and remunerate costs incurred by gas DSOs for innovations aimed at reducing methane emissions
- establish common guidelines for network operators to report on the methane emissions occurring on their networks
- support injection into the gas network of renewable gases, which reduce methane emissions, when the entire life-cycle is taken into account

GD4S urges policymakers to consider these recommendations in the context of developing future energy regulation and delivering on the European Green Deal. GD4S hopes that the specific recommendations are incorporated, as appropriate, in the upcoming legislative reviews, including the review of the gas legislative framework, the RED II and Energy Efficiency Directive reviews, the TEN-E Regulation, the Alternative Fuel Infrastructure Directive, and the envisaged obligations around methane emissions' reductions.

GD4S welcomes the opportunity to constructively engage with policymakers and key stakeholders regarding the recommendations outlined and GD4S' commitment to support the EU in achieving its decarbonisation ambition.

1 —— Leveraging the potential of renewable gases to reach climate neutrality

Renewable gases are key partners to delivering on the ambition of the European Green Deal, and to ensuring that a carbon-neutral economy becomes a reality. Their utilisation offers a robust solution to meeting the EU's energy and climate objectives, with significantly reduced greenhouse gas emissions. Additionally, they have a wholly positive impact on the economy through the creation of a sustainable agricultural sector and the provision of employment that cannot be outsourced.

With the production of significant volumes achievable, and with a gas infrastructure already able to transport biomethane to its end use (i.e. buildings, transport, industry), it is clear that renewable gases will play a vital role in assisting the EU to reach climate neutrality. In addition, the production of renewable gases provides numerous environmental benefits, enables the development of a circular economy, and enhances the EU's security of supply by reducing its energy dependence on external sources.

1a)

Renewable gases: an untapped potential to reduce carbon dioxide emissions

In its Strategy for Energy System Integration[1] the European Commission (EC) proposes the establishment of terminology for renewable and decarbonised gases. GD4S agrees that any discussion on the potential and uses of renewable gases must be preceded by clear definitions of those gases, based on their production and life-cycle emissions. In this paper, GD4S includes the following under the umbrella term of renewable gases: biomethane, synthetic methane and renewable hydrogen.

Concerning hydrogen development, GD4S welcomes the scale and ambition of the EC Hydrogen Strategy. This includes support for the deployment of renewable (green) hydrogen produced via Power-to-Gas technology using excess renewable electricity, in addition to the production of low-carbon (blue) hydrogen based on natural gas, combined with carbon capture and storage (CCS) technologies as an intermediary stage in the EU decarbonisation transition. This approach will allow the scale-up of the hydrogen economy, while maintaining security of supply. Hydrogen in all forms should be considered, with the objective that all hydrogen consumed in Europe will ultimately be green renewable hydrogen.

While the development of a robust and viable hydrogen network across Europe is an essential decarbonisation pathway in the medium- to long-term, biomethane offers an immediate, proven and readily available decarbonisation pathway.

1 European Commission (2020). *EU strategy on energy system integration.*

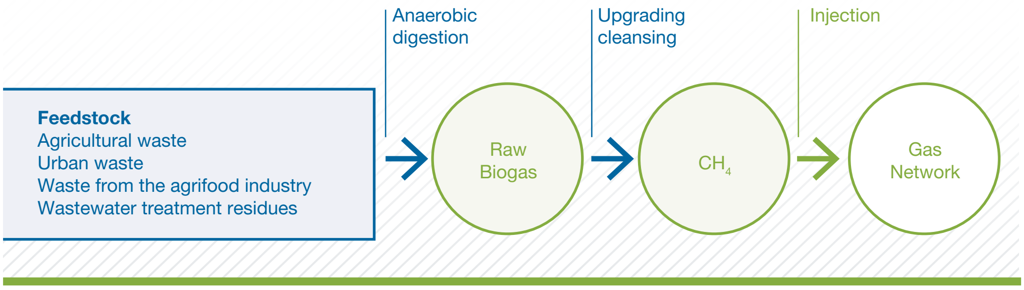

Figure 1 Anaerobic digestion production process. Source: GRDF

Biomethane produced by anaerobic digestion: the frontrunner renewable gas

Biogas is produced by anaerobic digestion. During this process, animal and/or plant organic matter is decomposed by micro-organisms. This produces a gaseous mixture that is saturated with water and composed of 50% to 65% methane.

Organic matter can come from various sectors, such as agriculture and agro-food industry residues, intermediate crops/catch crops, (bio) waste from communities and households, or sludge from wastewater or sewage treatment plants. Biogas can be purified to attain the same quality as natural gas, and in this case is considered **biomethane or bio-CNG** (Compressed Natural Gas) when it is intended to supply vehicles. Irrespective of the production process, purification is essential to remove impurities and undesirable components from biogas, e.g. carbon dioxide, sulphur and water. Once purified and odorised (for safety), biomethane can then be injected into the natural gas network.

Biomethane production is helping both the EU and Members States in meeting their renewable energy and emissions reduction targets. The process of biomethane production is a closed carbon cycle, meaning that the carbon dioxide (CO_2) emitted at its combustion has been recovered from the organic matter. The French biomethane life-cycle analysis (LCA)[2] estimates that CO_2 emissions are one-tenth (23.4 gCO_2/kWh) of those of natural gas for each megawatt hour (MWh) of biomethane produced, injected and consumed for heat purposes.

Specific criteria for greenhouse gas emissions reduction and sustainability have been fixed in the Renewable Energy Directive (RED II). If biomethane production matches these criteria, it will qualify as a renewable energy and count towards the EU objective for renewable energies.

Today, anaerobic digestion is a mature technology with significant growth potential in most countries. It represents not only a production of renewable energy, but also a waste management solution. In addition to biomethane, new technologies are being tested with a view to the extended roll-out of renewables gases in Europe.

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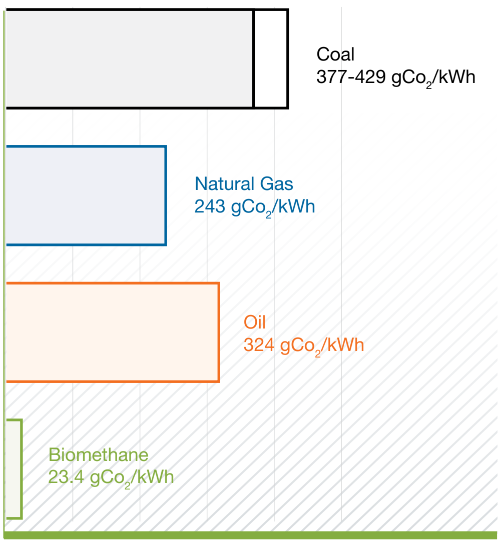

Figure 2 Total CO_2 emissions per fuel. Source: ADEME and ENEA (France)

2 ENEA-Quantis (2017). *Assessment of GHG impacts of injecting biomethane into gas networks.*

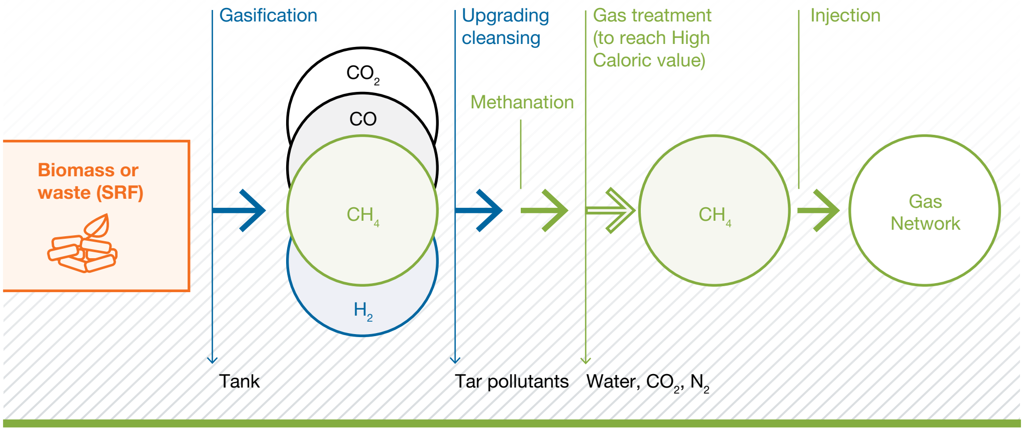

Figure 3 Gasification production process. Source: GRDF

Biomethane produced by gasification of biomass and solid waste: a promising sector

Gasification of biomass, also called pyro-gasification, is a high-temperature thermochemical process used to recover various residual waste (dry agricultural by-products, solid recovered fuels (SRF), wood residues, used tyres etc.) to produce biomethane that can be injected into existing gas networks. This sector is a complementary partner to the anaerobic digestion sector, as it processes non-fermentable residual dry waste to avoid landfilling. Anaerobic digestion enables the conversion of many kinds of biomass and waste that are currently either non-recoverable in the form of material, or technically and economically difficult to process in other sectors, into energy.

Biomethane from gasification can significantly reduce GHG emissions because it is part of a closed carbon cycle. According to a number of French stakeholders, by 2028 injected biomethane from gasification of biomass would allow for the recovery of nearly half a million tons of waste and the injection of 1 TWh of gas per year in France, thus reducing CO_2 emissions by around 165,000 tons[3]. Biomethane from gasification of biomass and solid waste will therefore contribute to the EU emissions reduction target. It will also count towards the renewable energy target when the production respects RED II criteria.

Gaya, the first gasification of biomass demonstrator in France
Led by ENGIE, the Gaya project aims to demonstrate the technical, environmental and economic feasibility of producing biomethane by pyro-gasification of dry biomass. Inaugurated in 2017 in the region of Lyon, it implements an innovative chain of semi-industrial biomethane production processes to reduce production costs and to check technical and environmental performance. The project carries out a life-cycle analysis to assess the environmental impacts of this new sector, and provides the public authorities with information about these issues. In the future, the platform will diversify the raw materials used by focusing on unrecoverable solid organic residues (such as solid recovered fuels and waste wood).

