ENERGY SYSTEM INTEGRATION

Eurogas is fully committed to achieving the objectives of the Paris Agreement and supports the European Commission's long-term vision of a carbon neutral economy by 2050. Eurogas advocates for an energy transition that delivers a diversified, economically, and environmentally sustainable energy mix, that guarantees security of supply, and that allows Europe's competitive industries to continue to thrive.

Climate neutrality and the deep decarbonisation of EU's economy requires a fundamental restructuring of cross-sectoral energy use. It requires carbon neutral and carbon negative energy vectors, and increased interlinkages between energy carries and economic value chains: industry, mobility, heating, and agriculture. The energy transition cannot succeed by policy measures that seek to decarbonise sectors in isolation of each other. A holistic and technology neutral approach for mature technologies, while fostering the development of commercially non-mature technologies, is primary for climate neutrality to be a success.

Energy system integration should promote the most cost-effective path towards carbon neutrality by 2050. To achieve this a variety of energy carriers are necessary. In 2017, about 22% of EU's final energy consumption was electricity based and most parts of the economy will continue to rely on molecules. Decarbonising electricity or electrifying processes alone will not enable the deep decarbonisation of activities in a timely, just, and cost-effective manner or ensure the reliability and security of energy supply. A credible strategy to a decarbonised energy system must therefore give the right consideration to gaseous energy and its existing infrastructure.

Unlocking the full decarbonisation potential of gas requires the rapid development of a supportive policy framework to accelerate the transition towards renewable and decarbonised gases. Energy system integration requires a level-playing field between electricity and gas to facilitate the transition towards renewable and decarbonised hydrogen, biomethane, biogas, synthetic methane, and other sustainable fuels. Leading the development of clean technologies will make Europe's economy stronger, create jobs and wealth for Europeans and ensure secure and sustainable supply of energy and goods.

Gaseous energy plays an indispensable role in energy system integration

Power.

Gas is one of the historical drivers of energy system integration and sectoral emission reductions. Gas fired power plants offer dispatchable power to the electricity system and can be fuelled with renewable and decarbonised gas. The need for flexible power generation will increase with the phase-out of coal and nuclear to cover production gaps being caused by growing intermittent renewable electricity generation and variable demand patterns.

The periodical availability of excess renewable electricity supports a business case for accelerating the development of power to gas technologies. It enables the conversion of renewable electricity to hydrogen for short term as well as seasonal storage or long-distance transport using the existing gas infrastructure.

The wider and deeper integration of economic sectors enables more efficient and smarter use of valuable energy between sectors. Gaseous energy will remain one of the backbones of the European energy system, providing storage, flexibility, and resilience to a climate neutral economy.

Climate neutrality requires a robust energy system able to accommodate massive increases in renewable energy from different, mostly intermittent sources. Relying on electrification as the basis of the future energy system would mean dependence on the one infrastructure, which is not well suited to handle peaks, adverse climate conditions, seasonal storage, or long-distance transportation.

Using the existing gas infrastructure will facilitate the mass deployment, conversion, transport, and storage of renewable and decarbonised energy. It will be an essential enabler for the decarbonisation of all sectors, including industry, transport, heating, and agriculture.

Industry.

Reaching climate neutrality by 2050 cannot go at the expense of the competitiveness of Europe's industrial base. Europe is home to pioneers in renewable and decarbonised gas technologies. It is home to the world's largest electrolyser factory as well as gas reformation technology (ATR/SMR). It supplies solutions to customers in transport, industry, and the power sector around the world. Europe is a market leader in anaerobic digestors, pyrolysis, carbon capture and storage, LNG engines and turbines manufacturing. All these European technologies will revolutionise the way in which we produce energy and goods around the world.

Decarbonising gas is a prerequisite to fully decarbonising energy intensive sectors such as steel, cement, chemicals, and many others. Various production processes rely on gas as feedstock, source of high-temperature heat and power generation. Energy efficiency, re-use and recycling of raw materials policies will play a central role in ensuring better use of energy. Molecules can continue to provide this energy by means of electrolysers, reforming plants and anaerobic digestors. At the same time, new carbon value chains will emerge and in turn create new jobs and revenue streams.

Only through the strengthening of new and existing value chains will Europe and countries around the globe have the necessary technologies to fight climate change.

Heating.

Heating is central to our daily life and represent a significant share of households' energy bills. Measures to increase the energy performance of buildings require investments which generally only pays back over time. Consequently, policies should encourage citizens to opt for efficient and climate-friendly heating solutions while considering individual carbon abatement costs and energy system costs.

