Annex: GIE answers to the European Commission's consultation related to the Energy System Integration strategy

Gas Infrastructure Europe (GIE) has 70 members from 26 European countries. They operate the central European gas infrastructure (gas storages, LNG terminals and transmission pipelines), thus providing citizens with more than fifty thousand jobs, and supplying around 25% of EU's Primary Energy Consumption. GIE shares EU's ambition of reaching climate neutrality by 2050.

This document is an **Annex to GIE's position paper on the EU's Strategy for Energy System Integration**. GIE invites the reader to visit the position paper, which gives valuable insights into the role that renewable and low-carbon gases, including hydrogen, will play in the integrated energy system, the measures that should be taken to promote the uptake of these gases and the best practices and projects that GIE members are already implementing to foster the integration of the energy system.

This Annex is **addressing the specific questions raised by the Commission** on its website to guide stakeholders' contribution.

1. a) What role should renewable gases play in the integrated energy system?
b) How could electricity drive increased decarbonisation in other sectors? In which other sectors do you see a key role for electricity use? What role should electrification play in the integrated energy system?

In an integrated energy system, **molecules and electrons will compete** on a level playing field to decarbonise the different sectors and achieve carbon neutrality by 2050.

Direct electrification should drive the decarbonisation of sectors where this proves to be economical and cost-efficient vis-à-vis alternative decarbonisation methods in, for instance, light transport and lower temperature industrial process heating. The level of overall electrification of the EU's economy would reach a maximum of 50-60 % of direct energy use in 2050 according to some estimates (Eurelectric, 2018; Gas for Climate, 2020). On the other hand, indirect electrification should contribute to supplying climate-neutral molecules.

In recent years, new technological developments and analyses have modified the ratio between electrons and molecules and GIE believes that **this trend will continue to greatly benefit from the utilisation of gas infrastructure**. Renewable and low-carbon molecules will be a structural component of a secure and flexible energy system, in particular when used in the so-called "hard-to-electrify" sectors, such as heavy-duty transport or industrial thermal uses. Besides, in a future energy system largely dominated by variable electricity sources from wind and sun, the **large storage capacity provided by the gas system**[1] allows for the **cost-efficient integration of renewable electricity sources**.

It is crucial to ensure a technological neutral approach where energy demand can be met by molecules such as renewable and low-carbon gases and fuels. Especially in some regions across the EU, **an immediate coal- and oil-to-gas switch and gas-to-power** will be a **key pathway for decarbonising the**

[1] Existing gas facilities in Europe can store approximately 1197 TWh of energy (1131 TWh in UGS and 66 TWh in LNG tanks, without considering the line pack potential), which is the equivalent of the capacity of more than 5 billion Tesla PowerPack battery units of 210 kWh (GIE, 2019).

power generation in a cost-effective manner, while preparing at the same time the energy system for the transition to renewable and low-carbon gases in the next decades.

2. What measures should be taken to promote decarbonised gases?

In the context of renewable and low-carbon gases, GIE members are actively developing new sustainable technologies and business models, whose scale-up would greatly benefit from an appropriate regulatory and political framework. Measures can include, inter alia:

- A **common terminology** for renewable and low-carbon gases,
- A set of **national binding targets for renewable and low-carbon gases** which consider technological developments of Member States,
- An **EU-wide credible documentation of the green value** of renewable and low-carbon gases**,** such as Guarantees of origin (GOs), compatible with the EU ETS,
- **Transparent and uniform criteria for better comparability of objective life cycle assessments** (GHG total carbon footprint) to assess policy measures and technologies,
- The **adjustment of levies, grid charges and taxes to reflect societal benefits provided by the gas infrastructure and the avoidance of double charging**,
- A **Roadmap for hydrogen gas assets readiness developed by/in close cooperation with the gas infrastructure and electricity sector,**
- **A robust regulatory framework that will allow research, development and pilot projects** by **infrastructure operators** on renewable and low-carbon gases, including the injection of pure, blended H_2, synthetic methane and other renewable and low-carbon gases into gas infrastructures and end-use applications,
- The **amendments of relevant EU legislation (e.g. TEN-E regulation) to enable network owners to operate several categories of gases** (H_2, CO_2 and admixtures), and providing them with incentives to adapt their infrastructures to cope with the coexistence of different gases in parallel to incentives for developers/promoters of renewable and low-carbon gases,
- **The consideration of the role of liquefied biomethane (LBM), liquified synthetic methane (LSM) and hydrogen-based energy carriers** to use existing LNG regasification terminals as entry door to energy imports.