Figure 3 Gasification production process. Source: ENGIE

3 GRDF, GRTGaz, SPEGNN, SER, Teréga (2020). *2019 renewable gas French panorama.*

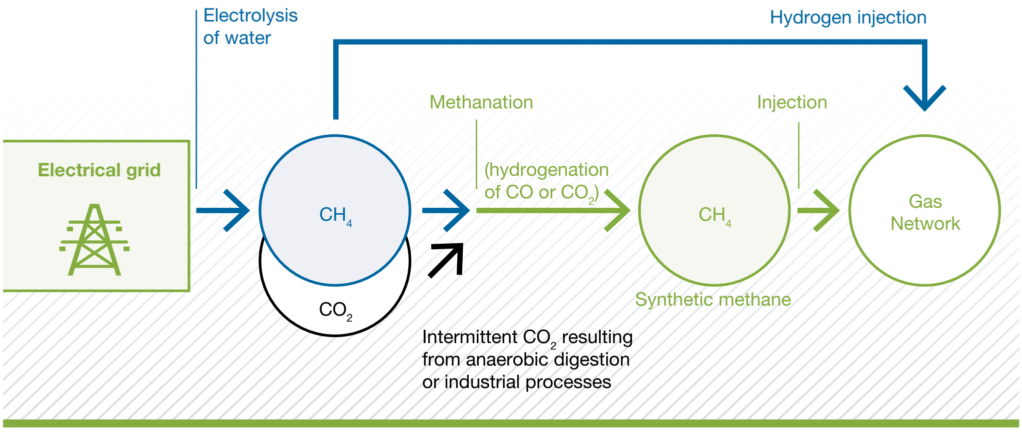

Figure 4 Power-to-Gas production process. Source: GRDF

Renewable hydrogen and synthetic methane produced via Power-to-Gas: enablers of energy system integration

Renewable hydrogen and synthetic methane are two essential renewable gases to reduce greenhouse gas emissions and contribute to the optimisation of the energy system, as they allow integration between the electricity and gas sectors. They are produced via:

- Power-to-Gas, also called Power-to-H_2 when the final product is hydrogen, and
- Power-to-CH_4 (Power-to-Methane) when the final product is synthetic methane.

Hydrogen is considered renewable when renewable electricity is used in an electrolyser. Renewable hydrogen may also be produced through the reformation of biogas (instead of natural gas) or biochemical conversion of biomass, if in compliance with sustainability requirements.

Renewable hydrogen can be further valorised by the addition of CO_2 from anaerobic digestion or industrial processes, resulting in the production of synthetic methane, a process called Power-to-Methane or methanation. This synthetic methane can be injected directly into the gas grid. The GHG emissions reduction potential of renewable hydrogen and synthetic methane depends on the GHG footprint of the electricity used. By recycling CO_2, synthetic methane could also see its GHG footprint further reduced.

Unlocking the potential of renewable gases

Biomethane, synthetic methane and renewable hydrogen are the three types of gases incorporated under the term renewable gases. There have been numerous studies about the potential volume for renewable gases at European and national levels in recent years. While study parameters including types of renewable gases, feedstock assessed, and reasoning in terms of technical or economical potential all differ, research concludes that there is a significant untapped potential in developing this renewable energy.

- The consultancy firm Trinomics undertook a study[4] for the **European Commission**, which found that there is a 1,150 TWh/year technical potential of biomethane, and a 7,900 TWh/year technical potential for renewable hydrogen.
- In a study[5] for the **Gas for Climate consortium**, Navigant concluded that biomethane and renewable hydrogen can be scaled up significantly. An “optimised gas” scenario allocates 2,900 TWh of renewable gas by 2050: 1,170 TWh of biomethane and 1,710 TWh of hydrogen to the buildings, industry, transport, and power sectors (equating to c. 270 billion cubic metres of natural gas).
- The **International Energy Agency** indicates a sustainable biomethane production potential in the EU (including the UK) of 1,200 TWh/year in 2040[6]. This potential includes feedstocks such as woody biomass, urban wastewaters, urban solid waste, manure and culture residue, and excludes energy crops.

4 Trinomics (2019). *Impact of the use of the biomethane and hydrogen potential on trans-European infrastructure.*
5 Navigant (2019). *Gas for climate study 2019.*
6 IEA (2020). *Outlook for biogas and biomethane. Prospects for growth.*

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Renewable gases present strong advantages to reduce GHG emissions and there are sufficient volumes to make them a credible decarbonisation and economic solution. To accelerate their development, GD4S proposes the following policy recommendations.

Policy recommendations

1.1. **Present clear definitions of renewable gases (biomethane, synthetic methane and renewable hydrogen).** Definitions should be written in the terminology for all renewable gases, and a European system of certification based on full life-cycle greenhouse gas emission saving must be created.

1.2. **Define a European Union-wide target for renewable gases in the Internal Gas Market Directive or the Renewable Energy Directive.** This target should be binding at the EU level, and Member States should have to define their respective objectives in their National Energy & Climate Plans (NECPs) accordingly. Member States will be free to design their objectives, e.g. they could choose a consumption target or an injection to grid target. GD4S believes that a target at the injection level has stronger advantages, taking account of the flexibility and storage capabilities of gas grids and improving the measurement of renewable gas volumes.

1.3. **Establish a Guarantee of Origin (GO) framework for renewable gases at an EU level, taking account of verifiable land use mitigation measures and of GHG emissions reduction.** Such a scheme will stimulate the market across borders, thereby encouraging stakeholders to invest in the sector. The GO must include the GHG emissions reduction of the renewable gas calculated on a life-cycle basis.

1.4. **Call on the Joint Research Centre (JRC) of the European Commission to study the potential of renewable gases in Europe.** Following numerous studies from diverse industry sectors and research agencies. GD4S believes the JRC should further research this subject and provide baseline results that would serve as a basis for further work and development on renewable gas volume potential at regional levels.

1b)

Renewable gases: a fuel with multiple applications

Renewable gases in buildings to benefit consumers

The built environment in its different forms (homes, workplaces, schools, hospitals or retail) is the single largest energy consumer in the EU, and one of the largest carbon dioxide emitters. Collectively, buildings in the EU are responsible for 40% of our energy consumption and 36% of greenhouse gas emissions, mainly stemming from construction, usage, renovation and demolition[7]. This implies that the highest potential to reduce CO_2 emissions is within the building sector. To reach the 2050 climate target goals, a transformation of the building sector towards low-carbon energy sources is essential; this transformation is dependent to varying degrees on individual-based decisions on heating systems deployed.

Renewable gases are essential to decarbonise the building sector. Biomethane and synthetic methane can be used in existing appliances, such as gas boilers, cookers and hybrid heat pumps. It is a key energy source to address end-consumers' needs (heating, hot water, cooling and cooking) with no need for retrofitting if they are already connected to the gas network. Renewable hydrogen can be used in buildings and existing appliances when injected in the gas network, subject to current limitations shown by the French demonstrator project GRHYD[8].

For the end user, hybrid heat pumps are more economic than their electric counterparts, as the electric heat pump (the most expensive component) is smaller. They are also easier

7 European Commission (2020). *Energy performance of buildings directive.*
8 Gestion des Réseaux par l'injection d'Hydrogène pour Décarboner les énergies (2020). *Presentation.*

to install, as they do not necessarily require a deep renovation prior to installation. The hybrid settings can be adjusted according to the evolution of energy prices to optimise the end user's bill. Smart hybrid solutions in the EU Renovation Wave Strategy[9] are "no regret solutions"; they enhance sustainability, making the best use of all renewables (electric or gaseous), increasing energy efficiency, and minimising costs of renovation. They enhance affordability, by reducing costs at the end-user and system levels.

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Policy recommendations

1.5. **Update the heating and cooling target in the Renewable Energy Directive.** In the RED II, Members States are encouraged to increase the share of renewable energy in the heating and cooling sector. This indicative target must be rewritten to focus on heat in buildings. Similar to the transport target, we call for a sub-target for renewable gases in heating, as gas heating technologies can rapidly decarbonise the sector when fuelled with renewable gases.

1.6. **Revise the notion of "efficiency" within the Energy Efficiency, Ecodesign and Energy Performance of Buildings directives to recognise the benefits of hybrid systems.** Efficiency should go beyond technologies and grids and look at the overall energy system. This evolution would facilitate the uptake of hybrid heating technologies such as hybrid heat pumps and the efficient transformation of energy systems in a smart integrated manner in terms of energy production, appliances and grids.

Renewable gases to improve the environmental footprint of the transport sector

Transport accounts for a quarter of the EU's greenhouse gas emissions, and this figure continues to rise as demand grows[10]. The European Green Deal seeks a 90% reduction in these emissions by 2050 by putting users first and providing them with more affordable, accessible, healthier and cleaner alternatives. Simultaneously, the European Commission is committed to improving air quality across Europe.

Renewable gases are the perfect solution to address both challenges. Natural gas and biomethane both reduce particulate matter (PM) by 95% compared to diesel in a car, and reduce nitrogen oxides (NOx) by 50%. Noise volume is reduced by 50%[11]. Natural gas reduces carbon emissions by 20% compared to a diesel EURO VI, and biomethane by 80%[12]. Biomethane can be used in all existing CNG vehicles.

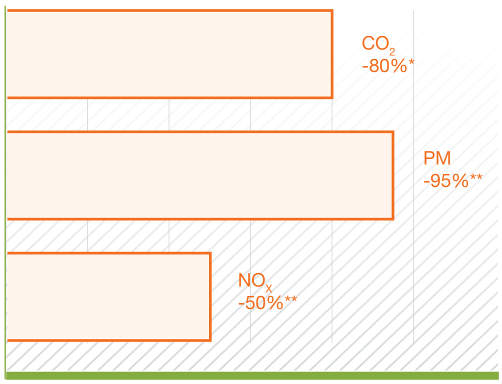

Figure 5 Emissions and pollutants reductions with (Bio) NGV mobility. Source: Data for France from IVECO Cursor 9 and ADEME *BioNGV versus traditional fuel **NGV and BioNGV versus Euro VI

9 European Commission (2020). *Renovation wave for Europe - greening our buildings, creating jobs, improving lives.*
10 European Commission (2017). *Greenhouse gas emission statistics – emission inventories.*
11 IVECO (Value for France)
12 ADEME (Value for France)

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Source: Nedgia

Natural gas and biomethane provide an immediately available alternative to oil. NGVs (natural gas vehicles) and bioNGVs, when fuelled by biomethane, do not require significant changes in the production chain of traditional vehicles, powertrains and structures, nor in the habits and behaviours of citizens. Gas mobility allows a smooth transition for the automobile value chain (manufacturers, car dealer etc.). Furthermore, natural gas is more affordable than traditional fossil fuels. According to NGV Italy, using gas for a 690km journey between Turin to Rome costs 22 euro; using gasoline 60 euro; and diesel 39 euro: therefore, NGVs are the economical solution[13].

(Bio)NGVs can be used for light-duty or heavy-duty applications, such as buses, agricultural vehicles, etc. They are particularly suited when it comes to public transport in urban and inter-urban areas. They offer high range and significantly reduce air pollution in urban areas. (Bio)NGVs have already been deployed in many urban centres. Today, several studies and demonstration projects are being completed to allow new transport sectors (such as passenger and freight rail and inland waterways) to benefit from using biomethane as a fuel.

