Acknowledging the full potential of biomethane as transport fuel

Photo credits: Deva Darshan

Despite all current efforts from the EU, transport is the only sector which is not decarbonizing but shows even an increase in GHG emissions on a yearly basis since 2014[1].

The need for further actions to reduce emissions in the transport sector must be addressed without delay. The development of green electric mobility is advancing but will not ensure alone the expected and much needed decarbonization in time and it will fall short to adequately cover all areas of transport. Other alternative green fuels can contribute, together with green electric mobility, to speed up transport decarbonization in the coming years and make sure its economic benefits remain in the EU.

> ***All studies on alternative fuels since 2010, including EU JRC reports, show that biomethane can reach even carbon negative levels of CO2 reductions in the transport sector. This renewable fuel is readily available, scalable and contributes to maintain a strong car industry within the EU. It is now crucial to untap the valuable role of biomethane on an equal footing with electric mobility to ensure the most needed decarbonisation of the EU transport sector.***

[1] https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-12

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Over the past years different studies have been performed on CO2 emissions of fuels by EU institutions, car manufacturers, research institutes and universities. The EBA has made a comparative analysis of 11 studies (see page 8). Although they show a great variety in methodology, they all concluded that biomethane has the best decarbonization potential for the transport sector.

Besides the significant levels of CO2 reductions which are equal, or in some cases, higher than those ensured by green electric mobility, biomethane offers immediate deployment opportunities, manufacturing of the engines/cars within the EU and direct positive impact on the decarbonization of the sector. Moreover, it can be used in heavy transport and in the maritime sector.

We need all alternative fuels and technologies to ensure the full decarbonization of the transport sector. Biomethane is already available and is ready for scale up to ensure ample future supply.

Based on the factual data, the European Biogas Association (EBA) calls upon EU policy-makers to recognise the valuable role and potential of biomethane in the Strategy on Sustainable and Smart Mobility and create a level playing field allowing for this scalable green fuel to contribute to the most needed decarbonization of the transport sector on an equal footing with e-mobility.

EBA's recommendations for faster decarbonization of transport

Biomethane production is at the heart of a circular economy: it is the best way to recycle biowaste, to produce valuable renewable gas and biofertilizers. This potential of biogas and biomethane is also pointed out in the recent Farm-to-Fork strategy of the European Commission that encourages farmers to *"grasp opportunities to reduce methane emissions from livestock by developing the production of renewable energy and investing in anaerobic digesters for biogas production from agriculture waste and residues, such as manure.[2]"*

Biomethane is already being used in NGV vehicles in Europe. The share of renewable energy in transport in the EU was 8.6% in 2018[3] whilst the share of biomethane in gas fueled cars accounted for 17%[4]. However, only e-mobility benefits for targeted legislative support, such as super-credits under the article 5 of Regulation (EU) 2019/631.

Recently, Spain has recognized the positive effects of biomethane and has set the CO2 contribution of biomethane fueled cars to "0" in a Tank-to-Wheel (TtW) approach[5]. This is in line with the initiatives implemented in other countries, such as Sweden, which recognizes the great potential of biomethane in the transport sector. In that country, biomethane accounts for 94% of the overall vehicle gas consumption.

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0381
[3] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics
[4] https://www.ngva.eu/medias/already-17-renewable-gas-used-by-the-mobility-sector-in-europe/
[5] https://www.miteco.gob.es/es/ministerio/proyecto-de-ley-de-cambio-climatico-y-transicion-energetica.aspx

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The EBA recommends the urgent implementation of the following policy measures:

- Recognise biomethane in the Strategy on Sustainable and Smart Mobility.
- Ensure further biomethane deployment, alongside with e-mobility, in the transport sector, and equally promote both fuels to foster the implementation of green fuels.
- Set targets for biomethane use in transport by 2030.
- Switch from TtW (Tank-to-Wheel) to WtW (Well-to-Wheel) or LCA (Life Cycle Assessment) approach by 2030 in all transport and fuel related legislation to guarantee the accurate and comprehensive quantification of CO2 emissions in the transport sector.
- Recognise biomethane as a non-CO2 contributor, on equal footing as electric mobility, while WtW /LCA approach is not implemented. This could be set in the context of the revised Energy Taxation Directive or Fuel Quality Directive, as well as the Regulation setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles.
- Promote biomethane as green fuel in the Alternative Fuels Infrastructure Directive (AFID).
- Encourage EU car manufacturers to develop and produce the required clean fuel gas engines that will enable the scale-up of biomethane in the transport sector and hence a faster

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Understanding the full potential of biomethane for faster decarbonization in transport

Transport decarbonisation and alternative fuels

All alternative fuels are necessary to guarantee an increased pace on transport decarbonization. Transport represents 27% of the GHG emissions in Europe according to the European Environment Agency. Even with the current efforts, the transport sector has seen GHG emissions increase since 2014[6].

