IEA Bioenergy
Technology Collaboration Programme

Sustainable Natural Gas production through gasification

Position paper

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Background

Sustainable natural gas (SNG) is methane produced from biogenic feedstocks, also referred to as biomethane. These feedstocks are for instance forest residues, agro residues or waste streams containing plastics (MSW). With Russia's aggression against the Ukraine, the dependency on fossil natural gas is reconsidered. The EU is steering away from natural gas and recently announced their REPowerEU plan, which aims on reducing the use of natural gas as well as replacing it with SNG. Furthermore, SNG is recognized as an important molecule in the transition of fossil natural gas, in a way to de-fossilize existing industries. As a molecule it has many advantageous:

- ☑ It can be distributed and stored using the extensive existing natural gas infrastructure, making use of existing downstream applications.
- ☑ Production via gasification reduces the need for gas extraction in urban areas.
- ☑ It allows countries to become more independent from foreign energy suppliers.
- ☑ A commodity market is in place for SNG
- ☑ SNG can be used to de-fossilize hard-to-abate sectors (old inner cities, high temperature heat, etc)
- ☑ SNG has a broad applicability (household heating, cooking, transport, industry)

SNG can be produced via digestion or gasification. There are claims that through digestion 35 billion cubic metres (bcm) can be made available by 2030[1], however with two strong non-competing technology pathways available it should be stressed not to focus on only digestion. Besides, through gasification other feedstocks become available for the production of SNG, speeding up the transition as well as increasing the energy security. As a reference to the European goals, the following numbers on gas production are the starting point for the EU:

- Currently 3 bcm of biomethane is produced through digestion
- Additionally 17 bcm of biogas is produced and part of this could be upgraded to biomethane
- Target for 2030 is 35 bcm of biomethane (SNG)

These numbers show that it is crucial that SNG production through gasification will enter the market as well. In a recent report of the Gas for Climate initiative the potential of SNG in the EU towards 2050 produced via gasification is 60 bcm. For 2030 they estimate a potential of 3 bcm[1]. The main reason for the lag in deployment of gasification is that there has been no commercial roll-out of the technology yet, which is halting the deployment.

IEA Bioenergy Task33 (Gasification of Biomass and Waste) has organized a stakeholder event to jointly analyse why the gasification technology deployment has not taken off yet. Large scale demonstrations such as the GoBiGas plant in Sweden and the Gaya project in France have shown

[1] Biomethane production potentials in the EU - Feasibility of REPowerEU 2030 targets, production potentials in the Member States and outlook to 2050, A Gas for Climate report, July 2022

the technical feasibility of different gasification pathways to SNG. The main question remaining is :

If not a technical barrier, then which barriers are holding back deployment of gasification based biomethane?

Deployment assessment

Gasification based SNG plants have to deal with;

SNG plants have to deal with;

- Mixed policies with different support schemes, sometimes counter productive
- Varying gas grid requirements, specifically to H_2 and CO content
- Perception issues on biomass/waste utilization
- Limited number of technology suppliers

Within the EU, several policy methods have been put in place to stimulate the production of SNG. However, these policies are not harmonized, which works counterproductive for the deployment of gasification based SNG. Gas quality requirements in the EU are not uniform, with large variations in for instance the amount of H2 allowed in the SNG. The stricter the requirements the higher the investment will be in order to meet that standard. This leads to situations where incentives are supportive for grid injection, but due to the very low H2 and CO requirement the overall business case becomes less favourable.

Building an SNG plant is complex. Too often support schemes consider the role-out of bio-energy similar to solar or wind developments. However, the scale at which SNG needs to be demonstrated is large and therefore costly. Secondly, the feedstock is an important part of the production costs and these feedstocks need to be under contract, the validity of subsidies and the timing of all permits and feedstock contracts for an SNG plant do not always match. Thirdly, the complexity is also observed in the multitude of solutions, making it difficult to design a one size fits all support mechanism.

Speeding up the SNG deployment

There is an immediate need for powerful policy frameworks and measures beyond the generally benevolent wording to support the expansion of European SNG industry and which strongly contribute to the goals set by REPowerEU and the Fit for 55 program. Such measures must aim at making investments in large-scale SNG production economically sustainable over time. We propose the following measures.

1. Allocate production targets of SNG in the grid all over Europe. For instance 10% in 2030 and 25% of the grid in 2050. This will create clarity and security for investors. A long term security will also allow feedstock to be allocated for the production of SNG, and as such reduce risks with associated to competition for feedstock that will otherwise be used for biofuels or biochemicals
2. Many of the technologies available need to be validated and improved in a pre-commercial setting. This requires large investments and is associated with large financial risks. Setting up a risk mitigation fund, allowing these de-risking steps to be taken will speed up the deployment in combination with for instance a Contract for Difference (CfD) for a first of a kind production facility.
3. Harmonization across Europe with respect to the allowed feedstocks (including non-recyclable waste that are mostly landfilled) and SNG composition for injection into the grid. Loosening the requirements will facilitate the introduction of SNG into the grid, it will also help introducing more SNG from digesters and it will allow the introduction of renewable hydrogen into the grid.