The number of refuelling stations is key for the development of (bio)NGV mobility. Today, there are around 1,480,000 NGVs in use in Europe, and 4,200 NGV stations[14,15]. With more than 1 million vehicles in 2018, and 1,100 refuelling stations, Italy is the leader in gas mobility in Europe. According to the Italian gas Transmission system operator (TSO) Snam and the automobile manufacturer Fiat, tripling this number to 3 million by 2030 (based on the assumption that the number of refuelling stations may double in the same period of time) would result in the following reductions from the overall emissions of the transport sector[16]: 4% CO_2; 10% nitrous oxide (NOx); 12% particulate matter (PM). Based on a well-to-wheel approach, a gas powered light vehicle with a fuel mix of 60% natural gas and 40% biomethane is estimated to have 57% less emissions than a gasoline vehicle. When compared to an electric vehicle, carbon performances are similar. The same vehicle fuelled with 100% biomethane will emit 3% of the CO_2 produced by a petrol vehicle. Its performance will equal that of an electric vehicle consuming 100% renewable electricity.

13 NGV Italy (Value for Italy)
14 EAFO (2020). *Number of vehicles*.
15 NGVA Europe (2020). *Refuelling stations.*
16 Snam, FCA and Iveco (2016). *Memorandum of understanding.*

Agribiométhane in Vendée (France) -
A biomethane site coupled with an NGV station
Agribiométhane is a biomethane plant in the French department of Vendée, which collects from ten farmers at four nearby farms. The agricultural waste collected is transported to the digester to produce biomethane. The feedstocks used are animal manure and agro-industry sub-products. The biomethane plant injects into the distribution gas grid to heat approximately 500 households and fuel a (bio)NGV station for light- and heavy-duty vehicles. The 24/7 (bio)NGV station has an annual consumption equivalent of 40 trucks and 800 passenger cars.

Policy recommendations

1.7. Develop and apply a life-cycle analysis or well-to-wheel methodology, as referenced in Regulation (EU) 2019/1242 to calculate GHG emissions. Emissions can not only be measured at the tailpipe, as doing so is too restrictive and does not take into account the GHG emissions reduction of renewable gases, fuels that can rapidly decarbonise vehicles. In order to optimise investment decisions, which reduce globally greenhouse gas emissions, application of life-cycle analysis is critical.

1.8. Support both NGVs and bioNGVs in the scope of the upcoming revision of the Alternative Fuel Infrastructure (AFI) Directive. The AFI Directive facilitates investments in (bio)NGV refuelling infrastructures. The European Commission should consider setting targets on the roll-out of alternative fuel infrastructures.

1.9. Create the conditions for preferential tax treatment in the Energy Taxation Directive for (bio)NGVs and fuels listed in the AFI Directive. Today, the Energy Taxation Directive favours diesel mobility despite the EU and Member States' goals to phase out this fuel and develop sustainable biofuels. This preferential tax treatment should also apply to renewable gases defined in RED II and used as heating fuels.

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Renewables gases for a carbon-neutral industrial sector

The industrial sector is a large contributor to the carbon footprint of the European Union. In 2018, emissions from industrial processes and product use represented 9% of the total GHG emissions in the EU[17]. The European Commission has been active in pushing for the decarbonisation of this sector, for example with Directive 2010/75/EU on industrial emissions and with the EU Emission Trading Scheme.

Renewables gases are the solution to strongly accelerate the decarbonisation of the industrial sector. Biomethane and synthetic methane can be directly used in factories or power plants using natural gas. Retrofitting industrial plants currently using coal or oil to biomethane or renewable hydrogen is also an encouraging solution. As underlined in the EU Commission's Hydrogen Strategy[18], the hydrogen economy will first be developed in industrial areas where strict safety standards are ensured. In those areas, 100% hydrogen distribution networks could be developed to connect production sites, factories and refuelling stations.

Policy recommendations

1.10. **Recognise the use of the Guarantee of Origin (GO) for renewable and decarbonised gases to validate emissions reduction in the Emissions Trading System (ETS).** Today, an industrial plant cannot buy GOs and use them as a proof for emissions reductions within the ETS system. This should be modified to accelerate the decarbonisation of the industry. It will also accelerate the development of renewable gases production sites.

1c)

Renewable gases: wider benefits – sustainable agriculture and circular economy

Anaerobic digestion: an enabler of sustainable agriculture

Production of biogas by anaerobic digestion is an agro-ecological practice. As such, it provides many environmental services in an affordable way, resulting in more sustainable and progressive agriculture. The production of biogas fosters the circular economy, based on the treatment of organic residues and waste from agricultural and urban sources. This creates new links between urban and rural areas, consumers and producers; it involves farmers in a new circular economy where all parties have direct benefits.

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17 European Commission (2017). *Greenhouse gas emission statistics – emission inventories.*
18 European Commission (2020). *Hydrogen strategy for a climate-neutral Europe.*

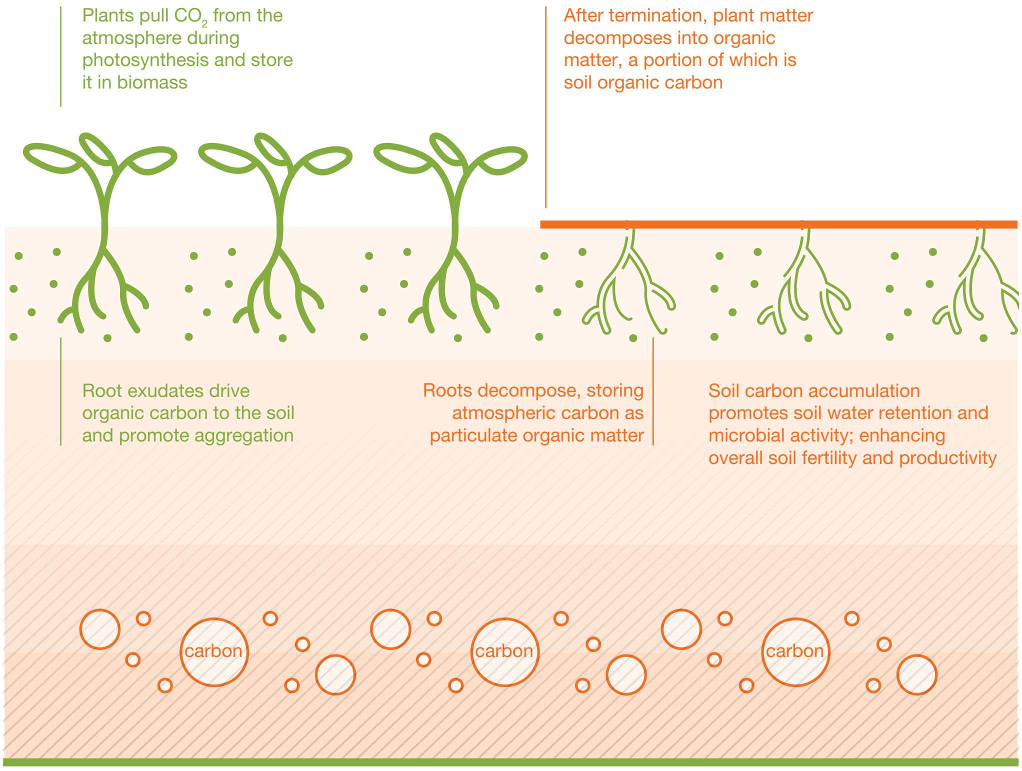

Figure 6 Cover crops carbon sequestration. Source: Cropwatch

Biomethane plants contribute to the decarbonisation of the agricultural sector which represents 10% of the GHG emissions in Europe[19]. As underlined in the EU Strategy to Reduce Methane Emissions[20], biogas production is a viable solution. Agriculture generates large quantities of manure, which spontaneously releases significant amounts of methane when stored or spread on fields. If manure is instead brought to a biomethane plant, the methane can be captured and used to produce renewable energy.

Biomethane plants generate a renewable fertiliser, the digestate, which can replace carbon-intensive chemical fertilisers. The use of digestate by farmers contributes to the protection of water and soils, while cutting fertiliser costs, representing a potential 3 to 4 euros/MWh gain, as stated by the French Energy Regulation Commission (CRE)[21].

Moreover, the application of the digestate as an organic fertiliser increases carbon storage in soils, taking carbon from the digested biomass out of the atmospheric carbon cycle. Digestate thus enables the soil to serve as a carbon sink.

An important feedstock for anaerobic digestion is intermediate crops (also called catch crops/cover crops). Farmers are incentivised to develop and take care of cover crops, encouraged by the Common Agricultural Policy, turning this residue into an income stream. The development of such cultures increases the carbon sequestration capability of the soil, reduces the use of herbicides (a carbon-rich soil is more fertile), and favours biodiversity[22].

19 Eurostat (2018). *Greenhouse gas emissions from agriculture.*

20 European Commission (2020). *EU strategy to reduce methane emissions.*

21 CRE (2019). *Le Verdissement du Gaz. ENEA (2019) Renforcer la compétitivité de la filière biométhane française : De nombreux leviers activables à court et moyen termes.*

22 S. Marsac (2019). *Optimisation of French energy cover crop production in double cropping systems for on-farm biogas use.*

Therefore, the use of digestate and intermediate crops bring significant benefits to the environment. When used correctly, they are two vectors of agro-ecology, according to a report from the French NGO WWF France[23]. The Biogas Done Right initiative from the Italian Biogas Association underlines the numerous benefits of intermediate crops for the environment without limiting food and feed crops' production.

The production of biomethane provides farmers with an additional, complementary income stream, contributing to strengthening the agricultural sector and its resilience. Moreover, anaerobic digestion could create 200,000–275,000 local and direct jobs across the EU and another 300,000–400,000 indirect jobs by 2050, according to the Gas for Climate study by Navigant[24].

The combination of these uses and advantages results in a negative carbon footprint[25] and prevents detrimental environmental impacts. It is a win-win approach for both the environment and farmers, with reduced costs and increased incomes. The CRE report states that for each MWh of biomethane produced, between 40 and 70 euros of positive externalities are produced.

Policy recommendations

1.11. Facilitate the financing of renewable gas projects to highlight the positive externalities, such as their potential to reduce methane emissions. Horizon Europe, the European Regional Development Fund (ERDF) and cohesion funds should include financing opportunities for renewable gases in their programmes.

1.12. Recognise the use of intermediate crops in the Renewable Energy Directive. Intermediate crops present strong benefits to the environment as they act as a carbon sink. They should clearly be mentioned in the Renewable Energy Directive Annexe IX.

Renewable gases: circular economy accelerators

Renewable gases are boosting the development of circular economy approaches. Biomethane helps cities and municipalities to establish a local and circular bioeconomy.

Biomethane plants can be filled with green waste, which refers to vegetable waste resulting from maintaining and renewing public and private green spaces. Sludge from urban wastewater treatment plants, and food waste from households, schools and companies' canteens are often used as feedstocks. The French Energy Regulation Commission has estimated (based on figures from ADEME[26]) that food waste caused by both the food industry and consumers would represent the equivalent of 7.5 TWh/year of energy for France in 2030. The 2018/8521 Waste Directive allows a maximum of 10% of organic waste to be sent to landfill. It is therefore essential to valorise the other 90%, and to transform a societal problem (waste treatment) into an opportunity to produce green energy and fertiliser. This circular economy chain is strongly contributing to the global objective of reducing emissions, since food waste generates about 8% of global greenhouse gas emissions[27]. In Madrid, Spain, the Valdemingómez plant injects approximately 100 GWh of renewable gas, produced from city waste, into the gas network every year. In 2017, the Valdemingómez plant treated more than 1.2 million tons of waste, the equivalent of 394 kilogrammes per inhabitant per year.