Around 80% of the current building stock will be standing in 2050[1], therefore the 'renovation wave' put forward by the European Green Deal should be a priority. The adaptation of existing appliances and infrastructure must also be addressed as part of this process. In 2017, inefficient boilers still accounted for 56% of the total stock of heating appliances in the EU.[2] Therefore, the lowest hanging fruit in curbing emissions[3] is the replacement of old heating systems with efficient and affordable appliances such as gas condensing boilers and hybrid heat pumps (not to forget the potential of gas solution for fast and efficient conversion from oil).

[1] European Commission, 2019
[2] EHI, 2019
[3] According to the IPCC, natural gas has the lowest carbon intensity amongst all fossil fuels. Switching from an oil boiler to a gas condensing boiler can reduce the emissions of CO_2 and NO_X by 25%, of CO by 64% and the emissions of SO_X and particulate matter by up to 95%. Source: Sedigas, 2014

Existing gas grids and gas appliances are 100% compatible with biomethane, and recent tests show that condensing gas boilers can accommodate blends of up to 20% hydrogen, with small adaptations to burners and combustion controls[4]. Moreover, dual fuel boilers or 'hydrogen ready' appliances would enable fuel switching from methane to hydrogen with minimal adaptation of the appliances. With coal still representing a third of the EU energy mix for district heating, renewable and decarbonised gases have significant potential to curb emissions in that sector too.[5]

Whilst single vector solutions are important, gas appliances can easily be combined with other technologies such as heat pumps or solar PV production. Such hybrid systems will be limiting the need for expensive electricity infrastructure expansion to meet peak demand or address intermittency constraints for the energy system. Hybrid solutions are the perfect example of how sector integration can help decarbonise our energy demand in a cost-efficient way.

Mobility.

Europe cannot afford to overlook any solutions considering that mobility is responsible for 25% of GHG emissions. The challenge of decarbonising the aviation, road and maritime sector is so extensive, that simply increasing the use of electric vehicles will not be sufficient. Both autonomy/energy density and availability of recharging/refuelling infrastructure are key in ensuring the necessary flexibility needed in logistics value chains.

Switching from conventional fuels to LNG is a cost-efficient solution for the shipping and heavy-duty transport sector. It offers an immediate CO2 emissions reduction of up to 28% at the tailpipe and air quality improvement. Moreover, using synthetic, bio LNG and hydrogen can lead to nearly 100% GHG emissions reduction. The sulphur content of LNG and CNG is 1 000 times lower than the IMO 0.5% target compared to currently used heavy fuels. Therefore, the beneficial effect on air quality is considerable.

Around 80% of NO_x emissions reductions are possible by replacing the traditional heavy-fuel oil operations in shipping and around 50% by replacing diesel with CNG/LNG in road transport. CNG and LNG reduce particulate matter by up to 95% compared to diesel and up to 99% compared to HFO operations.

Gas can be a zero-emission solution for mobility. Simply by fuelling an NGV car, truck, or bus with biomethane, the user reduces by 85% its carbon-footprint. Biomethane can fully substitute natural gas in all its usage, generating a fast and efficient potential for sustainable mobility. Furthermore, hydrogen and fuel cell vehicles produce zero emission at tailpipe with water vapour being the only by-product. Additionally, fuel cells engines do not rely on combustion and have few moving parts, thereby reducing noise pollution. FCEVs do not require any behavioural adjustments and offer a similar refuelling time to those of conventional petrol or diesel cars. This is a major advantage in comparison with battery powered electric vehicles. The major challenge of scaling hydrogen-based mobility is the creation of a developed fuelling station network.

Considering the solutions above, the energy system integration strategy must also consider the role of gaseous energy in the decarbonisation of transport. It must address the challenges to scaling existing decarbonisation solutions. Together with the design of a multimodal transport system where the transport of goods will rely on the best fit of the combination of shipping, railway and road sectors, increasingly renewable and decarbonised gas is a key component to a clean and sustainable transport system.

[4] *EHI, 2019*
[5] *European Commission, 2017*

Agriculture.

Integrating agriculture with other sectors can empower rural areas, create safe and long-lasting local employment, establish new revenue streams. Reducing the environmental footprint of agricultural activities cannot be underestimated.