We invite the reader to visit the GIE's position paper on the EU's Strategy for Energy System Integration for further measures and details.

3. What role should hydrogen plan and how its development and deployment could be supported by the EU?

Hydrogen is a promising solution for market segments where electrification appears unfeasible or relatively inefficient. More specifically:

- **In industry**, using gas (including hydrogen) is often the most cost-efficient solution to supply process heat and to conduct high temperature combustion processes. As highlighted by the High-Level Group on energy-intensive industries (2019), this sector will require increasingly higher shares of climate-neutral energy, including hydrogen. Hydrogen as feedstock can decarbonise polluting hydrogen-based processes (e.g. for processes in the chemical industry). Another example lies in the production of steel where emissions related to current coal-based processes can be avoided by using hydrogen as raw material. The cement industry also states in their 2050 Carbon Neutrality Roadmap that different carbon capture techniques will deliver 42% of the sectors' CO_2 emission reductions by 2050[2].

- **In transport**, hydrogen-based solutions are a promising decarbonisation option, due to the several limitations regarding the current technology of electricity storage. This particularly counts for heavy-duty road transport, shipping with long distances and heavy loads, as well as aviation. For instance, in 2018, 11 200 vehicles using hydrogen were already in operation worldwide, in addition to around 500 buses and 400 trucks, and those numbers are expected to significantly grow in the next few years (IEA, 2019).
- **In heating,** hydrogen will have a valuable role to heat buildings that have gas grid connections with hybrid heating solutions (Gas for Climate, 2020). The Hydrogen Roadmap Europe (Fuel Cells and Hydrogen Joint Undertaking, 2019) assesses a potential of up to 465 TWh hydrogen for heating households by 2050, whereas research institutes (IFPEN and SINTEF, 2019) see a potential demand for up to 1503 TWh hydrogen in the residential and commercial sectors combined in addition to 470 TWh hydrogen for medium- and high-grade heat in the industrial sector by 2050. To further illustrate this, the Dutch Long-Term Renovation Strategy (2020) already refers to hydrogen as one option for sustainable heating and trials for hydrogen blending in residential and commercial heating systems are already ongoing in the UK[3].
- Due to its versatility, hydrogen as an **energy carrier** appears as a cost-efficient solution. It will be a key enabler for reaching EU's climate targets by making full use of the advantages of existing infrastructures or through dedicated ones that may progressively emerge in parallel as the market for hydrogen develops.

The production and use of hydrogen or its derivatives will play an important role in many sectors of the EU's economy in the future. Therefore, we support the continuation of the hydrogen initiatives by the European Union into a comprehensive and technology-neutral EU's Hydrogen Strategy that will also give consideration to the import of hydrogen from third countries and the subsequent required infrastructure development.

4. How could circular economy and the use of waste heat and other waste resources play a greater role in the integrated energy system? What concrete actions would you suggest to achieve this?

Unlike gas, heat cannot be transported over long distances. Using waste heat in district heating systems cannot be a promising option for areas where renewable sources are unavailable (Gas for Climate, 2020). Hydrogen and biomethane will have a valuable role to heat buildings that have gas grid connections with hybrid heating solutions and can provide high temperature heat in energy-intensive heavy industry[4]. Moreover, in the areas with no access to the national distribution network,

[2] Cembureau (2020). 2050 Carbon Neutrality Roadmap: https://cembureau.eu/news-views/publications/2050-carbon-neutrality-roadmap/
[3] See HyDeploy: https://hydeploy.co.uk/why-hydeploy/

[4] Gas For Climate, March 2019: https://gasforclimate2050.eu/wp-content/uploads/2020/03/Navigant-Gas-for-Climate-The-optimal-role-for-gas-in-a-net-zero-emissions-energy-system-March-2019.pdf

liquified natural gas (LNG) can be supplied to regasification stations that feed off-grid 'island' gas networks.

In a more integrated energy system, potential actions for mobilising waste heat could include:

- As **electrolysis to produce hydrogen and synthesis to produce e-fuels create waste heat**, it is important to find applications for this waste resource, especially when looking at the geographical placement of Power-to-X processes. In a more circular energy system, waste heat could be mobilised for further hydrogen production based on other production methods requiring heat.
- District heating is not the only potential application to be assessed**. Excess heat is an important value stream** and further potential, for instance in the case of biogas plants, lies with various forms of **drying** or **cooling**.