Organic waste produced locally can be used to produce biomethane, which can be consumed locally. Biomethane can be used, for instance, to fuel urban garbage lorries, school buses and public buses between neighbouring cities, reducing noise pollution and improving air quality.

23 WWF France (2020). *Méthanisation agricole. Quelles conditions de durabilité de la filière en France ?*
24 Gas for Climate (2019). *Job creation by scaling up renewable gas in Europe.*
25 ENEA (2018). *Carbon neutral for ISDN and sludge, ACV sur le biométhane*
26 ADEME (2013). *Estimation des gisements potentiels de substrats utilisables en méthanisation.*
27 WWF (2020). *Food waste.*

@Gregory Brandel - GRDF "In this restaurant, we are recycling biowastes to produce a green gas: biomethane"

Policy recommendations

1.13. **Facilitate the use of all types of biowaste in the Renewable Energy Directive.** There is a massive unused potential in feedstocks such as biowaste from companies and cities, and those should be included in the Renewable Energy Directive Annexe IX.

2 — Leveraging the use of grids as a vector for decarbonisation and sector integration

Gas grids are vital assets and will play a key role in helping achieve EU climate and energy targets. Distribution gas grids are resilient and flexible and can distribute different gases including natural gas, hydrogen and biomethane while providing unparalleled storage capacity at a cost-effective price. Already in position, the grid is expansive, responsive and adaptable to large energy fluctuations. With digitalisation, the management of energy flows will be optimised, and the gas and electricity grids can become better integrated with the use of hybrid heating technologies.

In supporting a more integrated energy system, all technology options should be treated on an equal basis and evaluated in terms of their decarbonisation potential and their costs. Evaluation of the business cases for key technologies should be carried out on a system-wide basis, and should consider the investment in electricity and gas networks required to facilitate their deployment and integration into energy systems.

2a)

Distribution grids, flexibility providers to the energy system

Achieving an energy transition will require flexible infrastructures. The evolution of the energy sector will be characterised by a change in the energy mix and production location. It will be focused on the use of renewable and low-emission energies either in the form of electricity or gases, with an increasing weight of intermittent generation, requiring the capacity to store and connect the energy produced to the consumption centres. Gas distribution networks, due to their flexibility, are a key element in the execution of an energy transition.

Gas grids distribute different energy vectors while providing unparalleled cost-effective storage capacity

Gas distribution networks, due to their design characteristics, have the flexibility to channel different energy vectors through their infrastructure. In this way, they are a safe and efficient alternative for distributing different forms of renewable energy, thus contributing to the EU's energy decarbonisation objectives. Gas distribution grids traditionally deliver natural gas, but today, hundreds of biomethane sites are injecting into the gas network in Europe. In the future, gas distribution grids will distribute an important share of biomethane, as well as synthetic methane, produced through Power-to-Methane (see Figure 4). In the medium- to longer-term, renewable hydrogen will be injected into

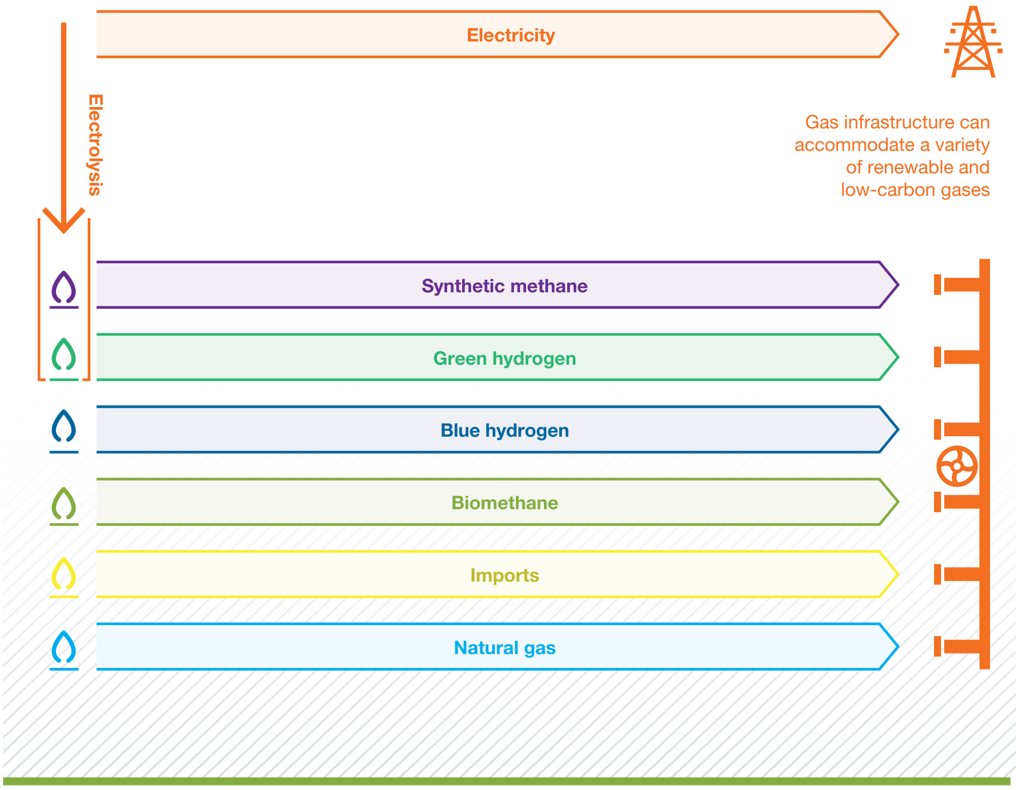

Figure 7 The value of gas infrastructure in a climate-neutral Europe. Source: Frontier Economics (2019)

the grid to a limited percentage, or will be distributed in fully dedicated retrofitted or new distribution networks. Ultimately, distributing renewable hydrogen and synthetic methane will enable the integration of renewable electricity in the gas grid, as both are produced from renewable sources. In the case of synthetic methane, we can add that gas grids allow the integration of recycled CO_2 from biogas plants or industrial sites to the system.

Gas grids provide an enormous storage capacity for the energy system. The gas storage capacity in Europe is currently about 1,500 times that of electricity[28], and it is ready to incorporate renewable gases. If the entire European vehicle fleet was electric, the resulting electricity storage capacity would be about 3% of the current gas storage capacity[29]. Energy storage in the form of gases offers the greatest flexibility in terms of storage capacity and discharge time; consequently, this is the best option for seasonal energy storage[30].

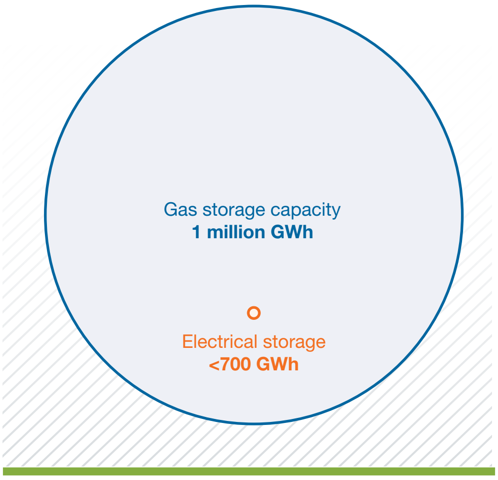

Figure 8 Comparison between gas and electricity storage capacities. Source: Frontier Economics and IAEW RWTH Aachen University (2020)

28 IEA (2015)
29 Frontier Economics and IAEW RWTH Aachen University (2020). *Sector coupling: Una visión para España*
30 REN21 (2017). *Renewables Global Futures Report: Great debates towards 100% renewable energy.*

2 Overview storage capacity of different energy storage systems

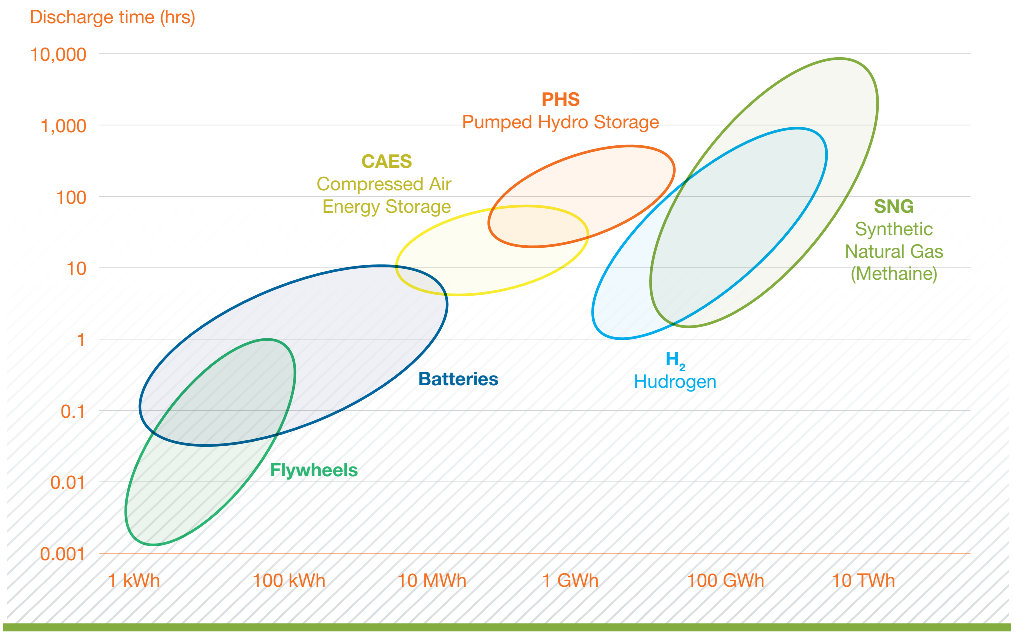

Figure 9 Renewable global futures report great debates towards 100% renewable energy. Source: REN21 (2016)

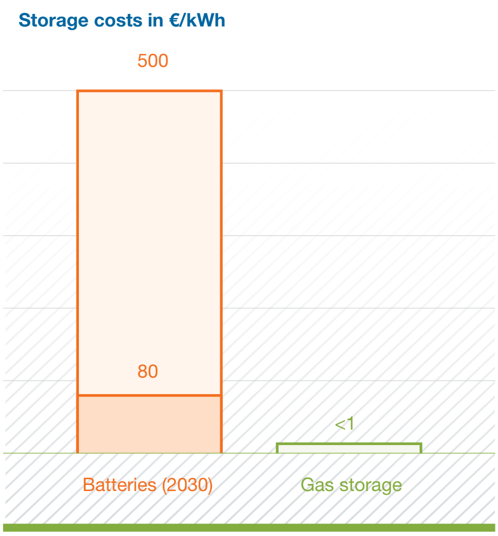

Figure 10 Cost of gas storage compared to electricity storage with batteries. Source: Frontier Economics and IAEW RWTH Aachen University (2020)

Gas storage is strongly cost-effective.
Electricity storage systems are not suitable for mid to long-term storage. The two main options are pumping stations and batteries. However, the high investment costs, and the geographical limitations in the case of pumping, make them unfeasible for seasonal storage. They are also more expensive than storing energy in gas form.

