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BIO-LNG FOR ROAD TRANSPORT: WHERE DO WE STAND?

PITPOINT.LNG

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Bio-LNG for Road Transport

Introduction

Compressed and liquid bio-methane gas offers great potential for the European society to decarbonize our transport and mobility sector[1][2][3]. More information about this type of fuel, the quality and, particularly, information about the infrastructure is necessary before deployment with real-life trials can be executed. As part of activity 9 of the LNG-motion project the potential of bio-LNG as fuel was investigated.
Here the main results are provided. Firstly, the quality and performance of bio-LNG in engines is discussed. Secondly, an assessment of the technical and economic feasibility of the use of bio-LNG in the transport sector is presented.

Quality of bio-LNG

Part of activity 9 of the LNG-motion project is an assessment of the quality of bio-LNG, specifically the performance of the gas in (truck) engines. Meanwhile, several parties have performed research on the quality of bio-LNG[4][5][6]. In addition, Volvo Group, one of the three original equipment manufacturers at the moment, has carried out tests with bio-LNG in their engines[8]. The main results are discussed here.

Quality assessments of bio-LNG show that bio-LNG has a very high methane content of over 99% constant composition. It can be regarded as a liquid biofuel consisting out of methane. As a result of the high methane content, evaporation of bio-LNG, in contrast to LNG, does not result in major changes in composition. Moreover, because bio-LNG is of biogenic origin it is considered largely CO_2 neutral and as it can be produced from waste streams (i.e. organic waste, sewage sludge, manure and landfill) it does not lead to changes in land use and hence does not compete with the food production chain.[4][5][6] Figure 1 shows an overview of the supply chain of bio-methane used as an energy supply source.

Regarding the performance of bio-LNG in engines, as the methane content of bio-LNG is very high, and the quality control of bio-LNG is typically greater than that of LNG, the quality as in methane content of the fuel generally does not pose a problem. For fossil LNG the composition of LNG varies depending on the source. Methane content can lie between 80 and 99.9%. Most gas engines are sensitive to gas quality and higher quality will result in better engine performance. [7]

[1] ENEA Consulting, Développer une filière française bio-GNL carburant pour décarboner les transports. January 2019. Available at: http://www.enea-consulting.com/wp-content/uploads/2019/01/ENEA-Consulting-Développer-une-filière-française-bio-GNL-carburant-pour-décarboner-les-transports-2019-1.pdf.
[2] https://www.europenowjournal.org/2019/05/06/biomethane-the-future-fuel-for-europe-%EF%BB%BF/
[3] https://www.biogas2020.se/wp-content/uploads/2018/03/a-study-on-lbg-productionfinal.pdf
[4] Bakker, B., Langerak, J., Lems, R., & Dirkse, E. H. M. Chances for Bio-LNG.
[5] https://groengas.nl/documenten/factsheet-productie-van-bio-lng-in-een-opkomende-lng-markt.pdf
[6] https://ec.europa.eu/energy/sites/ener/files/documents/ce_delft_3g84_biogas_beyond_2020_final_report.pdf
[7] https://www.hollandinnovationteam.nl/images/small_scale_LNG_Amsterdam_15_dec_2011.pdf

Results from a study performed by Volvo Group (2018) support these findings and show that higher methane content results in better engine performance. However, the risk of contamination of bio-LNG with Siloxanes and small particles does exists. Siloxanes are silica-based compounds that form sand and glass-like or ceramic-like deposits during combustion in the engines. This can result in damage of i.a. the truck engine and/ or the piston and valves. A relatively simple solution to this problem exists; a filter (with 5 micron absolute) is installed in LNG truck engines that filters out these particles. Likewise, pollution of small particles is prevented by ensuring cleanliness of the tank and pipes before commissioning of the LNG fueling station and by installing a filter.[8] This is also true for LNG.

In conclusion, study results show that the quality of bio-LNG is sufficient and does not constitute a barrier to the uptake of bio-LNG as an alternative fuel for road transport.