Opportunities to transform agricultural wastes and residues into energy enables shorter and more circular value chain, contributing to a more decentralised energy production system with positive externalities:

- Safeguard soils through intermediate and cover crops sowed in between regular cultures.
- The use of agricultural waste resources (but also municipal or industrial waste resources) allow for optimal valorisation of the latter and quality as recycling in the waste hierarchy. These resources ensure optimal efficiency rates when cleaned and injected to the grid as opposed to producing power/heat directly. In parallel, this create opportunities to reduce methane emissions from agriculture, for instance through improved manure management.
- Fuel local transport in shorter green loops of energy consumptions by using existing NGV technology e.g. trucks, tractors, others.

Furthermore, innovative gas technologies can help reduce emissions from livestock by recycling manure and produce renewable gas. This can be done through anaerobic digestion or gasification, building on steady waste streams such as those linked to the steady consumptions of end-produce by people. Increasing biogas production would increase the supply of organic fertiliser – digestate. This would allow replacing existing chemical fertilisers and in turn the quality of the cultivated products. This decentralised production process particularly needs acknowledgement when it can easily be transported through the existing gas infrastructure without need or considerable reinforcements.

The EU provides support to the agricultural industry in support of rural development under the second pillar of the Common Agricultural Policy. Biogas and biomethane, locally and sustainably produced intermediate crops the ideal partner for the necessary modernization and decarbonation of European agricultural by promoting modern land use techniques and practices.

Recommendations

Set an EU level target for renewable and decarbonised gas. The establishment of a technology neutral, binding EU-level target for renewable and decarbonised gas is essential. Member States provide little incentive for the uptake of renewable and decarbonised gas, which hinders investor confidence. A clear path expressed as a binding target in EU legislation, which Member States can translate into their National Energy and Climate Plan ambitions, could help overcome this barrier.

Measures to increase the demand for renewable and decarbonised gases. Renewable and decarbonised gases should be recognised as an option for decarbonisation throughout all sectors. The Renewable Energy Directive (RED) II sets an appropriate framework for the mobility sector. Its quick implementation into national law is now decisive. However, additional policies are needed, for instance for the building sector, where renewable and decarbonised gases often lack proper recognition in national law (see Gebäudeenergiegesetz in Germany).

Efficient energy system integration must consider intermittency and flexibility in a holistic manner. The advantages that gaseous solutions bring to the energy system as well as other sectors must be recognised. Policies and economic evaluations should therefore integrate the costs and benefits induced on the energy system and other sectors by each decarbonisation option and

ensure that adequate price signals are visible for end-customers. LCOE does not represent an objective metric for comparison.

Flexibility and other system services should be adequately remunerated. The integration of intermittent renewable energy sources will require increased flexibility and back up services. Without an adequate framework, such essential services might not be provided. CCGTs for instance, will need an appropriate market design encompassing CRM (open to flexible generation, storage and DSR) able to ensure their economic viability.

Future proof regulation. It is imperative that energy system costs are allocated to the benefiting part of the system, without cross-subsidisation. This would provide adequate economic signals and reduce the overall cost of the transition. An assessment of incurred costs and originated benefits must be carried out. This should cover for instance avoided curtailment costs, flexibility, and security of supply. Future regulation should be neutral between mature technologies and be supportive of efficient investments. The future regulatory framework should foster the development of commercially non-mature technologies (including pilot projects, demonstration plants, research, transformation projects and scaling up initiatives), while market-based instruments should be the norm for mature technologies. The overall objective should be to achieve the European climate objectives, while minimising potential distortive effects and promoting the ability to trade different types of gases in a competitive market. Network operators should be incentivised to operate their grids efficiently, optimise the use of infrastructure through digital solutions and accommodate new gas sources (e.g. reinforcement, reverse flow, blending equipment, reconversion of pipelines).

Cost reflectivity for informed decision making. A level playing field must be ensured in the decision-making process of end-users. Electricity and gas end-user tariffs should be more cost reflective, considering the effect that the consumer decisions have on the overall grid. It would enable, among others an economic case for flexibility solutions like hybrid heating. Revealing the costs generated by different consumptions patterns and technology choices would lead to more informed decision making and ensure that energy system integration remains efficient. For instance, seasonal consumption is the most demanding in terms of infrastructure investments. Therefore, appropriate price signals related to the cost of storage and system flexibility should be given to consumers when choosing between gas and power heating solutions. Moreover, energy labelling and building regulations strongly impact the choices over heating appliances by final customers. If the primary energy factor and CO2 content do not reflect the real system costs of a given appliance, they distort the perception and the choice of final customers hindering the selection of the most effective solution.