An existing and extensive European gas grid can manage large energy fluctuations

At an early stage of renewable gases development, the gas network has been fundamental to connecting decentralised production of renewables gases like biomethane with areas of consumption. The extensive European gas grid, with more than 2 million kilometres of network operated by 45 TSOs and 2,000 DSOs, offers the flexibility to effectively integrate renewable gases into the network, with its 100 million points of supply.

2 million kilometres of network operated by 45 TSOs and 2,000 DSOs

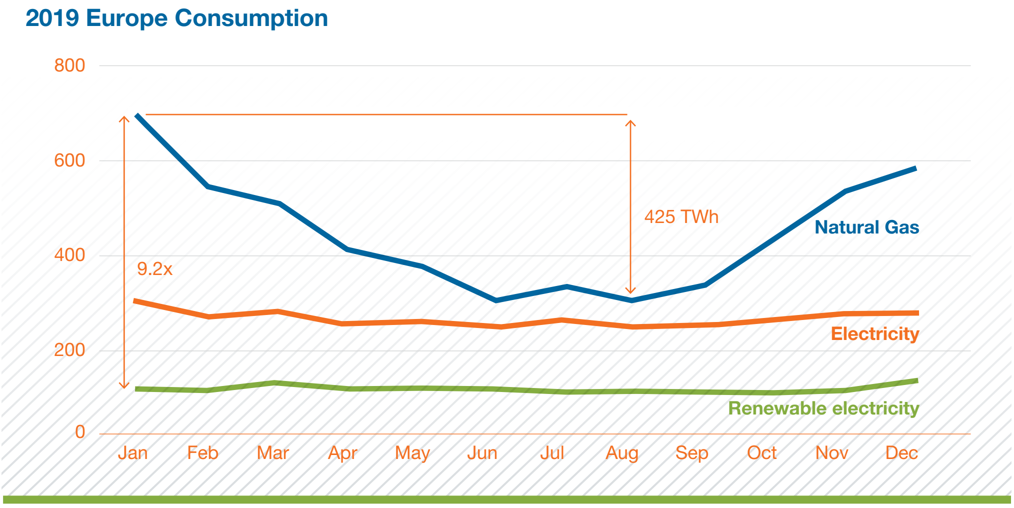

Figure 11 Gas and (renewable) electricity consumption in Europe in 2019. Source: Nedgia, based on Eurostat

Further evidence of the significant flexibility offered by gas networks is their ability to withstand large fluctuations in demand throughout the year. For example, during 2019, the difference between the natural gas consumed in Europe in the peak month and the valley month was 425 TWh[31]. To put this flexibility of the gas network into perspective: the average monthly consumption of electricity in Europe in 2019 was 237 TWh, of which only 76 TWh came from renewable sources on a monthly average. In other words, the gas networks are well prepared to leverage their flexibility to facilitate delivery of the decarbonisation objectives set for 2050.

The usage of gas networks can contribute to reaching a decarbonised Europe at far lower costs than in a scenario which relies to a large degree on electrification

***total cost savings in the EU-28 would be equivalent* to**

EUR 76 billion to 125 billion

per year in 2050[32]

Policy recommendations

2.1. **Recognise the value provided by gas grids in terms of seasonal flexibility and integration of renewable energies.** These advantages should guide technology choices and energy infrastructure development, and, as such should be emphasised in the Ten-Year Network Development Plan (TYNDP). Gas technologies must be considered because they are part of a value chain capable of addressing energy security issues, while presenting deployable and efficient solutions for decarbonisation.

2.2. **Enable grid operators to accept increasing volumes of renewable gas by reviewing the rules regarding injection** (including socialisation of the connection costs in the network tariff, and rules governing blending between gases).

2.3. **Set up an EU gas DSO entity.** An EU gas DSO entity must be created to make decisions on technical and planning issues linked to the new roles of DSOs, as an enabler of the green transition. It will improve coordination between gas DSOs on various topics, as well as with gas TSOs and electricity DSOs and TSOs.

31 Eurostat (2019)
32 Frontier Economics and IAEW RWTH Aachen University (2019). *The value of gas infrastructure in a climate-neutral Europe*

2 — 2b)

Sector coupling between gas and electricity sectors to optimise energy infrastructures

An integrated energy system – sector coupling of gas and electricity networks

The European Strategy for Energy System Integration is one of the most ambitious and all-encompassing elements of the European Green Deal. It sets out to establish the basis for *"the coordinated planning and operation of the energy system as a whole, across multiple energy carriers, infrastructures, and consumption sectors".* It envisages an integrated energy system that delivers decarbonisation *"at the least cost across sectors while promoting growth and technological innovation".*

One of the key interfaces in an integrated system will be between gas and electricity grids. By leveraging the bulk storage capability of gas infrastructure and gas distribution grids, and utilising innovative technologies such as Power-to-Gas and hydrogen networks, a decarbonised and secure energy system can be achieved. This approach will maximise the use of renewable energy sources, allowing greater penetration of intermittent renewables such as wind and solar. It will reduce the curtailment of these assets at times of peak generation, and will ensure security of supply and the overall efficiency of the energy system.

Sector coupling of gas and electricity networks reinforces and builds upon many of the key concepts articulated in the Energy System Integration Strategy, including:

- Transitioning to "*a climate neutral economy at the least cost*";
- "*Making the most of the existing infrastructure*"; and
- Enabling the *"smart use of distributed (renewable) energy supply"*.

Leveraging existing gas infrastructure to transport renewable and decarbonised gases will significantly reduce the substantial costs associated with the reinforcement of electricity grids to cope with peak demand scenarios, while solving the problem of energy storage. Renewable energy sources may not necessarily be located closed to demand centres. Renewable gases, such as biomethane and hydrogen, could *"be transported and stored at lower cost than electricity"*[33]. Utilising the gas infrastructure in this way may *"avoid potentially costly and disruptive changes to end-use appliances".* Furthermore, the use of advanced end-use applications, such as hybrid heat pumps and fuel cell technologies, will allow further savings relative to a segmented energy system.

The role of gas distribution grids in an integrated energy system

The roll-out of renewable energy sources across Europe has led to increased distributed energy production. This is already evident in the electricity system, but is becoming more apparent in gas grids, where biomethane production at local level is being deployed. Much of the new renewable electricity generation capacity is from intermittent sources (e.g. solar and wind) and may not be located close to energy consumers. It is therefore important to find a cost-effective storage and transport solution for renewable energy to balance the energy system and to provide security of supply.

The EU Hydrogen Strategy underlines the potential for electrolysers to *"transform renewable electricity into renewable hydrogen, providing long-term storage and buffering capability, and further integrating the electricity and gases markets."* In order to optimise these energy flows and deliver on synergies, such as the storage potential of the gas grids, a more integrated and "multi-directional" system will need to be developed. As well as bi-directional flows of energy with reverse flow installations (e.g. from local biomethane producers connected to distribution grids supplying transmission grids), there will be more horizontal energy flows between gas and electricity grids at local level. These horizontal flows may include, for instance, energy customers exchanging heat in smart district heating and cooling systems, or feeding in electricity produced by individuals or energy communities.

33 European Commission (2019). *Potentials of sector coupling for decarbonisation - Assessing regulatory barriers in linking the gas and electricity sectors in the EU - Final report.*

Bi-directional flows in practice: West Grid Synergy to improve collaboration between DSOs and TSOs on biomethane injection

GRDF is a partner of the West Grid Synergy demonstrator, which is trialling "reverse flow pipes", also called "intelligent compressor". Reverse flow pipes allow increases in gas pressure levels with the objective of circulating biomethane to additional areas of consumption. In 2017, two intelligent distribution-transport compressor pilot projects were initiated in the Brittany (Pontivy) and Pays-de-la-Loire (Pouzauges) regions.

These areas show proven needs for an intelligent compressor: production of biomethane higher than local consumption; sufficient maturity of the biomethane injection projects; a local dynamic favourable to the development of renewable gases and uses of these renewable gases (bio-NGV mobility in particular) supported by a strong involvement of communities (regions).

WEST GRID SYNERGY

To maximise the potential of an integrated energy system, digitalisation will be needed. The complex and dynamic energy flows arising from an integrated energy system will need to be managed carefully to ensure the overall integrity of the system and to maximise the use of renewable electricity and gases. See Section 2.c) for further details on the benefits of a digitalised energy ecosystem.

Advances in end-use applications such as gas absorption heat pumps, hybrid heat pumps and fuel cell technologies can deliver substantial energy savings. Smart hybrid options can help balance gas and electricity systems when coupled with smart technologies enabled by the growing digitalisation and integration of gas and electricity networks.

The European Commission's Renovation Wave for Europe communication underlines the intention to *"promote the use of decarbonised gases that can create local synergies"*. In particular, hybrid technologies (e.g. an electric heat pump with a mini gas boiler) can play a key role in decarbonising older housing stock where deep retrofit of dwellings is impractical or prohibitively expensive. According to the Energy System Integration Strategy, hybrid heat pumps *"provide opportunities for arbitrage between electricity and gas markets"*. This can allow local energy flows that can be managed in a cost optimal manner. These price signals are representative of the available resources in an integrated energy system, and will thus help balance energy flows on the system. Such signals will help ensure that all energy consumers can play a role in the energy transition and benefit from energy savings. Ultimately, hybrid heating technologies enable avoidance of unnecessary and expensive investments in peak demand technologies and electricity grid reinforcements.

Sector coupling project at consumer level in practice: Interflex/Nice Smart Valley

To demonstrate and test the technical and economic performance of smart gas solutions (hybrid heat pumps and cogeneration units) installed on the distribution network, GRDF is participating in the French demonstrator of the project Interflex, located on the territory of the metropolis of Nice.

This European project (funded by the European Commission as part of the Horizon 2020 Research and Innovation programme, and managed by Enedis) is focused on the use and promotion of multi-energies flexibilities at the local level. The French demonstrator is acting as a pioneer by integrating flexibilities offered by gas products. Interflex has several aims: Realise and demonstrate the value created by the complementarity of electricity networks and gas; make smart gas solutions controllable by aggregators to enable them to participate in flexibility portfolios, and thus give gas consumers the means of accessing new sources of emerging value (markets/mechanisms of flexibility); and evaluate the technical and economic performance of smart gas solutions.

