Revision of the Renewable Energy Directive creates an opportunity to set a clear pathway for renewable gaseous fuels

Position paper on the Renewable Energy Directive

The European LPG industry supports the European Union's ambitious goal to become climate neutral by 2050 and is fully committed to enable achieving it. For this reason, the LPG industry developed pathways showing that the demand for LPG in 2050 can be entirely met with Renewable LPG (rLPG).

Renewable Liquid Gas, also known as bio-propane (RED II, Annex III), **Renewable LPG,** or bioLPG, is a renewable liquefied gaseous fuel that is already available today on the European market in growing quantities.[1] Renewable LPG is chemically and physically identical to conventional LPG, allowing industry and consumers to seamlessly transition to a renewable solution. Renewable LPG can be 'dropped-in' to existing supply chains and can be used by consumers in their existing heating appliances or cars, stored in existing bulk tanks and cylinders, and transported using today's infrastructure and skilled workforce.

Renewable Liquid Gas, if supported by a regulatory framework promoting R&D activities and further means of productions, offers a long-term, cost-effective pathway to reduce carbon and air pollutant emissions from hard-to-decarbonise sectors such as transport and rural heating. LPG is one of the cleanest fuels available in comparison with conventional, high-carbon fuels such as coal, heating oil, diesel and petrol. Switching from an oil boiler to an LPG one can reduce CO_2 emissions up to 55% when using LPG and up to 83% when using bioLPG.[2] Furthermore, LPG from fossil and renewable origin has significant potential to reduce air pollution compared to other energy sources. Boilers using LPG emit 80-99% less PM and 50-75% less NOx than solid and liquid fuels boilers (such as coal, heating oil, peat, and biomass). LPG cars have almost no other harmful air pollutant emissions.

Renewable DME (rDME) also offers huge opportunities for near term decarbonisation, not only in the transport sector but also in industrial and domestic heating and cooking applications. It is a sustainable gaseous fuel that can reduce greenhouse gas (GHG) emissions by more than 80% and it significantly improves local air quality when substituting diesel, heating oil and coal.

Liquid Gas Europe's recommendations for the RED revision

To accelerate the take-up of bioLPG and rDME in the EU and make a decisive contribution to the EU's ambition of reducing net greenhouse gas emissions by at least 55% by 2030 – and ultimately becoming climate neutral by 2050 – Liquid Gas Europe urges Members of the European Parliament and the Member States to consider the following recommendations:

1. Ensure a regulatory framework which supports production pathways of renewable liquid gas and R&D activities, and incentivises their uptake to help achieve the increased RES target
2. Recognise all relevant production pathways of bioLPG and rDME (Annex V)
3. Define renewable LPG in Article 2 and include its energy content in Annex III alongside other terms such as 'bio-butane', 'renewable propane', and 'renewable butane'
4. Ensure that Guarantees of Origin and sustainability certificates are compatible and complementary

[1] See ANNEX I for a glossary with key definitions of all products

[2] CE Delft (2019) Emissions of (bio)LPG and other energy carriers in domestic heating, BBQs and forklift trucks, country report Belgium, p. 9-11.

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1. Ensure a regulatory framework which supports the production of renewable gaseous fuels and incentives their uptake to help achieve the increased RES target

Building on the Directive 2018/2001/EU, the Commission's proposal increases the current EU-level target of 'at least 32%' of renewable energy sources in the overall energy mix to at least 40% by 2030, which represents doubling the current renewables share of 19.7% in just a decade. The proposal also highlights the need to do more to reduce emissions in the building sector by setting a new benchmark of 49% renewables use in buildings by 2030 and by making the indicative 1.1 % point annual increase of the heating & cooling target binding on Member States.

Liquid Gas Europe supports the European Union's Green Deal objectives and has showcased that 100% of the product that LPG companies will distribute in 2050 can come from renewable sources. **To achieve this, however, a right regulatory framework needs to be put in place which a) gives confidence to industrial actors to invest in the emergence of innovative solutions for the production of renewable liquid gas, b) supports the R&D activities and further production of renewable gaseous fuels, and c) incentivises their use. Should this be put in place, Liquid Gas Europe supports the renewable energy targets put forward by the Commission in their proposal**.

One important aspect is the recognition of rLPG and rDME, potential production pathways, and R&D activities in the revised RED (see below). Other elements include support for R&D activities, producers, incentives for fuel distributors, support schemes to help end consumers switch to efficient rLPG heating systems and exemptions for rDME and bioLPG in the context of energy and CO_2 taxes.[3]

2. Recognise all relevant production pathways of bioLPG and rDME

2.1 Renewable Liquid Gas as a co-product

As a co-product, renewable LPG can be produced from a variety of production pathways using renewable feedstocks. One commercially available pathway is Renewable Liquid gas as a co-product of biodiesel produced using Hydrogenation of Vegetable Oils (so-called HVO) from food waste process. R&D progress around Sustainable Aviation Fuel (SAF) can also result in bioLPG. Regarding the two pathways above, there are a variety of feedstocks that are being used for producing bioLPG which include amongst others vegetable oils, used cooking oil and animal fats.

