The potential of biomethane for a faster decarbonisation of transport should not go to waste

Photo credits: Deva Darshan

Despite all current efforts from the EU, transport is the only sector which is not decarbonizing and even shows 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. Although The development of green electricity for mobility is making strides, it cannot single-handedly meet the expected and much needed decarbonization deadlines in time and as a result will fall short of adequately covering 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 CO_2 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 CO_2 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 CO_2 reduction 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 available right here and now and can be scaled 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 Smart/Sustainable mobility Strategy and to create a level playing field allowing this scalable green fuel to contribute to a much 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 an efficient circular economy: it is the best way to recycle organic waste, to produce valuable renewable gas and biofertilizers. This potential of biogas and biomethane was 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 from targeted legislative support.

Recently, Spain has recognised the positive effects of biomethane and has set the CO_2 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 Sustainable Mobility Strategy.
- Ensure further biomethane deployment, alongside 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 CO_2 emissions in the transport sector.
- Recognise biomethane as a non-CO_2 contributor, on equal footing with 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 CO_2 emission performance standards for new passenger cars and for new light commercial vehicles.
- Promote biomethane as green fuel in the Directive on Alternative Fuels Infrastructure (DAFI).
- 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 decarbonization.

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Understanding the full potential of biomethane for faster decarbonisation in transport

Transport decarbonisation and alternative fuels

All alternative fuels are necessary in order for transport decarbonization to pick up the pace. Transport represents 27% of the GHG emissions in Europe according to the European Environment Agency. In spite of the current efforts, the transport sector has seen GHG emissions increase since 2014[6].

> ***The EU spends on average 55 billion Euros 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 CO_2 emissions reductions performance in transport. As biomethane is derived from sustainable feedstocks, biogenic CO_2 (see paragraph: What is biogenic CO_2) is emitted during the combustion process but it does not increase the amount of CO_2 in the atmosphere[9]. Like green electric vehicles, biomethane-fueled vehicles are climate neutral with respect to 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 types 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 not only perform better than e-fueled engines in their CO_2 footprint at production level, but also at the end-of-life stage.[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

To meet the need for a fast decarbonisation of transport in the coming years, Sustainably fuelled ICE engines provide 2 key assets.

- 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 import dependency of batteries and rare earths produced in politically unstable regions or where labour rights are not respected

Acknowledging the strategic role that these types of cars represent would be a significant milestone in bringing the decarbonising of transport one step closer to reality by not only supporting 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 expressed increasing interest in biomethane as a sustainable fuel and in rail transport, locomotives can replace the use of diesel with 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 CO_2 emissions when biomethane is used as fuel? While biomethane does emit CO_2, the GHG protocol sees it as biogenic (fast cycle) CO_2, which is different from fossil CO_2.

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 timeframe required for the atmospheric carbon to be absorbed by the source reservoir can be measured at a human scale, as it varies from the lifespan of the considered biomass, thus its name of short cycle. It is called the biogenic carbon cycle.

The impact of a biogenic CO_2 emissions is offset by the sequestration of an almost simultaneous (or at least close in time) equivalent CO_2 absorption from biomass, unlike fossil carbon, for which the sequestration occurs over a geological timescale. This means that biogenic and fossil CO_2 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, CO_2 emissions of biogenic nature do not fall under the "Scope 2" but need to be reported separately[12]. When reported separately, CO_2 can be offset in the total life cycle of the fuel, resulting in a total overview of the GHG emissions or savings.

How are CO_2 (GHG) emissions being assessed in transport?

There are different ways to assess the impact of the CO_2 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 emits large amounts of CO_2, especially for electric mobility, when it is not produced by renewable energy sources. In the TtW approach these considerable amounts of CO_2 are 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 CO_2 emissions, but since they are biogenic in nature, they do not increase the CO_2 levels in the atmosphere. Hence, biomethane has a net zero contribution to CO_2 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 in terms of CO_2 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.

