Gas Infrastructure Europe

Towards a sustainable future

for gas transmission networks

Who are we?

Gas Infrastructure Europe (GIE) is an association representing the interests of European natural gas infrastructure operators active in natural gas transmission, storage and LNG regasification from 25 countries. They are committed to actively develop a transparent, secure, sustainable and competitive gas market in Europe underpinned by a stable and predictable regulatory framework as well as by a sound investment climate.

Photo : Image courtesy of GASUM - Biogas upgrading unit in Espoo, Finland

Sustainable future

The EU's Energy Union policy is based on five pillars: Security of supply, internal energy market, energy efficiency, decarbonisation, research and innovation. Given the importance of the latter two, it is important that the EU develops and supports new technologies which are more environmentally-friendly.

In this regard, GIE is a pro-active partner towards a sustainable future for transmission networks. It covers and analysis topics like injection of renewable gases, energy efficiency and utilisation of gas for mobility, observes initiatives that support the relevant new technologies and is an active partner in discussions with the Energy Community.

For the time being, GIE has decided to focus on two topics: renewable gases and power-to-gas technologies. By holding workshops with the participation of TSOs, stakeholders and representatives from the European Commission, GIE has established a dialogue with the European Community discussing innovative technologies that are essential for a sustainable future for the gas transmission networks. It is evident that these efforts provide mutual benefits for all involved parties as these interactions serve to better understand the opportunities and challenges, but also create access and exchange of information.

Image: courtesy of Gasum, Kujala Lahti biogas production facility

Renewable gases

In recent years, increasing attention has been focused on the possibility of utilising the gas infrastructure to transport and store renewable gases due to its strong inherent benefits. It can be produced with a nearly constant output and quality. It can be stored, traded, transported efficiently over long distances at a low cost, and it can provide flexibility to intermittent energy resources. Production of renewable gases also provides societal benefits such as production of energy from waste streams. Finally, by-products of renewable gases can in some instances be used as fertilizer, thus ensuring a recirculation of phosphorous and reduction of greenhouse gases emissions in the agricultural sector.

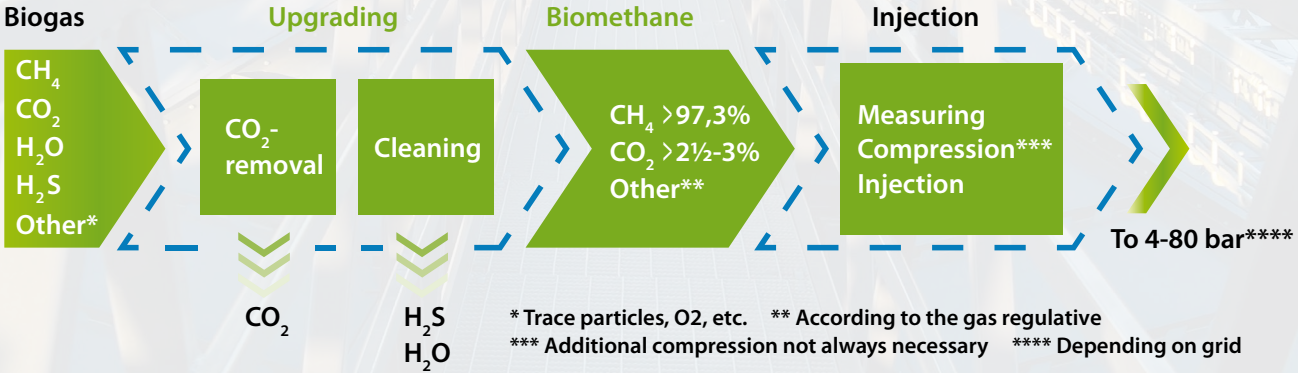
For those reasons, renewable gases have been produced for many years and from many different sources. Typical examples include biogas made from anaerobic digestion, synthetic natural gas (SNG) produced by thermal gasification or hydrogen by means of electrolysis which can be turned into methane also known as methanation.