Besides, it is possible to take advantage of other waste resources and residues:

- In integrated industrial clusters with large-scale electrolysers, **oxygen** from electrolysis can be utilised in other industries and provide additional revenue streams. **Carbon from nearby industries** and **biomethane** can, on the other hand, be used to produce synthetic methane. A dedicated infrastructure for storage and transportation of hydrogen may need to be developed to provide flexibility in these clusters, hereby reducing electricity grid investments substantially (Gasunie and TenneT, 2019).
- Waste resources from agriculture, wastewater, biogas, or household waste, also contain valuable resources such as **carbon**, which may be converted to hydrogen and solid carbon via methane pyrolysis or used to produce e-fuels (e.g. synthetic methane) through synthesis with hydrogen and water. In the case of methane pyrolysis, the **solid carbon material** (graphite, graphene, carbon nano tubes) can be further used as a feedstock for the plastic, battery and chemical industry. Regarding Power-to-X, counterintuitively, large-scale production of e-fuels may lead to a scenario where CO_2 sourcing becomes an issue due to scarcity of supply. **Carbon capture (CC) technologies should be envisaged as a means of sourcing CO_2 through CCU on point emissions**, and with an adequate technology readiness level through direct-air-capture (DAC).

Particular attention should be given to differences between Member States as **a 'one-size-fits-all' solution may constitute a detrimental or unrealistic approach**.

5. How can energy markets contribute to a more integrated energy system?

Energy markets and their price signals should continue to be the main point of reference for investment decisions and ensure that the most efficient technologies are deployed in the most cost-effective locations, irrespective of Member State borders. Given the important role that renewable and low-carbon gases play as energy carriers in a more integrated energy system, we have to **take advantage of the momentum of the EU Green Deal to introduce new legislation and regulations** and create the right conditions for an EU-wide market to scale up. The existing principles of European electricity and gas regulations should evolve properly with the ultimate aim of facilitating a timely and cost-efficient energy transition towards carbon neutrality in 2050.

GIE calls for **a regulatory framework which encourages gas infrastructure operators** to engage in decarbonisation activities aimed at increasing the potential and actual quantities of renewable and low-carbon gases, developing, operating and owning innovative technology facilities and supporting their scaling-up, in a way that does not distort market competition, complies with the applicable regulatory framework and secures third party access to maximise societal benefits.

To stimulate market demand to reach critical mass, a set of **national binding targets for renewable and low-carbon gases** which consider technological developments of each country should be introduced, along with measures tailored to different sectors and specificities of these gases. **Realistic paths for the use of Carbon Capture, Utilisation and Storage (CCUS) and Carbon Direct Avoidance (CDA)** technologies must also be developed and market participants that generate negative emissions should be able to trade and profit from them.

A **common terminology for renewable and low-carbon gases** and an EU-wide credible documentation system of their green value such as **Guarantees of Origin** (GOs) are essential for the fair evaluation and trading of these value products. The adverse effect may be that market participants could lose trust in the products with a negative impact on the willingness of investors to make long-term investments for the production of these gases.

The EU ETS should enable market participants to use the green value of all renewable and low-carbon gases certified by GOs for **compliance with their emission reduction obligations**. This will create a demand for the GOs, thereby providing market participants an additional efficient instrument to cover their emissions limits and obligations, along with the purchase of emission allowances and long-term investment in abatement technologies. To further facilitate this, renewable and low-carbon gases produced from renewable electricity should be able to receive GOs and such gases should be allowed to be stored without losing their GOs.

Finally, it is important to **keep physical integration of the EU's energy systems**, being one of the most important achievements of Commission's actions in the last decades. In the context of natural gas and gas blends with renewable or low-carbon gases, it should be ensured that **gas systems remain interoperable** and avoid market fragmentation. Ensuring a fully integrated market is essential to create liquidity in traded energy markets.

6. How can cost-efficient use and development of energy infrastructure and digitalisation enable an integration of the energy system?

The current gas infrastructure system is the backbone of the EU's energy system which serves to achieve the European energy and climate goals by transporting, distributing, and storing vast amounts of energy in a very cost-efficient way compared to electricity. By using the flexibility and large storage capacity offered by existing gas infrastructure, in combination with the integration of renewable and low-carbon gases, the **whole energy system will avoid unnecessary investments on the electricity side while simultaneously decarbonising the European Union at a lower social cost**.