NICE SMART VALLEY

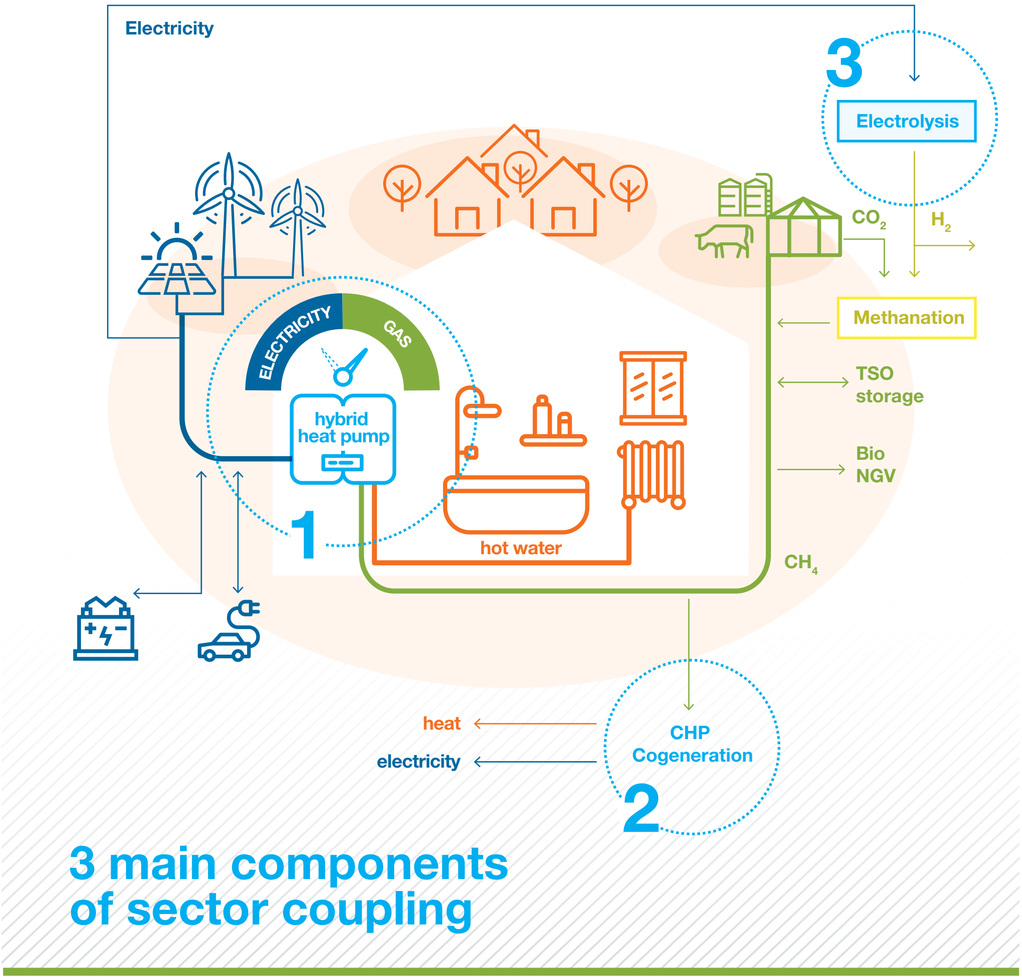

Figure 12 Sector coupling: an holistic view. Source: GRDF

The truly integrated energy system should maximise the utilisation of existing assets wherever possible, and deliver a decarbonised energy system at least cost and with least disruption to end users. The coupling of gas and electricity networks can provide security of supply and flexibility, in addition to allowing energy to be conveyed via multiple carriers in an optimised manner. However, effective sector coupling between gas and electricity networks requires integrated planning at both distribution and transmission levels. Adequate supports and funding must be afforded to DSOs to develop the necessary infrastructure.

In particular, GD4S recommends the following:

Policy recommendations

2.4. **Develop a framework for the coordinated planning of energy infrastructure by revising the TYNDP process.** The Energy System Integration Strategy recognises that gas networks provide *"ample capacities across the EU to integrate renewable and low-carbon gases"*. GD4S believes that integrated planning between gas and electricity grids across the transmission and distribution networks is essential to ensuring a least cost energy transition.

2.5. **Fund and support sector integration projects by revising the TEN-E Regulation.** Funding and supports will be required for key energy conversion projects, such as Power-to-Gas, which can link the gas and electricity systems. Support is also required for projects that allow for bi-directional flows between gas distribution and transmission networks, so as not to limit gas grids in storing energy from renewable electricity sources, which would otherwise be curtailed.

2.6. **Remove regulatory barriers to sector integration.** With more dynamic energy flows across networks and across energy systems, unintended consequences such as the double charging of gas and electricity tariffs should be avoided to encourage sector integration.

2.7. **Give DSOs the right to invest in sector integration solutions.** Gas DSOs should be allowed to invest in infrastructure that enables the integration of gas and electricity networks, particularly in the early stages of development, subject to appropriate criteria (including exit criteria). The involvement of DSOs in energy conversion projects could be aligned with the timelines set out in the EC's Hydrogen Strategy, which aims to establish an open and competitive hydrogen market by 2030.

2c)

Digitalisation of the gas grids to optimise the uses of renewable gases and improve efficiency

Having already described solutions to effectively decarbonise gas injected and distributed in the gas DSO networks, our focus now turns to the conditions for adopting such solutions and developing their full potential. The key enabler of all innovations will be the digitisation of the network, which in GD4S' view includes the following major objectives:

- To maximise the environmental benefits of renewable gas injection;
- To effectively control continuous changing of gas blends, while ensuring energy is delivered safely to end customers;
- To better manage complex flows between integrated gas and electricity systems, and to balance the available renewable resources to meet demand in the most cost-effective manner; and,
- To improve efficiency and safety of network management, benefitting both operators and consumers.

A true digitalised network for an optimised energy system

Grid digitalisation is sometimes viewed as a synonym for smart metering, however this is not the case. Smart meters are necessary to report reliable consumption data and enable proactive and more efficient consumption practices by end customers, helping minimise environmental impact, and curbing energy costs for households and industry.

In order to control grids in real time, sensors are required: these are able to verify and report relevant technical parameters (such as pressure, gas content, odorant level) to an Integrated Supervision Centre (ISC). The ISC must be in a position to remotely control actuators to balance the grid and different gas flows, and, when necessary, to activate reverse flows to the TSO networks. Sensors will be located on biomethane and hydrogen injection stations to optimise their integration into the grid.

The numerous advantages of digitalising gas grids

From an operator perspective, digitalisation delivers many tangible advantages, including:

- Enabling remote control and on-site workforce support;
- Helping improve network safety and management via predictive maintenance;
- Allowing better control of operational parameters, such as odorisation and gas pressure; and
- Dramatically improving network resilience against crises such as Covid-19.

Only a fully digitalised network will be able to support true energy system integration, matching energy demand with climatic conditions, storage capacities and the final cost for end customers.

Most notably, innovation and digitalisation will allow gas DSOs to monitor, report, control and effectively reduce methane emissions, further contributing to reaching energy decarbonisation European targets.

Real beneficiaries of grid digitalisation are end-users

The benefits of digitalisation to gas DSOs are clear. The resultant improvements in networks management also benefit end-users in several ways. For example, more accurate and updated data from smart meters will enable better control of energy consumption and induce proactive behaviours when using gas and heating appliances.

Efficiency gains obtained by the network operator will ultimately be mirrored in gas tariffs, limiting energy costs for households and industry. Safer crisis-proof operations will promote continuity of service and decrease the likelihood of disruptions in network management, particularly in the event of adverse weather conditions. The control, monitoring and reduction of methane emissions, along with an increasing share of decarbonised gas in networks, will provide a better, cleaner and safer environment for all. In this way, gas DSOs are strongly committed to, and are already investing in, the digitalisation of their grids.

Example: Italgas

1. Extensive smart metering roll-out programme (over 7.7M meters in 2/5 years)
2. Fully sensorised and remotely controlled grids by 2022
3. Digital Factory to design and implement digital solution in Network Management & Staff Operations

€1 B invested in 5 years

Figure 13 Italgas digitalisation strategy. Source: Italgas

Digitalisation will benefit end customers in multiple ways, for example

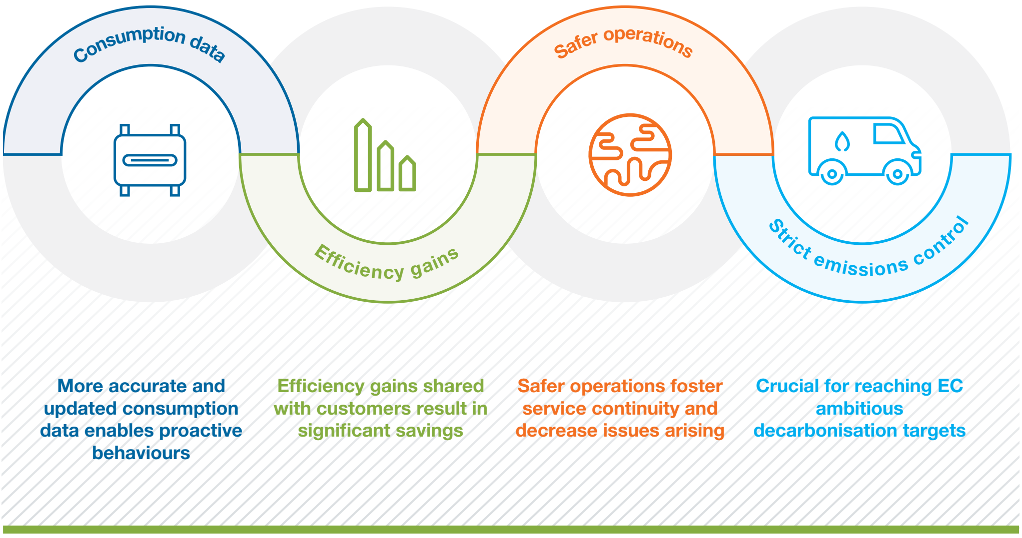

Figure 14 Benefits of digitalisation. Source: Italgas

Policy recommendations

2.8. **Enable a digitalised energy system.** The Energy System Integration Strategy previews the development of a *"Digitalisation of Energy Action plan by 2021 to develop a competitive market for digital energy services"*. The smart integration of gas and electricity networks, where appropriate, should be a key focus of this work.

2.9. **Include a new category for smart gas grids in the TEN-E Regulation.** Today, smart grids are only defined as smart electricity grids despite the decarbonisation and optimisation potentials of gas technologies.

3 GD4S' commitment to decarbonisation through methane emissions' mitigation

According to the EU Methane Strategy, there is currently no specific regime in place to ensure a drastic reduction of anthropogenic methane emissions, which account for 59% of total methane emissions. As presented in the EU, oil and gas sectors contribute 10% of methane emissions from human origin (see Figure 15). In Europe, methane emissions related to the gas sector represent 0.6% of all EU GHG emissions[34].