Some of the other potential pathways to produce bioLPG as a co-product, have been demonstrated either at a commercial scale or at R&D stage. It includes gasification combined with Fischer Tropsch synthesis, renewable methanol to gasoline, biomass pyrolysis, alcohol to jet fuel and potentially Power-to-X technologies.

BioLPG as a co-product was launched in 2018 and is currently available in modest but growing volumes. The production is scaling up as HVO's renewable capacity continues to increase. Analysis shows that the future European demand of rLPG in 2050 will be 8-12 million tons LPG/year.[4] This demand can be entirely met by bioLPG but only if all available technologies producing sustainable renewable gaseous and liquid fuels are operational. It is thus really key that all relevant pathways of production should be recognized and fostered, especially the ones fully dedicated to Renewable Liquid Gas.

[3] Examples of this include the "Biofuels Obligation Scheme" in Ireland or the "Renewable Transport Fuel Obligation" in the UK

[4] Atlantic Consulting (2021) "BioLPG: A Renewable Pathway Towards 2050"

2.2 Renewable Liquid gas from dedicated processes

Further R&D studies have identified dedicated processes to produce directly **from 90% to 100%** bioLPG.

- One pilot consists of in developing a fermentation process within bio refining: reacting Glycerin, that can be produced through transesterification of oil, reacted with H2, can yield bioLPG and water.

- The other R&D project is based on anaerobic digestion within a closed digester fed with organic material such as manure, food waste, sewage sludge and organic industrial waste converted into biogas and digestate.

The revised RED should recognize the important role that renewable liquid and gaseous fuels such as renewable LPG and rDME can play in achieving the objectives of the European Green Deal. **It is therefore key that rLPG and rDME are included in the comprehensive terminology for renewable fuels and that the annexes are amended to reflect the technological state of play with regard to production pathways**. A list of production pathways is included in Annex II of this position paper.

Fuel pathways are differentiated by technology and against each technology a different GHG value can be associated with a specific feedstock**. Typical and default GHG values for bioLPG and rDME should also be included in Annex V alongside the production pathways**.

3. Define renewable LPG alongside other renewable liquid and gaseous fuels or include all variants in Annex III of the Directive

3.1. Inclusion of definitions

Despite calls from the LPG industry to establish a comprehensive terminology for all renewable and low-carbon fuels, the European Commission did not opt to include a clear definition of renewable LPG in its proposal on the revision of the Renewable Energy Directive (Article 2). Given that rLPG is a *liquefied gaseous* fuel that can be produced on the basis of various production pathways and feedstocks and used for a variety of applications, the lack of a clear definition and recognition in RED results in rLPG being excluded or often overlooked in national transpositions.

Therefore, **Liquid Gas Europe requests that renewable LPG is clearly defined in Article 2**. In addition, it should be mentioned as a fuel that can be produced from biomass and renewable sources in Annex III. This means that bio-butane should also be included, next to bio-propane, where its energy content is specified by weight and volume. This would also apply to propane and butane from renewable sources just like it is now done for hydrogen in the revised proposal for RED.

3.2. Create a stimulating regulatory framework for RFNBOs and recycled carbon fuels

Liquid Gas Europe welcomes the European Commission's decision to include two categories of non-biomass-based fuels in the revision proposal: recycled carbon fuels (RCFs) and renewable fuels of non-biological origin (RFNBOs). rDME and rLPG produced from the conversion of non-biogenic waste can qualify as a RCF, while rDME and rLPG produced from renewable hydrogen and carbon dioxide is a RFNBO according to the RED definitions.

RCFs and RFNBOs have an important role to fulfil in the energy transition, the former primarily in the transitional phase, and the latter after 2030. **The amendment of the definition of RFNBOs with Article 1 (1a), ensuring they can be counted as renewable energy regardless of the sector in which they are consumed, will encourage the development and the production of rDME**. The new sub-target in transport for RFNBO of 2.6% by 2030 will stimulate the early uptake of synthetic routes, preparing their larger scale development after 2030.

Liquid Gas Europe welcomes the introduction of greenhouse gas emissions savings criteria for both categories in the proposal in Article 1 (19). **At the same time, we call on the European Commission to shortly specify the methodology for assessing greenhouse gas emissions savings from renewable fuels of non-biological origin and from recycled carbon fuels in a delegated act**.

