



IEA Bioenergy
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Perspectives on biomethane as a transport fuel within a circular economy, energy, and environmental system

Summary Series

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The literature indicates that the life cycle costs of biomethane fueled light vehicles may be 15 to 20% higher than for similar petrol and diesel fueled vehicles, while liquid biomethane fueled heavy duty trucks may have similar life cycle costs to diesel. However, such an analysis can be two dimensional and limited in the message it conveys. On one hand the acceptance of diesel fueled trucks and buses will be limited due to the climate emergency and air pollution and after 2030 diesel may not be the competition for biomethane anymore. On the other hand, biomethane production is part of a larger circular economy, energy, and environmental system. It is very difficult to divorce the energy vector, biomethane, from the system through which it is produced. In essence biomethane can be considered as one of the products or services of a broad biogas system.

An advantage of biogas is that it can be produced from most wet organic wastes or by-products, including for food waste, animal by-products, (such as manure), agricultural residues, sewage sludge, industrial biowaste (such as from slaughterhouses and food and beverage processing industries). Biogas production is an element in the environmental management of such wastes; biogas plants can also deliver digestate, which contains most of the nutrients in the feedstock and can be an excellent biofertilizer. In addition, it is possible to utilize the carbon dioxide removed in upgrading biogas to biomethane as a product with added value. The resource of biomethane is very significant in considering the vast amounts of organic wastes landfilled around the world each year, that instead could be used to produce biogas, biofertilizers and food grade CO₂ while improving the environment through reduced fugitive methane emissions and improved water quality. Furthermore, the application of biogas systems in bio-industrial contexts (such as paper mills, food production facilities, or other types of biorefineries) has huge potential to decarbonize industry while significantly increasing the resource of biomethane.

Due to the multifunctionality of biomethane solutions, broad assessment methods are needed to grasp the wide spectrum of relevant factors when comparing different technologies:

- Biomethane has a competitive performance compared with fossil fuels and other biofuels on a whole life cycle analysis and is particularly suited to long distance heavy vehicles.
- Biomethane from manure, residues, waste & catch crops is estimated to have low GHG emissions as compared to other renewable fuels.

- Biomethane may contribute to reduced air pollution in comparison with diesel, petrol, and other biofuels.
- Biomethane can contribute to a substantial reduction in acidification compared with fossil fuels.
- Biomethane may contribute to significantly reduced noise levels in comparison with diesel heavy goods vehicles.
- Well-designed and applied biogas systems may be essential to transform conventional farming to more sustainable farming and to organic farming.
- Common types of biogas solutions provide essential sociotechnical systems services as components of systems for waste and (waste) water management.
- Biogas solutions may importantly contribute to improved energy supply/security and flexibility.

Natural gas systems should be a facilitator of the introduction of biomethane for transport, but the sustainability problems associated with natural gas negatively impact the view of biomethane. This is where arguments amongst the renewable sector actors can hinder progress. Biomethane and (power to methane) can utilize the existing gas grid and accelerate progress to decarbonization of the overall energy sector beyond just electricity and also to decarbonize chemical (such as ammonia and methanol) and steel production. This should be advantageous especially when realizing that more energy is procured from the natural gas grid than the electricity grid in the EU and the US; however, suggestions that biomethane is only greenwashing the natural gas industry, and in doing so extending the lifetime of natural gas, greatly impedes this progress.

This report provides exemplars of very good biomethane based transport solutions, with a high technological readiness level for all elements of the chain from production to vehicles. Transport biomethane sits well in the broad circular economy, energy, and environmental system providing services across a range of sectors including reduction in fugitive methane emissions from slurries, treatment of residues, environmental protection, provision of biofertiliser, provision of food grade CO₂ and a fuel readily available for long distance heavy haulage. What we do not have is time to postpone the sustainable implementation of such circular economy biomethane systems as the climate emergency will not wait for absolutely perfect zero emission solutions; should they exist.