The most common type is biogas which can be produced from different sources of biomass such as energy crops, agricultural waste and sewage sludge. In many cases biogas is used locally for heat and/or electricity production. Biogas mainly consists of methane and CO_2. By removing the CO_2 and cleaning the impurities, biogas can be upgraded to biomethane in order to meet the quality standards of the natural gas grids – thus making its injection into the gas grid possible.

Image : Göteborg Energi, GoBiGas plant in Sweden: thermal gasification, production of bio-SNG

Image: Riihimäki biogas production facility, Finland

To inject renewable gases into the gas grids, it is necessary to compress it to the grid pressure.

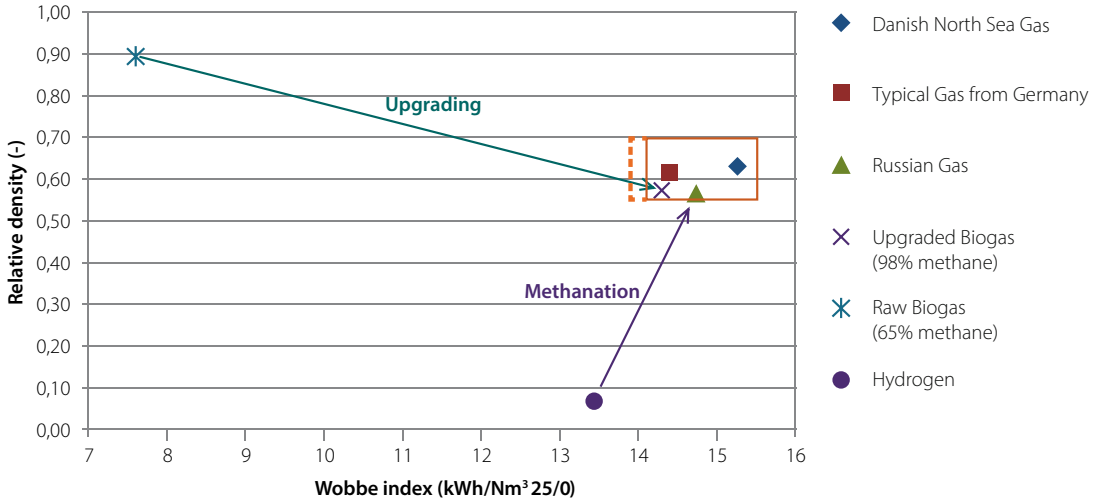


* Trace particles, O2, etc. ** According to the gas regulative
*** Additional compression not always necessary **** Depending on grid

Image: Enagás - Vadelmingomez biogas production plant, Spain

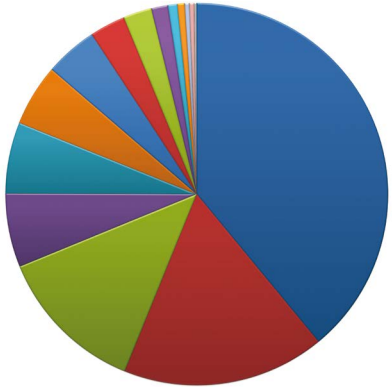
Gas Quality of Biogas and Natural Gas

Injection into the gas grid can be done as long as the quality specifications are met and the renewable gases do not compromise either the security of the grid or the security of the end-consumer.



EU Member States have made large progress in the first quarter of 2017, there were a total of 497 plants in the EU which deliver biomethane to the gas networks and/or to the transport sector.

In 2017, the total energy produced from biomethane was 17.264 GWh. Some countries have experienced moderate growth - while countries as United Kingdom and Denmark have experienced a tremendous growth. Germany still has the largest amount of plants followed by Sweden.



Source : EBA Statistical Report, 2017

Germany	194
United Kingdom	85
Sweden	63
Switzerland	31
France	30
The Netherlands	26
Denmark	22
Austria	15
Finland	12
Italy	7
Norway	4
Luxembourg	3
Hungary	2
Iceland	2
Spain	1
Total	497

