



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

Impact Assessment Methodology

Revision of the Renewable Energy Directive

Deploying renewable liquid gases for decarbonisation through the introduction of an EU wide renewable heat blending mandate

Contents

EXECUTIVE SUMMARY	2
1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT	4
1.1. Key aspects of the policy framework under assessment	4
1.2. Interactions with other initiatives and policy instruments	5
2. PROBLEM DEFINITION.....	12
2.1. What are the problems?	12
2.2. What are the problem drivers?	14
3. REASONS FOR EU ACTION	17
3.1. Legal basis	17
3.2. Necessity of EU action.....	18
3.3. Added value of EU action	18
4. OBJECTIVES: WHAT IS TO BE ACHIEVED?	19
4.1. General objectives.....	19
4.2. Specific objectives	19
5. WHAT ARE THE AVAILABLE POLICY OPTIONS?	21
5.1. Business as Usual scenario	22
5.2. Fragmented policy scenario	25
5.3. Supportive Policy scenario	25
5.4. Scope of the proposed blending mandate and alignment with long-term targets.....	27
6. WHAT ARE THE IMPACTS OF THE PREFERRED POLICY OPTION?.....	30
6.1. Economic viability – end use cost assessment of rLG	30
6.2. Emissions reduction impact	38
7. CONCLUSION	41



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

EXECUTIVE SUMMARY

Decarbonising heating remains one of the most significant and complex challenges in the European Union's energy transition. While electrification is central to long-term decarbonisation pathways, it is not cost-effective or technically feasible to deploy in all regions or for all consumer groups. This is particularly evident in rural and off-gas-grid areas, where building stock is often older and less energy-efficient, where infrastructure constraints are more pronounced, and where households face higher affordability barriers. In these areas, liquefied petroleum gas (LPG) provides essential heating and process energy to approximately 7 million households and 700,000 businesses across the EU.

Renewable liquid gases (rLG), including BioLPG and renewable dimethyl ether (rDME), offer a viable pathway to decarbonise these LPG-reliant consumers. As drop-in fuels, BioLPG can be blended progressively with fossil LPG and used in existing storage, distribution networks, and appliances. This enables immediate emissions reductions without imposing extensive upfront investment costs or requiring deep renovation works. Renewable liquid gases can therefore complement electrification by providing an alternative decarbonisation route for consumers for whom heat pumps or network solutions may be unsuitable or prohibitively expensive.

Despite their potential, the deployment and production of renewable liquid gases remain limited. EU production is currently estimated at around 0.25 Mt, largely as a co-product of Hydrotreated Vegetable Oil (HVO) and Sustainable Aviation Fuel (SAF) production, representing less than 2% of LPG demand for energy purposes. Projections indicate potential growth to 1.0–1.6 Mt by 2030, but further scale-up requires dedicated production pathways and greater investment in supply chains. These investments are unlikely to materialise in the absence of clear, long-term demand signals.

Existing EU policy frameworks do not provide such signals. Under RED III, renewable liquid gases are not supported by dedicated, binding targets for heating. Provisions for buildings and industry are indicative, and rLG competes indirectly with other renewable energy carriers under broad sectoral targets. Carbon pricing through ETS II will increase the cost of fossil LPG but, without complementary measures, is unlikely to deliver stable conditions sufficient to drive large-scale investment in renewable alternatives. In addition, renewable liquid gases receive limited explicit recognition in EU legislation, and outdated or unclear fuel definitions complicate consistent implementation at national level.

The decarbonisation of rural heating further underscores the need for diversified solutions. Studies demonstrate that full electrification is not technically or economically feasible for a significant share of rural households across EU Member States. High upfront costs associated with appliance replacement, building fabric upgrades, and connection infrastructure present barriers, particularly for low-income or geographically isolated households. Industrial users requiring medium-to-high temperature heat face similar constraints, as electrification technologies become substantially more costly at higher temperature ranges and may be technically infeasible in some cases.

Electrifying all current LPG demand would also place additional pressure on electricity systems. Modelling indicates that such electrification would increase annual electricity consumption by approximately 4.1% and raise winter peak demand by 4.4%. Meeting this incremental peak would require substantial additional firm generation capacity and, in many regions, further distribution network reinforcement. Renewable liquid gases can mitigate these system-level challenges by providing a firm, storable, low-carbon alternative capable of reducing incremental electric peak load.

With an appropriate policy framework in place, renewable liquid gases could meet up to 50% of LPG energy demand by 2040, resulting in approximately 20 MtCO₂ of annual emissions reductions. This would deepen emissions reductions across the manufacturing, residential, commercial, and agricultural sectors, where LPG plays a role despite representing a relatively small share of overall energy consumption. By 2050, renewable



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

liquid gases could potentially replace most fossil LPG, delivering emissions reductions of approximately 40 MtCO₂ relative to current levels.