Joint infrastructure planning between electricity and gas in the Ten-Year Network Development Plans with a strong involvement of Distribution System Operators will be essential to energy system integration. It should be based on sound principles and a transparent process. It should, cover investments in energy transition projects aiming at optimising investments in both networks and aiming for the lowest societal cost. The objective of the TYNDP should be to create a competitive level playing field across sectors and enable the delivery of cost-efficient outcomes for consumers by appropriately factoring in the evolutions linked to decentralised production, blending, and new consumption patterns.

Moreover, increasing decentralisation of the energy system and local injections of renewable and decarbonised gases will require a stronger cooperation between TSOs and DSOs and optimised rules for DS operations.

Revise the trans-European energy network policy to ensure that projects supporting the integration of renewable and low-carbon gases are covered (PCIs).

A harmonized framework for Guarantees of Origin (GO) is necessary to ensure transparency on the source of the molecules and improve market signals for renewable and decarbonised gas. The national standards for GO should be harmonised according to a European blueprint which would enable GO tradability across the EU. Member States should also issue GO for decarbonised gases to facilitate energy disclosure to gas consumers opting for renewable and decarbonised gas products. This would ensure a swifter transition by increasing consumer awareness and willingness to demand these products. An obligation for Member States, to issue one standard GO for all renewable and decarbonised gases, including GHG abatement information should be introduced. It is important to maintain a clear distinction between renewable and decarbonised gases.

Provide access to funding. A level playing field that fosters competition between technologies requires a similar degree of policy certainty and instruments between energy carriers. This includes targets and market-based support schemes that facilitate the uptake and maturation of new technologies. Technology-specific support mechanisms (such as contracts for differences with "tender for premium setting" for large installations) and EU funding mechanisms are necessary to ensure that commercially non-mature technologies (e.g. biomethane, renewable and decarbonised hydrogen and CCS/CCU) are market ready as fast as possible and that their development is not stopped prematurely. Private and public funding should be channelled towards the scaling, development and integration of renewable and decarbonised gases. Technology neutrality and a holistic approach – covering not only energy but also infrastructure and equipment costs – are central to the definition of rules to determine which future investments should be considered sustainable. A coherent approach to financing the energy transition requires the use of all technologies which support the transition of the economy as a whole, and also the decarbonisation of the energy that supply those technologies. A comprehensive Sustainable Finance framework that is consistent with the Taxonomy Regulation should support all solutions that are necessary to achieve the transition towards climate neutrality. This includes gaseous energy and the gas infrastructure that will over time accommodate growing shares of renewable and decarbonised gases. Renewable and decarbonised gas technologies should be incorporated for its flexibility, affordability, but also sustainability and resilience compared to non-gaseous existing solutions.

Targeted support for renewable and decarbonised gas to reach maturity. This should include rural development funding for biomethane through the Common Agricultural Policy, Regional Cohesion Funds, and explicit technology specific support, through competitive tenders for larger projects. Allocation of financial support to specific technologies should consider their impact on energy system flexibility. Gas contributes to the resilience of the energy system and will be needed for several sectors to meet the carbon neutrality target. It facilitates the integration of variable renewable electricity and is necessary to balance its production.

Support farmers to become part of the energy transition while improving and diversifying their income. Eurogas considers that biogas and biomethane production should be supported. It is fully in line with the priorities set out in the Cork 2.0 Declaration on rural development, notably by promoting rural value chains in areas such as clean energy, the emerging bioeconomy, and the circular economy. Moreover, it could promote the development of sustainable farming practices, such as sequential cropping that could result in the supply of additional biomass without a negative impact on land use change or food production.

Recognize and value positive externalities of biomethane. The competitiveness of biomethane is gradually increasing, but the missing valorisation of positive externalities related to its production is hampering its large-scale development potential in the short term. Positive externalities include additional income for farmers as well as the significant potential for methane emission reductions in the agricultural sector.

Widen the scope of the European assessment for lifecycle GHG emissions and GHG avoidance cost. Efficient system integration can be fostered by creating greater transparency for policymakers and consumers on the sources of emissions by means of full life-cycle emissions analysis. Such an analysis should also include information on CO_2 and other GHG avoidance and abatement costs based on life-cycle emissions calculations. LCA on GHG emissions and avoidance costs should be introduced for the mobility sector through a well-to-wheel approach; for biogas/biomethane by considering externalities such as reducing agricultural methane emissions; and for different energy storage technologies, including power-to-gas and batteries.