> ***The EU spends on average 55 billion Euro each year to subsidize fossil fuels[7] and 44% of this total amount is invested in the transport sector[8].***

Biomethane is a readily available alternative fuel with high CO2 emissions reductions performance in transport. As biomethane is derived from sustainable feedstocks, biogenic CO2 (see paragraph: What is biogenic CO2) is emitted during the combustion process but it does not increase the amount of CO2 in the atmosphere[9]. As green electric vehicles, biomethane fueled vehicles are climate neutral in their emissions (see Figure 1).

The elephant in the room

Standard Internal gas Combustion Engines (ICE) are compatible with biomethane. This seems to be controversial as those type of engines are also used for fossil fuels. However, it is important to highlight that emissions depend on the type of fuel that is used and not on the technology, in this case the engine.

Life Cycle Assessments consider the production of engines, together with their scrapping and recycling. The first studies on this show that ICE engines are not only performing better than the e-fueled engines in its CO2 footprint at production level, but also at the end of life phase.[10]

[6] https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-12
[7] https://op.europa.eu/en/publication-detail/-/publication/d7c9d93b-1879-11e9-8d04-01aa75ed71a1
[8] https://www.odi.org/sites/odi.org.uk/files/resource-documents/11762.pdf
[9] https://www.europeanbiogas.eu/wp-content/uploads/2020/04/20200419-Background-paper_final.pdf
[10] https://www.ifpenergiesnouvelles.com/article/lca-study-vehicles-running-ngv-and-biongv

Sustainable fuelled ICE engines give a large advantage for the coming years in tackling the necessary fast decarbonisation of transport. ICE engines have two main advantages:

- The production of these types of cars and HDV's is cleaner than the production of e-fueled cars.
- The production of these types of engines is done in Europe, which reduces the dependency on the import of batteries and rare earths produced in the regions with political instability or violated labor rights.

Acknowledging that these types of cars can greatly help in our task of decarbonizing transport will not only support the production of biomethane, but also the EU industry itself in the present difficult times.

Biomethane – versatile in its use

Biomethane is a versatile sustainable fuel. It can be compressed to Bio-CNG or liquefied to Bio-LNG. It is already being used in light passenger vehicles as Bio-CNG, but also in heavy transport as Bio-LNG and Bio-CNG. The maritime sector has increasing interest in biomethane as sustainable fuel and in rail transport locomotives can replace the use of diesel by Bio-CNG or Bio-LNG.

To promote the use of green fuels, it is also possible to retrofit gasoline or diesel engines, creating a dual fuel or fully gas-based engine suitable for the use of biomethane.

> ***Biomethane is currently the only sustainable fuel besides green electricity which is readily available and allows for the fast decarbonization of all transport areas.***

There are currently 1.4 million cars with gas engines within the EU. It is estimated that 17% of the total gas used in these cars is biomethane[11]. The share of biomethane is growing along with the increase of biomethane production. To allow for a faster transition, legislation should support the scale up of both the production of this alternative fuel and its use within the transport sector.

[11] https://www.ngva.eu/medias/already-17-renewable-gas-used-by-the-mobility-sector-in-europe/

What is biogenic carbon dioxide?

What happens with the CO2 emissions when biomethane is used as fuel? Biomethane does emit CO2 but this is in GHG protocol seen as biogenic (short cyclic) CO2, which is different from fossil CO2.

Two carbon cycles are usually considered:

- The long cycle that represents carbon flows between fossil sinks and the atmosphere. It is called the fossil carbon cycle.
- The short cycle that stands for carbon flows between biomass sinks and the atmosphere. The timeslot required for the atmospheric carbon to be absorbed by the source reservoir can be measured at a human scale, as it varies with the lifespan of the considered biomass, thus its name of short cycle. It is called the biogenic carbon cycle.