To realise this potential, long-term demand visibility is required. This impact assessment therefore considers the introduction of an EU-wide renewable heat blending mandate for liquid gases, aligned with the structured, binding mandate frameworks already applied in the transport sector under RED III and in dedicated legislation such as RefuelEU Aviation and FuelEU Maritime. A blending mandate, designed on either a renewable energy share or greenhouse gas reduction basis, would provide a predictable and harmonised market signal, support investment in new production capacity, and guide efficient allocation of feedstocks across sectors. The mandate could be phased in progressively, with appropriate market-stabilising mechanisms, to avoid sharp price impacts while enabling periodic reviews and adjustments.

Harmonisation across Member States would minimise administrative burdens, support the integrity of the Single Market, and avoid fragmented national approaches that could distort competition and impede investment. In parallel, enabling measures such as harmonised certification frameworks, appropriately updated sustainability criteria, and revenue-stability mechanisms for producers would increase market confidence and enhance cost-effectiveness. Ensuring that renewable liquid gases have access to support schemes on an equivalent basis to alternative renewable heating technologies would facilitate equitable consumer choice and help ensure that rural and off-grid consumers can participate fully in the energy transition.

An EU-wide blending mandate for renewable liquid gases would therefore support the EU's wider decarbonisation objectives by enabling a complementary pathway for sectors and consumers for whom electrification is not feasible. It would provide a credible long-term demand signal, unlock investment in domestic production capacity, reduce emissions in a cost-effective manner, and help maintain energy system resilience during a period of rapid transformation.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

1.1. Key aspects of the policy framework under assessment

The EU's climate and energy legislation identifies the decarbonisation of heating and cooling as an area requiring accelerated progress to meet the Union's 2030 and 2040 objectives. Electrification is expected to play a central role, but its implementation varies widely across Member States due to differences in building characteristics, infrastructure capacity and socio-economic conditions. These challenges are most acute in rural and off-gas-grid areas, where consumers often rely on decentralised fuel-based heating and where low-carbon alternatives may be slow or costly to deploy at scale.

In this context, liquefied petroleum gas (LPG) remains an important energy source for households and businesses without access to natural gas networks, providing a flexible and readily available heating option. As the Renewable Energy Directive (RED) has evolved, the need to ensure that these consumers can participate in the transition on an affordable and equitable basis has become increasingly prominent.

Renewable liquid gases (rLG), including BioLPG and renewable dimethyl ether (rDME), offer a potential pathway to reduce emissions from existing LPG systems. These fuels can be blended progressively with conventional LPG and used within the current storage and appliance infrastructure. Their compatibility with existing equipment allows emissions reductions to be achieved where other technologies may face technical barriers or require substantial upfront investment.

However, rLG production remains at an early stage. Current supply is limited, largely arising as a co-product of other renewable fuel processes, and significant expansion would require investment in dedicated production capacity. The current policy framework does not provide the long-term demand certainty necessary to support such investment. RED III's provisions for heating and cooling are largely indicative, and no binding, fuel-specific obligations exist to drive sustained uptake of renewable liquid gases. In the absence of such mechanisms, production scale-up and deployment are likely to remain insufficient for rLG to contribute meaningfully to the EU's decarbonisation trajectory.

These shortcomings in the policy framework translate directly into four major barriers that continue to suppress market confidence and hinder the scale-up of rLG.

1. No clear long term demand signals for rLG

Under RED III, rLG is not subject to any dedicated mandate and instead competes with renewable electricity, hydrogen, and other biofuels for the same emission reduction targets. Other than in transport, these targets are indicative rather than mandatory. This indirect competition creates uncertainty for producers and users and does not provide a stable long-term market signal for rLG. The result is weak investment confidence, unclear future pricing, and limited incentive for end-users to commit to rLG-compatible technologies or long-term supply agreements.

2. Carbon pricing unlikely to give sufficient incentive to switch

The introduction of the Emissions Trading Scheme (ETS) II will increase the cost of LPG, but without complementary policies that support renewable alternatives, carbon pricing will not provide the stable conditions needed for large investments in rLG production. This will create a fragmented and uncertain environment that constrains renewable LPG deployment. Addressing these gaps will be essential to unlock investment, build supply, and ensure that rural and off-grid consumers can participate equitably in the energy transition.

3. Limited visibility for LPG and rLG in EU legislation

Only a small number of EU laws refer specifically to LPG, and even fewer identify rLG as a recognised fuel. Under the Alternative Fuels Infrastructure Regulation (AFIR), LPG is mentioned but described as a transitional

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

option, suggesting declining support in the long term. In addition, buildings and industry are covered only by “indicative targets” or “endeavours” in REDIII. This lack of binding sectoral targets deprives renewable liquid gases of a clear and stable market signal in the very sectors where they can deliver the fastest and most cost-effective emissions reductions.

4. Unclear or outdated fuel definitions

RED separates “biofuels” (usually liquid transport fuels) and “bioliquids” (liquid fuels from biomass for non-transport use) from “biomass fuels” (solid or gaseous), which creates uncertainty for renewable propane and butane, which are “liquid gas” fuels (neither solid, liquid or gaseous fuels). This lack of clarity makes it harder for Member States to implement consistent rules.