On the other hand, methane emissions reduction has always been a key concern for the gas distribution industry across Europe for safety reasons.

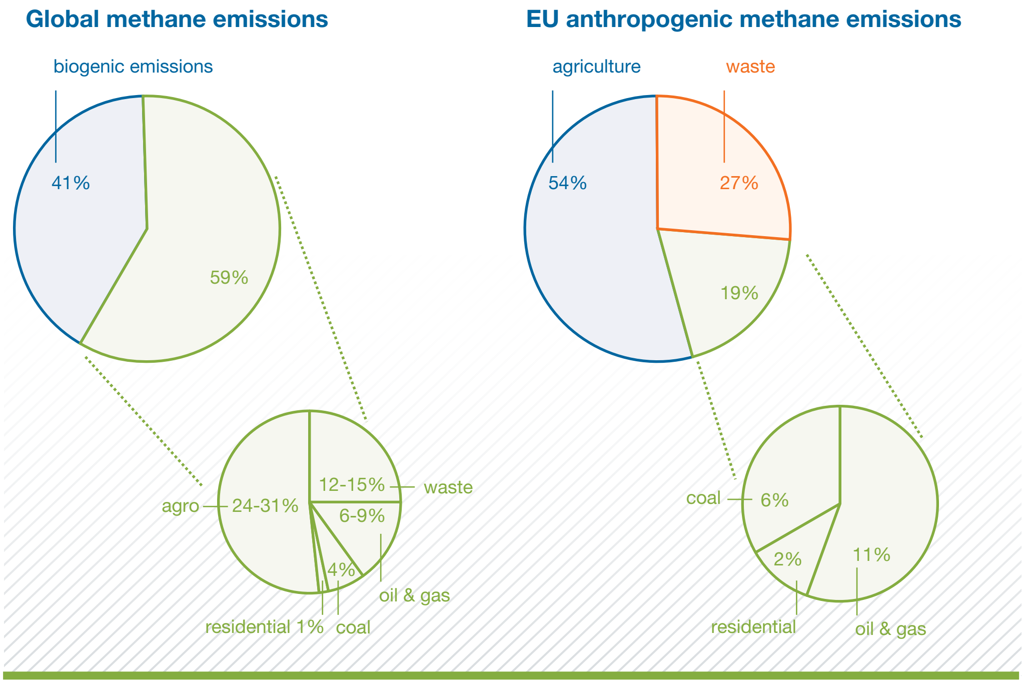

Figure 15 Methane Emissions at Global and EU level

34 *European Environmental Agency (2016)*

GD4S' members are determined to continue to reduce the methane emissions occurring on the network as part of their commitment to improve their carbon footprint.

Tackling methane emissions in the gas distribution system is a challenging task, and one that gas DSOs are actively addressing in their day-to-day activities. Distribution grids are built mainly in the urban environment and are highly reliable, with safety being the key priority of gas distribution activity. However, pipelines can be impacted by the activities of third-parties, like civil and road works. Gas DSOs experience a range of practices and methodologies, continuously sharing information and lessons learned.

GD4S wishes to support its members and all European DSOs in ensuring more sustainable operations.

Gas network connections to delivery points total 112 million[35]. Gas DSOs have varying dimensions, technical knowledge and financial capacity. Even the reconciliation of emissions estimates and measurements between bottom-up and top-down approaches is difficult with traditional technologies.

New and effective means of addressing methane emissions are becoming available, together with accurate instruments for reporting emissions attributable to the gas distribution networks. GD4S is ready to share improvements, research and experiences with other gas DSOs.

Gas DSOs' long standing commitment to reduce methane emissions

Gas DSOs have always been aware of and committed to the reduction of methane emissions. Their efforts to increase the safety of installations, for example, by substituting older pipes and joints, have already led to significant reductions.

According to the annual EU GHG inventory[36], all emissions from exploration, production, processing, transport, and handling of oil and natural gas accounted for 1.2% of total GHG emissions in 2018; and emissions decreased by 44% between 1990 and 2018. **This trend was mainly due to the reduction of fugitive methane emissions from natural gas activities, which decreased by 51% over that period[37].**

Methane leak detection along the gas grid also developed. In response to the complex task of controlling emissions on an extended grid, gas DSOs have developed several methods of emissions' estimation and measurement including bottom-up and top-down approaches. Methodologies for estimating emissions have also been refined over the years, thanks to the work of technical associations such as GERG and Marcogaz, based on standard "Emission Factors" for approximating real emissions; these consider different materials, installations and facilities that compose the grids.

This impressive work must be continued and accelerated to answer the questions raised by European Institutions and stakeholders about the impact of natural gas on the environment. Most of all, it is necessary to support the ambitions of gas DSOs to propose their infrastructure as a cost-effective and readily available instrument to achieve the European Commission's ambitious goals in terms of decarbonisation of the energy system and reduction of GHG emissions.

Gas DSO commitment on methane emissions is accelerating

The gas DSO members of GD4S are convinced that it is time for a new paradigm in tackling methane emissions to be adopted by the gas distribution industry. Therefore, GD4S supports addressing methane emissions reductions under the following four pillars:

- **Innovation in leak detection**
  Hardware-enabled software and analytics solutions measuring and locating natural gas leak emission rates at scale are now available on the market. Measurement of leak emissions can be completed more accurately, at speed and at scale, allowing gas DSOs to rapidly repair leaks.

35 GRDF

36 European Environment Agency (2020). *Annual European Union greenhouse gas inventory 1990–2018 and inventory report 2020- Submission to the UNFCCC Secretariat*

37 GIE-Marcogaz (2019). *Report for the Madrid Forum.*

3

- **Digitalisation of the networks**
Grid digitalisation, starting with smart meters up to sensor deployment for real-time monitoring of gas grid parameters is underway and implementation programmes, as well as cost estimates under real conditions, are now available.

- **Emissions' figures based on real, reliable, proven data**
Data collected facilitates the reporting of emission rates for individual leaks, as well as the aggregation of emissions over individual pipelines, specific regions of interest, or even over an entire utility network. This allows members of GD4S to commit individually to joining a world initiative focused on best practice, such as the UNEP's OGMP 2.0 Framework.

- **Development of renewable gases**
As outlined in the EC Methane Emissions Strategy, biomethane production is a key enabler to address methane emissions' reduction. Agriculture uses large quantities of manure, which spontaneously releases significant amounts of methane when stored or spread on fields. If manure is instead brought to a biomethane plant, the methane can be captured and used to produce renewable energy.

Any methane emissions reduction policy instruments should not undermine the commitments of gas DSOs, nor raise doubts on their willingness or capability to comply with such policies. On the contrary, any such policies should support DSOs' efforts to address methane emissions.

Policy recommendations

3.1. **Establish common guidelines for network operators to report on the methane emissions occurring on their networks.** A common methodology at the European level will allow collection of accurate and useable data on methane emissions, enabling DSOs to take proactive actions to reduce such emissions.

3.2. **Implement consistent emissions mitigation measures by regulatory bodies at the European level, since gas DSOs are regulated entities.**

3.3. **Recognise and remunerate the costs incurred by gas DSOs at national level in the case of all innovations aimed at improving the monitoring, measuring and verifying of methane emissions.**

3.4. **Support injection of renewable gases into the gas network,** reducing methane emissions in other activities, such as agricultural and waste management, when the entire life-cycle is taken into account. This favours the circular economy and contributes to smart sector integration.

4 — Policy recommendations

1.	Policy recommendations to leverage the uses of renewable gases
1.1.	**Present clear definitions of renewable gases (biomethane, synthetic methane and renewable hydrogen).** Definitions should be written in the terminology for all renewable gases, and a European system of certification based on full life-cycle greenhouse gas emission saving must be created.
1.2.	**Define a European Union-wide target for renewable gases in the Internal Gas Market Directive or the Renewable Energy Directive.** This target should be binding at the EU level, and Member States should have to define their respective objectives in their National Energy & Climate Plans (NECPs) accordingly. Member States will be free to design their objectives, e.g. they could choose a consumption target or an injection to grid target. GD4S believes that a target at the injection level has stronger advantages, valuing the flexibility and storage capabilities of gas grids and improving the measurement of renewable gas volumes.
1.3.	**Establish a Guarantee of Origin (GO) framework for renewable gases at an EU level, taking account of verifiable land use mitigation measures and of GHG emissions reduction.** Such a scheme will stimulate the market across borders, thereby encouraging stakeholders to invest in the sector. The GO must include the GHG emissions reduction of the renewable gas calculated on a life-cycle basis.
1.4.	**Call on the Joint Research Centre (JRC) of the European Commission to study the potential of renewable gases in Europe.** Following numerous studies from diverse industry sectors and research agencies. GD4S believes the JRC should further research this subject and provide baseline results that would serve as a basis for further work and development on renewable gas volume potential at regional levels.
1.5.	**Update the heating and cooling target in the Renewable Energy Directive.** In the RED II, Members States are encouraged to increase the share of renewable energy in the heating and cooling sector. This indicative target must be rewritten to focus on heat in buildings. Similar to the transport target, we call for a sub-target for renewable gases in heating, as gas heating technologies can rapidly decarbonise the sector when fuelled with renewable gases.

1. Policy recommendations to leverage the uses of renewable gases

1.6. **Revise the notion of "efficiency" within the Energy Efficiency, Ecodesign and Energy Performance of Buildings directives to recognise the benefits of hybrid systems.** Efficiency should go beyond technologies and grids and look at the overall energy system. This evolution would facilitate the uptake of hybrid heating technologies such as hybrid heat pumps and the efficient transformation of energy systems in a smart integrated manner in terms of energy production, appliances and grids.

1.7. **Develop and apply a life-cycle analysis or well-to-wheel methodology, as referenced in Regulation (EU) 2019/1242 to calculate GHG emissions.** Emissions can not only be measured at the tailpipe, as doing so is too restrictive and does not take into account for the GHG emissions reduction of renewable gases, fuels that can rapidly decarbonise vehicles. In order to optimise investment decisions, which reduce globally greenhouse gas emissions, application of life-cycle analysis is critical.

1.8. **Support both NGVs and bioNGVs in the scope of the upcoming revision of the Alternative Fuel Infrastructure (AFI) Directive.** The AFI Directive facilitates investments in (bio)NGV refuelling infrastructures. The European Commission should consider setting targets on the roll-out of alternative fuel infrastructures.

1.9. **Create the conditions for preferential tax treatment in the Energy Taxation Directive for (bio)NGVs and fuels listed in the AFI Directive.** Today, the Energy Taxation Directive favours diesel mobility despite the EU and Member States' goals to phase out this fuel and develop sustainable biofuels. This preferential tax treatment should also apply to renewable gases defined in RED II and used as heating fuels.