Overview of biomethane plants in the EU

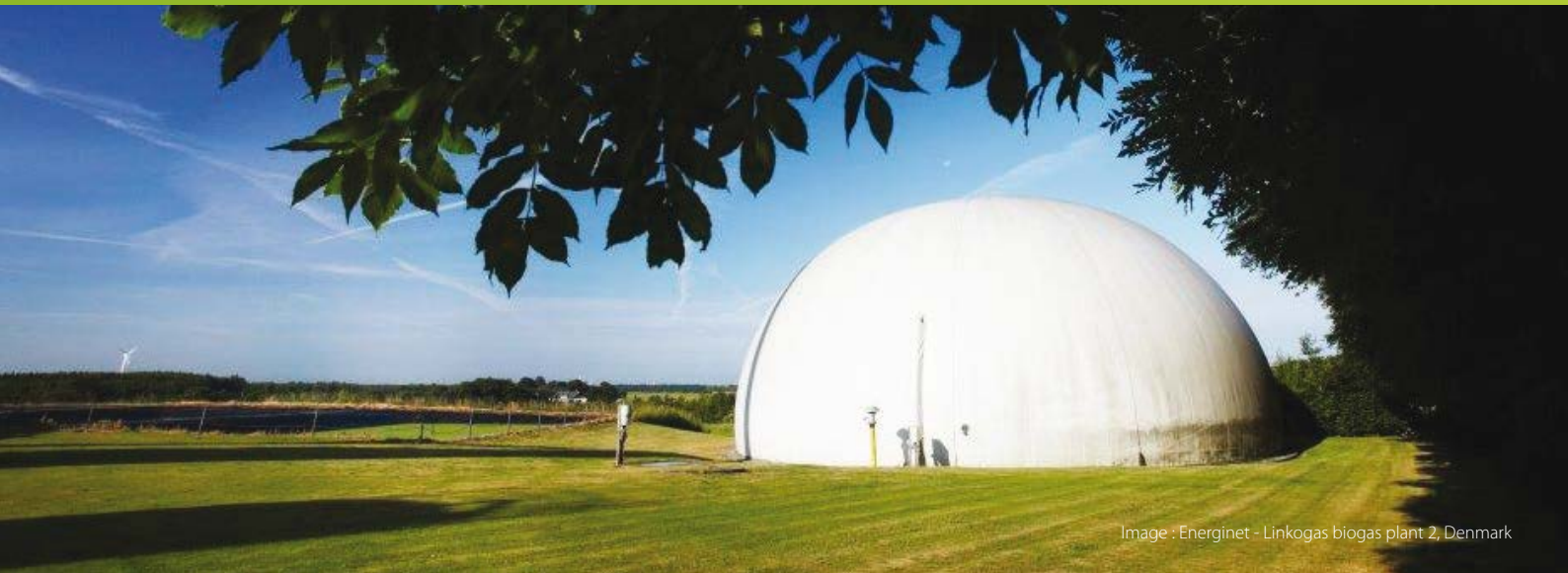


Image : Energinet - Linkogas biogas plant 2, Denmark

Power-to-gas

The term 'power-to-gas' (or 'P2G') describes the process of converting surplus electrical power generated from renewable sources such as wind and solar into combustible gases (hydrogen or methane) which can be injected into the natural gas infrastructure. The technology allows us to store electrical energy in huge quantities with minimum losses over a long period of time. **As of now no other storage technology offers such a long-term bulk energy storage**. The first process step for P2G concept is electrolysis.

It is used to split water into hydrogen and oxygen. The hydrogen is then injected directly into the natural gas grid or converted into methane in a subsequent phase where e.g. excess CO_2 from the production of biogas is combined with hydrogen. Both concepts offer different advantages.

The rapid growth in development of new P2G demonstration projects has been noted recently by the European Power to Gas Platform[1].

In January 2018, 40 P2G installations were in operation and 16 additional P2G installations are planned in Europe. Germany is by far the most active country.

P2G enables the coupling of the electricity system with the gas system which must be considered vital to ensure a stable and efficient supply in a future energy system characterised by intermittent energy sources such as wind and solar.

➔ **Can be stored and/or transported separately** by converting excess electricity into hydrogen or synthetic natural gas, electricity can actually be stored in gas networks and storage facilities. This way, the gas infrastructure can support the electricity networks by transporting and storing energy at low costs while accom-modating future large volumes of excess sustainable energy, thus preventing suboptimal use of costly sustainable energy.