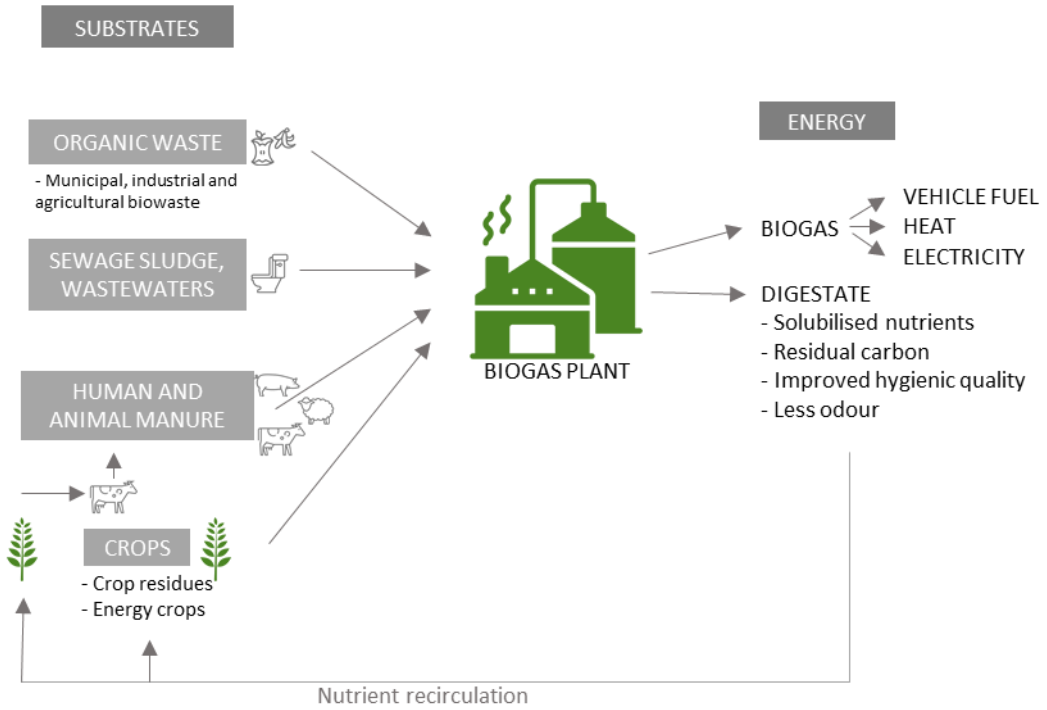

Figure 1: Visualization of the supply chain of bio-methane used as an energy supply source. Adapted from: Europe Now[9].

[8] Volvo (2018). *LNG fueling stations requirements Volvo FH-FM LNG EURO 6 (pre-release)*. Reg. No. 50295740.
[9] Https://www.europenowjournal.org/2019/05/06/biomethane-the-future-fuel-for-europe-%EF%BB%BF/

Feasibility of bio-LNG for road transport

Looking into the current situation there is no bio-LNG contracted by PitPoint or other partners in the application to be used in road transport. In several countries LNG is seen as one of the pillars to clean the Heavy Goods Vehicles (HGV) transport sector. In some countries (i.e. Netherlands) bio-LNG is seen as essential to continue the use of LNG in this sector.

Based on the new Renewable Energy Directive (RED-2) and other regulations there is no barrier to use LNG as a clean fuel now. However, in order to be able to meet the CO_2 emissions standards in the future bio-LNG is needed to reduce the CO_2 footprint of the industry. Some barriers to the adoption of bio-LNG as fuel for the transport sector still exist:

- Firstly, at the moment bio-LNG is not included as a fuel in the CO_2 emissions standards for vehicles, meaning that the vehicles are tested and categorized as LNG vehicles, making it less attractive for haulers to invest in bio-LNG
- Secondly, now bio-LNG is still more expensive than LNG and, in a sector competing on small commercial margins the use of bio-LNG must be either a commercial advantage or a request from the shipper of the goods (clients)

Because of the economics bio-LNG is currently not available on a large scale in the project area and only few shippers are requesting the use of bio-LNG. PitPoint is currently investing the production of bio-LNG in Germany and the use in the Netherlands.

Outside of the project area (Norway & UK) there is currently a positive business case for the production of bio-LNG based on the local market and they are looking into exporting to other countries.

Outlook

Bio-LNG will play an important role in providing clean transport after 2030 and can contribute to the decarbonization of the transport sector. A network of LNG stations which can be supplied by either LNG or bio-LNG can, by using a book and claim system, be greened incremental according to customer demand and contribute to this transition.

As mentioned above, bio-LNG can be seen as a liquid biofuel consisting out of methane. The production process and feedstock are mostly the same as for bio-CNG (biomethane) and only at the end of the process there is the choice to use either feed into the grid (as a gas) or liquify the material.

Using bio-LNG which is currently produced outside of the project can be a first step in establishing more local bio-LNG production as this contributes to solving the chicken and egg problem.

The Road Ahead

Most Guarantee of origin (GoO) schemes use the feed-in into the grid to create a GoO based on a Proof of Sustainability (PoS).

In the RED-2 and the Clean Fuel Directive there is the possibility to use (advanced) biofuels in the blending obligations.

In the current legislation, several main elements of the existing regulation can be used to create a positive business case for bio-LNG. These include: the blending obligations, customs code regarding tariffs on (bio)fuels, renewable energy regulated targets and CO_2 reduction targets.
For Germany and the Netherlands these elements can already help in creating a business case, but for France and Belgium time and effort is needed to let this work. Currently in both countries legalization is being geared toward implementing RED-2.

In order to be able to use bio-LNG to comply with blending obligations in the countries covered by the project scope, two routes are identified:

1. The first is to see bio-LNG as a liquid biofuel and to use these characteristics to either be able to blend-in and blend-out or do a physical transfer from one location (country) to another and use a mass balance system in this
2. The second route is to use the GoO / PoS route for gasses and the ERGar system for transferring these between countries

For both options a roadmap needs to be created to cover the origination, registration, trade and finally the end use of the bio-LNG across the network. Finally, both options rely on using the blending obligation targets as a way to pay for the additional cost of bio-LNG over LNG.