In some cases, new gas infrastructure should be built to connect, for instance, industrial consumers with blended natural gas or pure renewable and low-carbon gases. In parallel, in some regions of the EU, investments in natural gas infrastructure are necessary to support the switch from coal- or oil-to-gas or to manage evolving supply-demand patterns. For these reasons, **refurbishment, upgrading and**

needed developments of gas infrastructure should be **part of the TEN-E regulation** and when these investments are made 'fit for the future', these costs should be **eligible and accounted for as 'sustainable'** under the Taxonomy Regulation.

Moreover, smart integration and operation of new components of the decarbonised gas systems, such as Power-to-Gas electrolysers, biomethane plants or CCUS facilities, should be incentivised to avoid bottlenecks and unnecessary investments into electricity infrastructure. Potential actions include, inter alia:

- **Coordinated network planning** between gas and power TSOs at EU, regional and national levels (common scenarios and cooperation for TYNDP, GRIPs and national plans),
- Inclusion of gas TSOs in the **process of setting the optimal geographical locations and sizing of Power-to-Gas and Power-to-X units** by providing valuable and transparent information regarding constraints,
- Definition of **must-run scenarios for Power-to-Gas installations** to avoid curtailment of renewable electricity production,
- **Grid tariffs** that should incentivise an effective system integration,
- A **robust regulatory R&D framework** which allows innovators to try new products, services and business models, linked to renewable and low-carbon gases, and overcome regulatory barriers or the lack of enabling regulation,
- The **revision of the EU's LNG Strategy** to consider the role of liquified biomethane (LBM), liquified synthetic methane (LSM) and hydrogen-based energy carriers to use existing LNG regasification terminals as entry doors to energy imports[5].

Digitalisation will be a key driver in the development of a cost-efficient integration of the energy system, increase energy efficiency in infrastructure companies and improve asset management. For example, a resilient and transparent IT system to facilitate cross-border transfer and trade of GOs for renewable and low-carbon gases can help provide information to producers and consumers in view of developing a reliable market.

To unleash the full potential of digitalisation, it is increasingly important to support open data initiatives as means of stimulating or catalysing innovation. Whilst other private actors should be the drivers of digital innovation, regulated subjects should also be **encouraged and incentivised to facilitate data flows and innovation** and ensure that the strongest and best solutions can be implemented. For instance, gas TSOs will have to digitalise to cope with the increased challenges in terms of gas quality management (of different types of gases) and conversion (e.g. from methane to hydrogen) in order to maintain current levels of interoperability.

7. Are there any best practices or concrete projects for an integrated energy system you would like to highlight?

GIE members are already taking steps and promote projects for an integrated energy system. Here are some examples:

[5] LNG can help to further decarbonise different sectors, for instance transport, with the use of LBM and LSM that offer almost 100% GHG emissions reduction and contribute to achieving net-zero emissions (LNG Protocol, 2019).

- Austria: Underground Sun Storage by RAG Austria
- Belgium: Eoly / Fluxys: P2G by Eoly and Fluxys, Hydrogen transport and storage by Fluxys and ENGIE and others, Hy Off Wind by Fluxys and others
- Denmark: M/R Helle by Energinet and others, HyBalance by Energinet and others
- France: Jupiter 1000 by GRTgaz, HyGreen Provence by ENGIE, Azola by Storengy
- Germany: Bad Lauchstädt Energy Park by Uniper, VNG and ONTRAS; Membrane filter technology by ONTRAS and GRTgaz.
- Hungary: Hydrogen storage in depleted fields by Hungarian Gas Storage.
- Ireland: The Causeway Study and the Green Connect project (CNG) and CCS feasibility study in Kinsale Gas Field by Gas Networks Ireland
- Italy: Blending Hydrogen for Decarbonisation by Snam: injection of a hydrogen and natural gas mix in the high-pressure transmission network.
- The Netherlands: North Sea Wind Power Hub by Energinet and Gasunie; NorthH2 by Gasunie and others
- Poland and Denmark: the Baltic Pipe project
- UK: HyNTS - Hydrogen Injection into the NTS and Hydrogen Deblending by National Grid, Humber Zero by Uniper, Phillips 66 and VPI Immingham - a large-scale decarbonization and hydrogen project that aims to create zero-carbon industrial cluster in Humberside (by reducing carbon emissions from power and petrochemical facilities, as well as creating a sustainable platform for industrial growth and economic development).

Partner companies are also developing projects to facilitate the integration of energy system:

- Germany: Graforce developing high-efficient plasmalyzer for sustainable hydrogen production, EVONIC using methane pyrolysis (electric arc) technology for clean hydrogen production.
- UK: HiiROC developing methane pyrolysis with plasma at industrial scale.

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