➔ **Can directly be injected and mixed into the natural gas grids** to be used as transport fuel, for heating, the production of electricity or for industrial processes. Though, due to hydrogen's lower carbon intensity and impact on the heating value, Wobbe index and methane numbers of the gas mix, only a certain percentage of hydrogen can be directly injected into the gas grid.

➔ Finally, **the hydrogen can be combined with CO_2 also known as methanation,** to produce synthetic methane that can be directly injected into the natural gas grids without any limitations. If the CO_2 is re-employed from a non-fossil source, the synthetic methane is green.

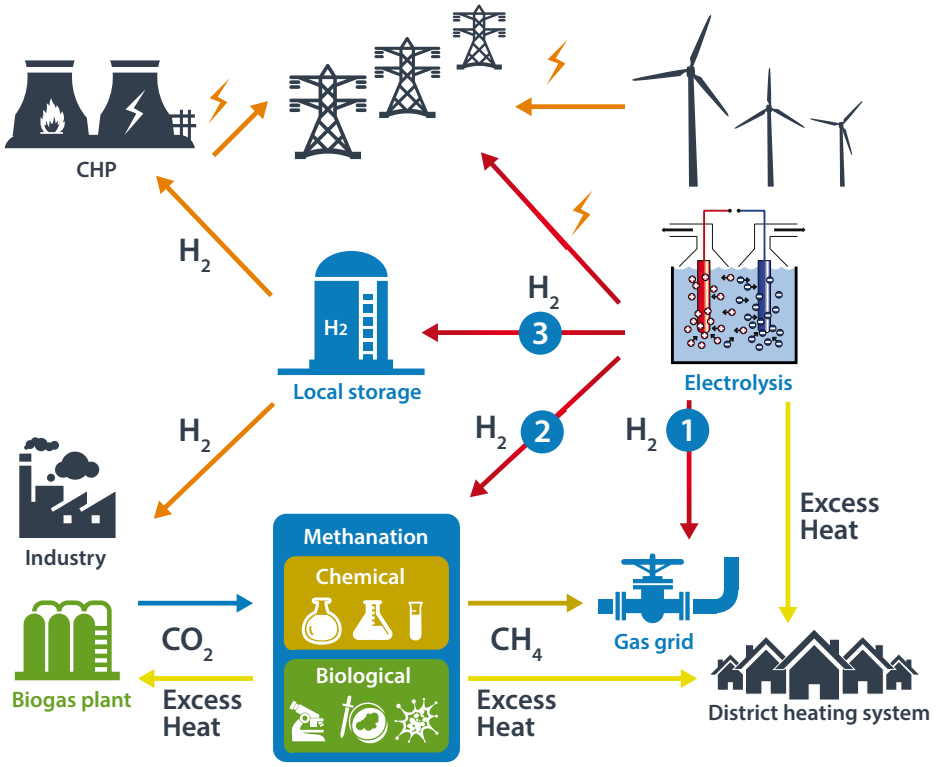
[1] http://www.europeanpowertogas.com. The website of the European Power to Gas Platform contains an overview of all the power-to-gas projects in Europe (www.europeanpowertogas.com/demonstrations)

The following advantages of P2G should be widely promoted:

- Storage and transport of excess renewable electricity/energy;
- Avoid curtailment costs for renewable electricity/energy and start/stop cost for other power plants;
- Avoid extra investments in reinforcing electricity grids by using available natural gas grids;
- Decarbonisation of the natural gas mix / production of renewable gases;

The several operational and planned P2G plants are good indications of the maturity and proof of the technology. In order to support the research and development activities, the members of GIE are very committed to increase its knowledge on issues related to hydrogen injection in the gas grid as well as underground storage and methanation. They deliver inputs in the design of appropriate regulatory frameworks that allows for technology deployment that bridges the energy markets, thus supporting renewable energy production to meet consumers demand. Renewable gases and P2G are good examples on how to reduce the carbon footprint of the natural gas mix and the European gas infrastructure's great potential of integrating renewable energy.

Power-to-gas / Different options



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Photos : Enagás - Pipeline marker (back)
EWE - Biomethane production facility Werlte, Germany (cover)