4. Strengthen communication around show cases of positive and ground-breaking digestion and gasification examples. This can create “willingness” and “awareness” among policy makers to include SNG more emphatically in policy-making.
5. Clarification of the regulatory framework regarding the guarantees of origin (or equivalent system) to allow a sustainable SNG trading. A European harmonisation of GOs will make it possible to structure an organised market on which all these GOs would be exchanged under conditions of transparency and security. This would make it possible to completely disconnect the physical flow of SNG from consumption, knowing that what counts is that one molecule of green gas replaces one molecule of fossil gas and that there is no double counting. This European harmonisation of GOs, which the sector is calling for, is an additional and essential element in the implementation of the large internal SNG market and will facilitate the achievement of the Green Deal and REPowerEU objectives.

Great opportunities to create climate positive gasses

SNG production can displace natural gas, it also allows the generation of carbon credits. SNG produced from biogenic residues through gasification, has a second product available. Clean CO2 has to be taken out of the process, in order to meet grid specifications[2]. This clean CO2 can be sequestered, leading to negative emissions. Some SNG pathways also produce bio-char, which upon use in the soil is also considered a negative emission technology. This makes SNG produced with gasification technology a climate positive value chain. This concept is depicted in general terms in the graph below.

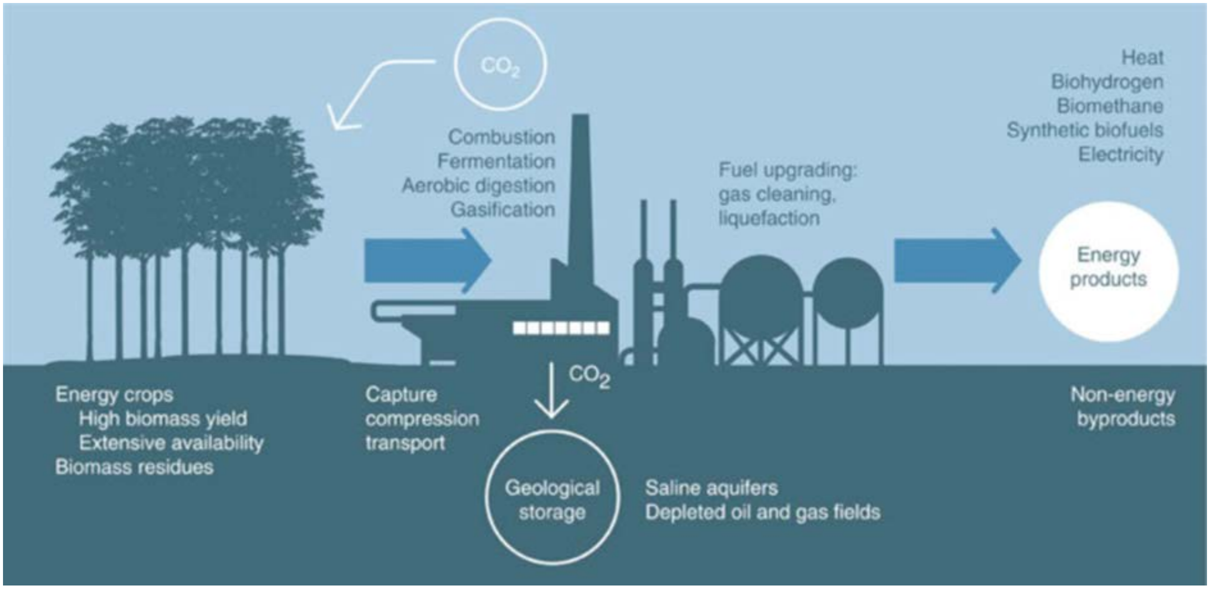

Figure 1: Concept of Bio-CCS (Sanchez et al., 2015, courtesy of Nature[3])

In order to stay below 1.5 or 2 degrees climate change, negative emission technologies are essential. In the production of SNG 30 – 40 % of the available carbon leaves the system as storage ready carbon (CO_2 or bio-char). By supporting SNG deployment we can

- Become less dependent on foreign energy suppliers
- Utilize our own waste streams much better
- Maintain a large part of investments in steel
- Extract carbon from the global carbon cycle

[2] Implementation of bio-CCS in biofuels production, IEA Bioenergy Task33 Special Report, July 2018
[3] D.L. Sanchez, J.H. Nelson, J. Johnston, A. Mileva, D.M. Kammen, Biomass enables the transition to a carbon-negative power system across western North America, Nat. Clim. Change, 5 (2015)

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Italy	*New Energy Coalition*
United Kingdom	*TKI Gas*
United States	*TotalEnergies*
India	*Gasunie*
China	*GTI*
Sweden	*Svebio*
Belgium	*Engie*
Canada	*GERG*
France	

Common names describing in essence the same end product:
SNG: Sustainable Natural Gas (Substitute or Synthetic is also used) common name in the EU
RNG: Renewable Natural Gas, similar to SNG but used more often in the US and Canada
Biomethane: Renewable gas, often linked to digesters but also used in the gasification context
Green Gas: A phrase used to describe the green (biogenic) origin of the natural gas produced

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