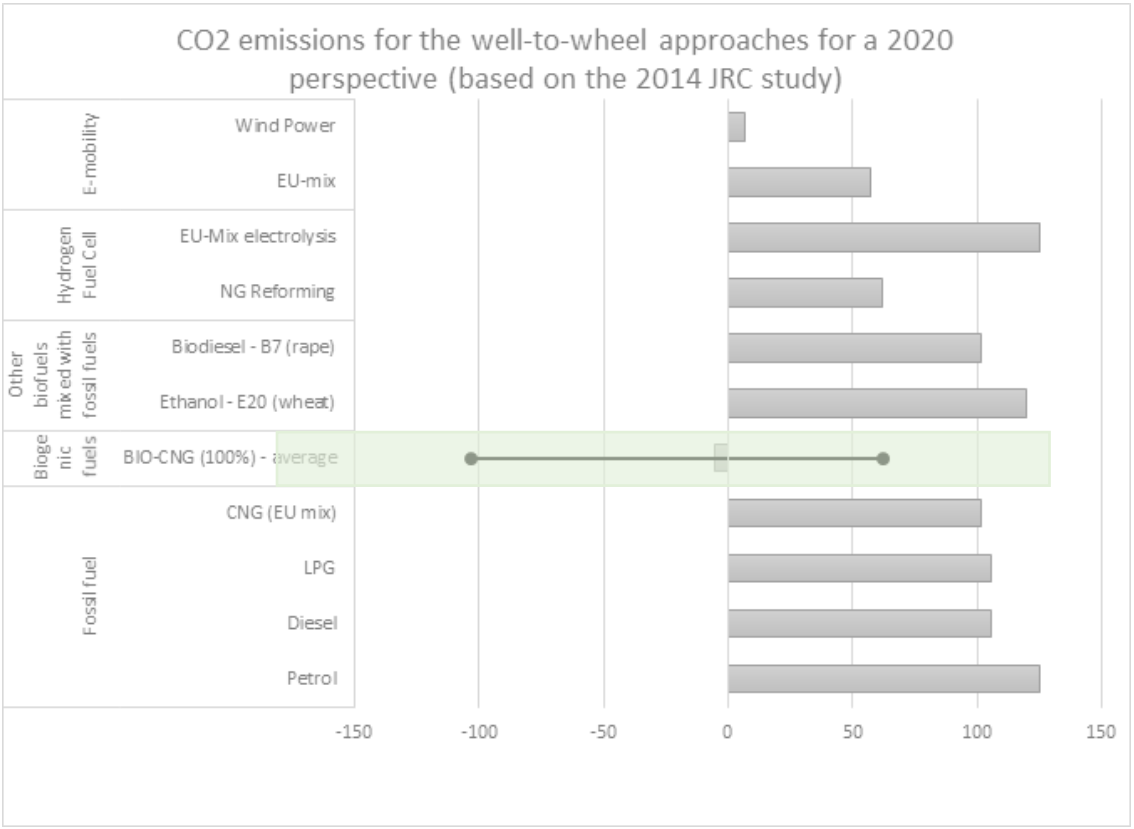

Figure 1 : CO2 emissions for the WtW approach from a 2020 perspective

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 CO_2 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 CO_2 emissions per km (CO_2 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 were 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*
- ScienceDirect 2018, *Well-to-wheel assessment of natural gas vehicles and their fuel supply infrastructures – Perspectives on gas in transport in Denmark*

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 GHGs 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.

The amount of GHG reductions from biomethane depends on the type of feedstock used and on how the production process is being controlled. In the least favourable scenario, biomethane would be produced from unsustainable feedstocks, diesel and grey electricity would be used in the production process and the remaining digestate would be incinerated.

However, biomethane is currently obtained primarily from sustainable feedstocks, produced in a sustainable way and using digestate to revitalize the soil. In turn, this minimises the use of mineral fertilizers (also called chemical fertilizers), and therefore further avoids CO_2 emissions. This type of biomethane production can lead to carbon negative emissions.

The reduction of emissions can be even higher if the biogenic CO_2 from biomethane production is used as a resource to replace fossil-based CO_2 in other production chains, for instance in greenhouses, as well as in food & beverage or packaging industries.