For recycled carbon fuels, the current REDII gives Member States the option to decide on whether they can contribute to the targets. Divergent Member State acceptance of RCFs when implementing REDIII will create a fragmented EU market, unnecessary barriers to deployment, and delay their market access and uptake in the EU. As the EU and its Member States should be able to rely on all sustainable solutions available to decarbonise the energy system, **Liquid Gas Europe calls to include RCFs in the calculation of the greenhouse gas reduction target by default**.

4. Ensure sustainability certificates and Guarantees of Origin are compatible and complementary

RED II has expanded the sustainability and greenhouse gas emissions saving criteria for biogas/bioLPG and other biomass fuels from transport to all energy uses (Art. 29 and 30). To show compliance with these criteria, the RED II provides two options: follow a national scheme or certification by so-called "voluntary certification schemes" which must be recognized by European Commission. For the certification of compliance with sustainability criteria, a mass balance system is to be used, which implies a degree of "physical tracking". Guarantees of Origin, on the other hand, can be transferred separately or together with the physical transfer of energy, which is often referred to as "book & claim" principle.

From the point of origin of feedstocks till the product/fuel is introduced into local distribution infrastructure, the physical tracking of molecules is possible and should be made mandatory. Afterwards, the gaseous fuel enters off-grid distribution networks which can be treated as single logistical facilities that require the contractual flow of green molecules rather than the physical flow. Introducing physical tracing at each intermediate location would make the system cumbersome adding layers of complexity. The certification and verification system needs to introduce minimum monitoring and reporting requirements to ensure transparency in tracking of sustainability credentials along the fuel value chain and to avoid the risk of double counting and fraud. Any requirements that are unnecessarily bureaucratic could make the system inefficient and costly for fuel suppliers. Such a system would severely limit the market growth and uptake of biofuels including bioLPG/bio-propane.

Illustration: Green Gas Certification Scheme (GGCS)
The Green Gas Certification Scheme (GGCS) in the UK tracks bio-propane with in the network of bottles and tankers. It tracks the green gas from its injection into the distribution network of buses and trucks as well as its sale to a supplier or trader, through to when it is sold on to an end-use consumer. The scheme traces contractual flows of green gas in the distribution infrastructure rather than physical flows, and since each unit of bio-propane replaces a unit of conventional propane it ensures there is no double-counting or double-selling of bio-propane. Bio-propane is a certified renewable energy product that is eligible for incentives under Renewable Transport Fuel Obligations (that were defined in line with RED

requirements). Bio-propane units are ISCC EU certified, which fuel distributors receive from bio-propane producers such as Neste. The certificate guarantees that there is physical tracing of bio-propane and its sustainability credentials from the point of origin till the product enters into local distribution infrastructure. Afterwards, the credentials of the ISCC certificate are embedded in a local/national scheme (GGCS) that traces the contractual flow of green gas in the distribution value chain. This is an example of a reliable system that implements RED requirements on fuel sustainability and traceability.

Liquid Gas Europe considers that the revision of the directive should facilitate cross-border trade of bioLPG and its recognition under different policy instruments. This could be done by ensuring that sustainability certificates and certificates issued using book and claim such as Guarantees of Origin are compatible, rendering it possible to use them together in a complementary manner. F**or gaseous fuels, sustainability certificates could be issued using the mass balancing system defined by RED II until the product enters downstream distribution value chain. Once the renewable gas enters the distribution infrastructure, GOs should become the main instrument to carry information**. GOs compatible with sustainability certificates would enable smooth flow of information till it reaches the end consumer.

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About Liquid Gas Europe
Liquid Gas Europe is the authoritative voice for the European Liquefied Petroleum Gas (LPG) industry, and is composed of national LPG associations, the main European LPG suppliers, distributors and equipment manufacturers. With the support of its Taskforces of industry experts, Liquid Gas Europe is actively involved in concrete initiatives and programmes to ensure the sustainable, safe and efficient development of LPG and bioLPG in Europe.

ANNEX I – Glossary

- **Renewable LPG or Renewable Liquid Gas:** It consists mainly of propane and/or butane or the combination of the two produced from renewable sources including sustainably sourced biomass. It could also include propylene, butylene, iso-propylene and isobutylene all derived from renewable including sustainably sourced biomass feedstocks. They are normally liquefied under pressure for transportation and storage.

- **Renewable propane:** Propane produced from renewable sources

- **Renewable butane:** Butane produced from renewable sources

- **BioLPG:** Consists mainly of bio-propane and/or bio-butane or a combination of the two.