The impact of a biogenic CO2 emissions is offset by the sequestration of an almost simultaneous (or at least close in time) equivalent CO2 absorption from biomass, unlike fossil carbon, for which the sequestration occurs over a geological timescale. This means that biogenic and fossil CO2 should not be accounted for in the same way and that both emissions (Tank-to-Wheel) and absorptions (Well-to-Tank) should be considered, leading to the carbon neutrality principle.

For this reason, within the GHG protocol, CO2 emissions of biogenic nature do not fall under the "Scope 2" but need to be reported separately[12]. When reported separately, CO2 can be offset in the total life cycle of the fuel, resulting in a total overview of the GHG emissions or savings.

How are CO2 (GHG) emissions being assessed in transport?

There are different ways to assess the impact of the CO2 emissions in transport. If we consider the origin of the fuel, emissions are measured using the **Well-to-Tank (WtT)** approach. This measurement considers production emissions from the fuel, but not those emitted by the combustion of the fuel.

A second approach is to look only at the combustion side of the fuel. This is called **Tank-to-Wheel (TtW).** In this approach emissions from production are not considered. The production of electricity generates large CO2 emissions, when it is not produced by renewable energy sources. In the TtW approach this significant amount of CO2 emissions is not being accounted for.

[12] https://ghgprotocol.org/sites/default/files/ghgp/standards/Scope%202%20Guidance_Final_0.pdf

On the other hand, biomethane does produce CO2 emissions, but since they are of biogenic nature, they do not increase the CO2 levels in the atmosphere. Hence, biomethane has a net zero contribution to CO2 emissions according to this model, same as electric vehicles.

A third and wider approach is to look at all emissions generated from production to use in the transport sector. This approach is called **Well-to-Wheel (WtW)**. This is a combination of both WtT and TtW and measures all the emissions across the production and use chains.

We can also take one step further and consider the whole life cycle of the vehicles. This is called **Life Cycle Assessment (LCA)**. In this case, not only the production and use of the fuel are being considered, but also the emissions of the car during the manufacturing process and during the recycling at end of life, in Europe or abroad, which gives the most accurate impact on CO2 emissions. In addition, LCA measurements allow for the implementation of other environmental impact categories.

Summary of emissions studies in Europe

Many studies on emissions in transport for standard fossils fuels and alternative fuels such as electric mobility and biomethane have been conducted/published between 2014-2020. In total, the EBA has reviewed 11 studies and reports to establish a summary on emissions on alternative fuels, notably regarding biomethane.