Smart taxation policies to promote energy efficiency and decarbonisation solution on a level playing field, without cross-subsidisation Foster innovation by avoiding double taxation of energy conversion and storage processes including Gas-to-Power, gas storage and Power-to-Gas. This is a systemic requirement ensuring that only end consumption of energy is subject to taxation which will be essential to removing obstacles for energy system integration. Moreover, the review of the Energy Taxation Directive must incentivise the development of clean energy technologies such as those producing renewable and decarbonised gases. Consequently, their emissions reduction potential must be recognised by using instruments such as favourable taxation, tax exemption and others. Natural gas should be distinguished from coal and oil and not be considered a fossil fuel that pollutes in the same way.

Tackle methane leakage. Security and safety of the grid are at the core of the operations that infrastructure operators conduct. Through leak detection and repair (LDAR), regular inspection of their grids, and immediate intervention in case of incidents, they ensure the safety of the grid. LDAR ensures, through a constantly evolving array of technologies such as drone detection, a safe and reliable grid in line with the operators' public service mission and national technical regulation.

Eurogas welcomes the ambition from NGOs, industry, and regulators, notably highlighted in the recent Bridge Beyond2025, to commit to further efforts to reduce methane emissions. An assessment of the responsibilities of DSOs could be carried out to consider whether their activities should cover sustainability aspects related to reducing methane emissions.

Scale carbon capture value chains. All options will be needed to reach carbon neutrality in a cost-effective way while providing for security of supply. This includes decarbonised gas – hydrogen from reformed natural gas in combination with CCSU. Appropriate policies are needed to accelerate and scale the deployment of CCUS. The Global CCS Institute reports that around 260 mill tonnes of anthropogenic CO2 have been safely captured and permanently stored to date. To strengthen this trend, regulation must facilitate the transportation of CO2, also by ship, in an offshore environment. National Regulatory Authorities should be given mandates to oversee such activities to enable the cross-border transport of CO2 for offshore storage.

Develop clear blending and technical rules. Clear rules are needed to facilitate the integration of renewable and decarbonised gas into the gas infrastructure, particularly for hydrogen. To increase market uptake and maintain the interoperability of the EU gas infrastructure, technical

rules should swiftly enable and foster the blending of hydrogen in existing grids. This blending will help to quickly integrate decentralised production but should not preclude the possibility for hydrogen grids to develop, also in the mid-term. Any option will need to take into account technical feasibility in terms of end users and appliances[6] , to ensure that consumers can benefit from the energy that they wish to consume without undue burden. Over time, the latter will be replaced in any case (lifetime of 15-20 years) and new appliances that can take higher levels of hydrogen up to 100% , some of which are currently being put onto the market, could substitute the existing ones. These appliances should be able to operate not only in a wide range of the Wobbe Index but have the possibility – e.g. through an exchange of the burner unit - to be operated also at 100 % of H2. This stepwise approach would ensure that hydrogen can be brought to the market without delay. In parallel, EU Member States are increasingly putting forward hydrogen strategies, which will lead to a growing a share of hydrogen. In time the possible conversion of existing grids to dedicated hydrogen grids will have to be assessed, taking into account national specificities, end-user preferences, but also technological maturity, notably smart gas grids, sensors or de-blending filters.

Clarify who can own and develop new technologies. The effective separation of networks from activities of production and supply will continue to be fundamental. Emphasis should first and foremost be put on creating the policy framework which supports the commercial development of renewable and decarbonised gases. Only if this framework is not delivering or the market is not reacting and developing autonomously following an open and transparent tendering procedure, a role could be envisaged for other interested parties. This includes the development, operation, and ownership of these assets by network operators for a limited period, until a market test reveals market uptake. This time-limited role should be subject to appropriate regulatory oversight, to avoid any detrimental impact on existing and future competition. Clear principles are required to determine the degree of contestability and clear exit conditions must be defined. Regular market tests must be carried out to reveal if there is an interest by the market. In case Transmission System Operators or Distribution System Operators develop power-to-gas facilities, these should operate under Third Party Access.

Maintain a liquid and competitive gas market and extend the regulatory framework for natural gas to cover to all gases. The successful decarbonisation of the gas system will require a competitive, liquid, and integrated single EU gas market covering all gases. In some parts of Europe further progress should be made to implement the Third Gas Package and Network Codes. Specific measures targeted at local levels could be considered on an ad-hoc basis where there are proven structural constrains to competition and liquidity.

[6] *Marcogaz (2019) Overview of test results & regulatory limits for hydrogen admission into existing natural gas infrastructure & end use*