- **Bio-propane:** Propane produced from biomass and/or biomass processing operations

- **Bio-butane**: Butane produced from biomass and/or biomass processing operations

- **rDME**: stands for renewable Dimethyl Ether and can be blended with (bio-)propane

ANNEX II – Overview of renewable LPG and renewable DME production pathways

A. Renewable LPG Production Pathways:

Pathway	Feedstock	Operator	Country	Project description
LPG from HVO renewable diesel production	Vegetable oils, vegetable oil processing waste and residues, used cooking oil, animal fats, fish fat, tall oil, technical corn oil	Neste Oil	Rotterdam, The Netherlands	Neste Oil refinery in Rotterdam using waste fats and vegetable oils to make premium quality renewable diesel and biopropane.
LPG from HEFA/SAF production	Vegetable oils, vegetable oil processing waste and residues, used cooking oil, animal fats, fish fat, tall oil, technical corn oil	Neste Oil	Porvoo, Finland	Neste Oil refinery in Porvoo Finland is using waste fats and vegetable oils to make Sustainable Aviation Fuel (SAF) that is distributed around the world. Biopropane and biobutane are also produced as a co-product.
LPG from Fischer Tropsch diesel and jet fuel	Forestry and sawmill residues Household and commercial solid waste	Red Rock Biofuels (RBB)[5] Velocys[6]	Oregon, USA Immingham, UK	RBB is using forestry and sawmill residues to make FT biodiesel and biojet fuel. The process also results in fractions of biopropane and biobutane. Velocys will take thousands of tonnes of household and commercial solid waste and turn it into clean burning sustainable jet fuel.
LPG from Pyrolysis oil	lignocellulosic biomass	BTG-BTL[7]	Hengelo, The Netherlands	BTG-BTL is using fast pyrolysis technology to convert lignocellulosic biomass into a dark-brown liquid best known as pyrolysis oil (biocrude). Pyrolysis oil can be co-processed in a traditional refinery to produce gasoline, diesel and/or kerosene. A gas mixture containing LPG components is also produced as a co-product.
LPG from Alcohol to Jet fuel	Industrial organic waste	Ekobenz[8]	Bogumiłów, Poland	UGI International, one of the world's largest LPG distributors, announced a new supply and development partnership with Ekobenz, a Polish technology specialist in catalytic conversion of bioethanol to bio-gasoline and bioLPG.
LPG from Biogas	Biogas	Alkcon[9] Plasmerica[10]	(Patent pending)	Alkcon Corporation has developed a proprietary process for the conversion of methane to propane. The process can convert natural gas, biogas, landfill gas or

[5] https://www.redrockbio.com/
[6] https://www.velocys.com/2019/08/20/plans-submitted-for-the-first-waste-to-jet-fuel-plant-in-the-uk-and-europe/
[7] https://www.btg-btl.com/en/technology
[8] https://biofuels-news.com/news/partnership-formed-to-drive-biolpg-availability-across-europe/
[9] https://ww.alkcon.com/
[10] https://www.plasmerica.com/our-technology/

				wellhead flaring gas to liquefied propane gas. Plasmerica has developed a similar process for biogas/methane to LPG conversion.
LPG from IH2 technology	Agri residues, forestry residues, MSW	Shell[11]	Bangalore, India	IH2 technology is a continuous catalytic thermo-chemical process which converts a broad range of forestry/agricultural residues and municipal wastes directly into renewable hydrocarbon transportation fuels including diesel, gasoline and jet fuel. The process also results in fractions of LPG.
LPG from Power to X	Renewable electricity and CO2	Highly Innovative Fuels (HIF) Consortium[12]	Magallanes, Chile	The project will produce green hydrogen derived from water separated through electrolysis using 3.4MW of dedicated wind energy. The hydrogen will be combined with CO2 from the atmosphere and synthesized into green methanol, which will then be used to produce carbon-neutral gasoline and LPG.

B. Renewable DME Production Pathways

Pathway	Feedstock	Operator	Country	Project description
DME from renewable methanol	Renewable methanol	Nouryon[13]	Rotterdam, Netherlands	Nouryon are producing renewable DME by co-processing renewable methanol alongside fossil methanol in their existing DME plant. The methanol is catalytically converted into DME.
DME from biogas	Manure	Oberon Fuels	Brawley, California	Oberon Fuels has developed proprietary skid-mounted, small-scale production units that converts biogas from dairy manure and food waste to DME.
DME from gasification	MSW, sewage sludge, lignocelluosic biomass	Kew Technology	Wednesbury, United Kingdom	Kew Technology is using advanced gasification technology to convert MSW, waste and lignocellulosic biomass into DME.
DME from Power to X	Renewable electricity and CO2	RWE[14]	Niederaussem, German	RWE are using captured CO_2 and electricity to produce DME

[11] https://www.shell.com/business-customers/catalysts-technologies/licensed-technologies/benefits-of-biofuels/ih2-technology/demonstration-facility.html
[12] https://www.argusmedia.com/en/news/2214112-chile-clears-groundbreaking-green-h2-fuels-project
[13] https://www.nouryon.com/products/dimethyl-ether/
[14] http://alignccus.eu/news/making-fuels-co2-rwe-unveils-new-synthesis-pilot-plant-germany