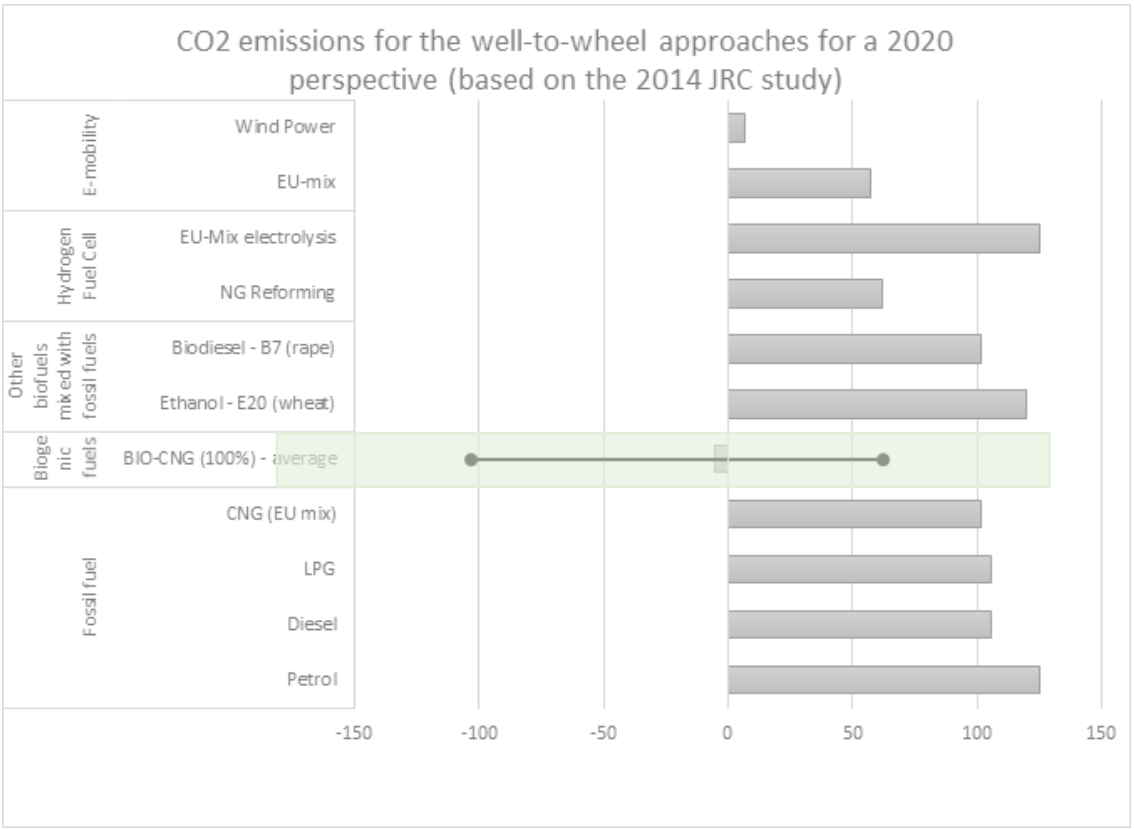

Figure 1 : CO2 emissions (g/km) for the WtW approach from a 2020 perspective

The purpose was also to assess what kind of methodological solutions and assumptions have been made in the calculations of the studies and how accurately the decisions reflect the total CO2 emissions or, more broadly, other environmental impacts of a vehicle. The studies focused on several areas of the emission spectrum, often related to a specific area of interest and sometimes with an overarching view. Most of the research studies focused on one or more scenarios such as WtT, TtW and WtW in relation to CO2 emissions per km (CO2 g/km). They were performed by several bodies, including the EU JRC, several car manufacturers, IFPEN and CE Delft. Although they show a great variety in methodology, they all showed that biomethane has the best decarbonization potential for the transport sector.

The following studies where analyzed:

- IFPEN, 2019 Life Cycle Analyses of Bio CNG
- CE Delft, 2016, Stream Goederenvervoer
- Bundesministerium fur Umwelt, Naturschutz und nukleare Sicherheit 2019, Wie Umweltfreundlich sind Elektroautos
- EMPA, 2017, Abgasemissionen von Gasfahrzeugen
- Sustainable Gas Institute, 2019, Natural Gas as a Fuel for Heavy Goods Vehicles
- Aarhus University, 2017, Is it beneficial to use biogas in the Danish transport sector – an environmental economic analysis
- VW, 2017, Dena Konferenz – Sehr gute Treibhausbilanz
- SEAT,Presentation: Por qué biometano?
- MDPI, 2019 sensitivity analyses in the Life-Cycle Assessment of Electric vs. Combustion Engine Cars under Approximate Real-World Conditions
- JRC 2014, Well-to-Wheels Report Version 4.a
- Well-to-wheel assessment of natural gas vehicles and their fuel supply infrastructures – Perspectives on gas in transport in Denmark; 2018

Together with green e-mobility, biomethane fueled vehicles have the best decarbonization potential. As the combustion phase of biomethane emits biogenic carbon dioxide, which is quickly reabsorbed, it does not contribute to the increase of the GHG in the environment. When looking at the full production and use cycle (WtW), cars fueled with biomethane are extremely well positioned to contribute strongly to the decarbonization of transport.

How much GHG are being saved by biomethane depends on the type of feedstock which is being used and how the production process is being controlled. Biomethane is in most cases obtained ing sustainable feedstocks, produced sustainably and using the digestate to revitalize the soil, minimizing the use of mineral fertilizers (also called chemical fertilizers), and therefore avoiding further emissions. The production of biomethane in this way can lead to carbon negative emissions. Recent reports such as the 2020 Gas Decarbonisation Pathways study[13] showed a potential of biomethane of 35 bcm by 2030 and 95 bcm by 2050.

The reduction of emissions can be even higher if the biogenic CO2 from biomethane production is used as a resource to replace fossil-based CO2 in other production chains, for instance in green houses, as well as in food & beverage or packaging industries.

[13] https://gasforclimate2050.eu/publications/