1.10. **Recognise the use of the Guarantee of Origin (GO) for renewable and decarbonised gases to validate emissions reduction in the Emissions Trading System (ETS).** Today, an industrial plant cannot buy GOs and use them as a proof for emissions reductions within the ETS system. This should be modified to accelerate the decarbonisation of the industry. It will also accelerate the development of renewable gases production sites.

1.11. **Facilitate the financing of renewable gas projects to highlight the positive externalities, such as their potential to reduce methane emissions.** Horizon Europe, the European Regional Development Fund (ERDF) and cohesion funds should include financing opportunities for renewable gases in their programmes.

1.12. **Recognise the use of intermediate crops in the Renewable Energy Directive.** Intermediate crops present strong benefits to the environment as they act as a carbon sink. They should clearly be mentioned in the Renewable Energy Directive Annexe IX.

1.13. **Facilitate the use of all types of biowaste in the Renewable Energy Directive.** There is a massive unused potential in feedstocks such as biowaste from companies and cities, and those should be included in the Renewable Energy Directive Annexe IX.

2.	Policy recommendations to leverage the uses of gas grids
2.1.	**Recognise the value provided by gas grids in terms of seasonal flexibility and integration of renewable energies.** These advantages should guide technology choices and energy infrastructure development, and, as such, should be emphasised in the Ten-Year Network Development Plan (TYNDP). Gas technologies must be considered because they are part of a value chain capable of addressing energy security issues, while presenting deployable and efficient solutions for decarbonisation.
2.2.	**Enable grid operators to accept increasing volumes of renewable gas by reviewing the rules regarding injection** (including socialisation of the connection costs in the network tariff, and rules governing blending between gases).
2.3.	**Set-up an EU gas DSO entity.** An EU gas DSO entity must be created to make decisions on technical and planning issues linked to the new roles of DSOs, as an enabler of the green transition. It will improve coordination between gas DSOs on various topics, as well as with gas TSOs and electricity DSOs and TSOs.
2.4.	**Develop a framework for the coordinated planning of energy infrastructure by revising the TYNDP process.** The Energy System Integration Strategy recognises that gas networks provide *"ample capacities across the EU to integrate renewable and low-carbon gases"*. GD4S believes that integrated planning between gas and electricity grids across the transmission and distribution networks is essential to ensuring a least cost energy transition.
2.5.	**Fund and support sector integration projects by revising the TEN-E Regulation.** Funding and supports will be required for key energy conversion projects, such as Power-to-Gas, which can link the gas and electricity systems. Support is also required for projects that allow for bi-directional flows between gas distribution and transmission networks, so as not to limit gas grids in storing energy from renewable electricity sources, which would otherwise be curtailed.
2.6.	**Remove regulatory barriers to sector integration.** With more dynamic energy flows across networks and across energy systems, unintended consequences such as the double charging of gas and electricity tariffs should be avoided to encourage sector integration.
2.7.	**Give DSOs the right to invest in sector integration solutions.** Gas DSOs should be allowed to invest in infrastructure that enables the integration of gas and electricity networks, particularly in the early stages of development, subject to appropriate criteria (including exit criteria). The involvement of DSOs in energy conversion projects could be aligned with the timelines set out in the EC's Hydrogen Strategy, which aims to establish an open and competitive hydrogen market by 2030.
2.8.	**Enable a digitalised energy system.** The Energy System Integration Strategy previews the development of a *"Digitalisation of Energy Action plan by 2021 to develop a competitive market for digital energy services"*. The smart integration of gas and electricity networks, where appropriate, should be a key focus of this work.
2.9.	**Include a new category for smart gas grids in the TEN-E Regulation.** Today, smart grids are only defined as smart electricity grids despite the decarbonisation and optimisation potentials of gas technologies.

3. Policy recommendations to mitigate methane emissions

3.1. **Establish common guidelines for network operators to report on the methane emissions occurring on their networks.** A common methodology at the European level will allow collection of accurate and useable data on methane emissions, enabling DSOs to take proactive actions to reduce such emissions.

3.2. **Implement consistent emissions mitigation measures by regulatory bodies at the European level, since gas DSOs are regulated entities.**

3.3. **Recognise and remunerate the costs incurred by gas DSOs at national level in the case of all innovations aimed at improving the monitoring, measuring and verifying of methane emissions.**

3.4. **Support injection of renewable gases into the gas network,** reducing methane emissions in other activities, such as agricultural and waste management, when the entire life-cycle is taken into account. This favours the circular economy and contributes to smart sector integration.

5 — Conclusion

This position paper provides an overview of how gas grids are a key enabler of meeting our EU and national climate commitments in a cost-efficient way, using case study examples to demonstrate gas DSO decarbonisation in action. In doing so, it highlights GD4S' solid commitment to delivering on the European Green Deal.

We urge policymakers to consider the recommendations outlined in the context of developing future energy regulation and delivering on EU and national decarbonisation ambitions. GD4S hopes that the specific recommendations are incorporated, as appropriate, in upcoming legislative reviews. This includes the review of the gas legislative framework, the RED II and Energy Efficiency Directive reviews, the TEN-E Regulation, the Alternative Fuel Infrastructure Directive, and the envisaged obligations around methane emissions reductions.

GD4S welcomes engagement with policymakers and key stakeholders in relation to the recommendations outlined and our commitment to supporting EU decarbonisation targets and activities.

6 Glossary

Anaerobic digestion: Anaerobic digestion is the process to produce biogas and biomethane. During this process, animal and/or plant organic matter is decomposed by micro-organisms. This produces a gaseous mixture (biogas) that is saturated with water and composed of 50 to 65% methane. This biogas can be purified to attain the same quality as natural gas. It is then called biomethane (see figure 1).

Biomethane: Biomethane is the fuel produced by anaerobic digestion or gasification of biomass. It is made from organic matter or woody biomass. Biomethane can be directly injected in the grid.

(Bio)NGV: (Bio) natural gas vehicles run either on natural gas or biomethane. (Bio)NGVs can be used for light-duty or heavy-duty applications, for example, buses, agricultural vehicles etc.

Carbon Sequestration: Carbon sequestration is the removal, capture or sequestration of carbon dioxide from the atmosphere to slow or reverse atmospheric CO_2 pollution and to mitigate or reverse global warming.

Digestate: Digestate is a co-product of anaerobic digestion. It is an organic fertiliser which can replace chemical fertilisers, which are carbon-intensive products. The use of digestate by farmers contributes to the protection of water and soils as well as cutting fertiliser costs. The application of the digestate as an organic fertiliser has the advantage of increasing carbon storage in soils.

Distribution system operator (DSO): According to Article 2 of Directive 2009/73/EC, a gas DSO is natural or legal entity that carries out the function of distribution and is responsible for operating, ensuring the maintenance of, and, if necessary, developing the distribution system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the distribution of gas.

Flexibility: Flexibility can refer to the extent to which an energy system can modify its energy production or consumption in response to variability. It is the modification of generation injection and/or consumption patterns in reaction to an external signal (price, temperature) in order to provide a service within the energy system[38].

Gasification of biomass: Gasification of biomass is one technology to produce biomethane (see figure 3).

Guarantee of Origin (GO): A GO is a tracking instrument defined by European Directive 2009/28/EC. A GO labels electricity or gas from renewable sources to provide information to customers on the source of their energy.

Hybrid heat pumps: Hybrid heat pumps are flexibility tools. They are composed of a traditional electric heat pump and a gas boiler.

Hydrogen: Hydrogen (H_2) is a fuel which can be produced via different technologies.

Power-to-Gas: Power-to-Gas is a process to produce renewable hydrogen (see figure 4).

Power-to-Methane: Power-to-Methane is a process to produce synthetic methane (see figure 4).

Renewable gases: Renewable gases include biomethane, renewable hydrogen and synthetic methane.

Renewable Hydrogen: Renewable hydrogen is hydrogen produced via electrolysis of renewable electricity or via steam methane reforming of biogas.

Intermediate crops: Intermediate crops (also called catch crops/cover crops/sequential crops) are feedstocks used for anaerobic digestion. They are crops used between two main food crops. The development of such cultures increases the carbon capture capability of the soil, reduces the use of herbicides (a carbon-rich soil is more fertile) and favours biodiversity.

Smart gas grids: Smart gas grids are all infrastructures and projects allowing the integration of renewable gases in the grid (reverse flow pipes, reinforcement of grids), to digitalise the operation of the network (smart meters, sensors) or to integrate different sectors (coupling between gas and electricity network with hybrid heat pumps or Power-to-Gas).

Smart hybrid solutions: Smart hybrid solutions include hybrid heat pump and (micro) cogeneration units.

Synthetic methane: Synthetic methane is gas produced via Power-to-Methane. It can be directly injected into the gas grid.

Transmission system operator (TSO): According to Article 2 of Directive 2009/73/EC, a gas TSO is a natural or legal entity that carries out the function of transmission and is responsible for operating, ensuring the maintenance of, and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transport of gas.

38 IEA, Eurelectric

GD4S: who we are

Gas Distributors for Sustainability (GD4S) brings together the seven largest gas distribution system operators (DSOs) in France, Greece, Italy, Ireland, Portugal, Spain and Romania. 86% of gas vehicles in the EU are used in these seven countries.

- Biomethane makes natural gas renewable.
- Biomethane should be clearly incentivised in reaching the EU's renewable energy objectives. Other renewable gases such as hydrogen need to be supported.
- Gas mobility improves air quality.
- Natural gas is a sustainable alternative fuel for transport. 86% of NGVs in the EU are in use in our respective countries.
- Gas networks to distribute and store renewable energies already exist and are very flexible.
- Innovative gas solutions and existing gas distribution infrastructure must be better incorporated in the European decarbonisation vision.
- Gas offers efficient and affordable technological solutions.
- The introduction of renewable gas objectives would accelerate the greening of the gas network with concrete impacts on several sectors (heating, cooling, and transport).
- Gas is the best alternative fuel for a sustainable economy. Natural and renewable gases can enable a gradual and smooth transition to a low-emission society.

Distrigaz Sud Retele
operating in Romania

1.9 million delivery points
20,200 km of network
860 gas vehicles in use in Romania

Galp Gás Natural Distribuição
operating in Portugal

1.1 million delivery points
13,000 km of network
503 gas vehicles in use in Portugal

Nedgia
operating in Spain

5.4 million delivery points
54,000 km of network
30,000 gas vehicles in use in Spain

Gas Networks Ireland
operating in Ireland

705 thousand delivery points
12,050 km of network
57 NGVs in use in Ireland

GRDF
operating in France

11 million delivery points
201,716 km of network
23,000 gas vehicles in use in France

Italgas
operating in Italy

7.7 million delivery points
72,700 km of network
971,830 gas vehicles in use in Italy

Thessaloniki – Thessaly s.a. (EDA THESS)
operating in the Regional Unit of Thessaloniki and the Region of Thessaly, Greece

360 thousand delivery points
2,503 km of network

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