The following sections provide a detailed assessment of the relevant EU policy instruments, examining how each contributes to or constrains the development of a coherent framework for renewable liquid gases.

1.2. Interactions with other initiatives and policy instruments

Policy	Relevance to rLG	Implementation status
RED III	Creates demand for renewable fuels but does not explicitly recognise LPG/rLG, forcing it into generic categories and creating ambiguity. Stronger impact in transport than in heating.	In force; implementation via NECPs and national transposition.
ETS2	Places a carbon price on fossil LPG, improving relative economics of rLG, but price levels are far too low to drive major uptake.	Legislated; requirement to procure allowances from 2028.
ETD	Allows tax relief for biomass derived fuels but is optional and inconsistent, with small differentials that do not materially support rLG.	In force; reform under negotiation, but little sign of consensus being reached
EPBD	Drives building decarbonisation and influences heating choices; rLG seen as a practical drop-in option for rural/off-grid buildings.	Recast Directive (EU) 2024/1275 in force, national transposition underway.
AFIR	Explicitly names LPG as transitional alternative fuel, and rLG is a renewable alternative to LPG. Although it doesn’t set targets for LPG infrastructure, the deployment of rLG could use existing infrastructure to decarbonise existing vehicles and is expected to be sufficient to meet current and expected demand for Autogas.	In force and directly applicable.
ESR	Sets national GHG reduction targets for sectors where LPG/rLG is used (e.g., heating, transport) but does not provide specific incentives or recognition for rLG. Deployment depends on national discretion and broader policy support.	In force, revised targets and flexibilities apply from 2021–2030, with national reporting and compliance.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
 ✉ info@liquidgaseurope.eu

Contact Person:
 Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

Renewable Energy Directive (RED III)

What the legislation does

The Renewable Energy Directive (RED) establishes the overarching EU framework for promoting renewable energy deployment across sectors. It sets out the EU-level ambition, including the collective 2030 renewable energy target. It also introduces binding mandates and detailed accounting rules for renewable energy in transport, as well as important provisions affecting heating and cooling, including district heating and cooling systems.

How it relates to liquid gases

RED is the EU's primary engine for creating demand for renewable fuels, especially in transport. It provides the accounting rules, eligibility conditions, and sustainability and Greenhouse gas (GHG) intensity criteria that determine whether renewable liquid gases can count toward national targets and qualify for support mechanisms.

Although RED III does not define LPG, propane, or butane directly, the Directive includes several fuel categories into which renewable liquid gases must be placed. These include "bioliquids" for non-transport liquid bioenergy use, "biofuels" for liquid transport fuels, "biomass fuels" for gaseous and solid biomass fuels, "renewable fuels of nonbiological origin" (RFNBOs) for renewable liquid and gaseous fuels produced from electricity and other non-biomass sources, and "recycled carbon fuels" (RCFs) for liquid or gaseous fuels produced from waste streams of non-renewable origin.

This definitional architecture is central for renewable propane and butane because it forces these fuels into categories that do not align neatly with their physical characteristics. Biopropane used in transport will typically attempt to qualify as a "biofuel," although ambiguity arises because the molecule is gaseous at ambient conditions even if stored and traded as a liquid. Biopropane used in heating is generally classified as a gaseous fuel under RED III, however challenges arise as gaseous fuels are often linked with grid-based systems, creating ambiguity for off-grid gaseous fuels like biopropane and introducing uncertainty about how they should be treated in compliance and accounting frameworks.

Further complexity arises from the definitional inconsistency between different pieces of EU legislation. Commission Implementing Regulation 2022/996 classifies LPG as a gaseous fuel but defines DME as a liquid fuel, despite the similar physical properties of propane, butane, and DME. Since renewable DME (rDME) is expected to be used in increasing quantities as a replacement for fossil LPG, the inconsistency risks creating significant practical complications.

Provisions that can encourage renewable liquid gas deployment

In transport, RED III remains the central mechanism for driving renewable fuel uptake. It establishes a transport compliance mandate that Member States may fulfil either through achieving a 29% renewable energy share or through a 14.5% reduction in GHG intensity. It also requires a combined sub-target for advanced biofuels (Annex IX Part A) and RFNBOs amounting to 5.5% by 2030, including at least 1% RFNBOs. The inclusion of RCFs is also allowed under RED III, but their inclusion is left to individual Member. This framework can indirectly support



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

renewable liquid gases when they qualify as advanced biofuels or RFNBOs, depending on feedstock and production pathway.

In heating and cooling, RED III requires Member States to adopt supportive policy measures for renewable heat in buildings and industry, such as financial incentives, replacement schemes for fossil heating systems, renewable heat planning and network development. The Directive also establishes an indicative requirement for average annual increases in renewable heat in district heating and cooling systems and obliges Member States to reflect these measures in their NECPs.

Limitations for liquid gases

A major limitation stems from the absence of explicit recognition of LPG, propane or butane, which forces renewable liquid gases into generic categories (bioliquids, biofuels or RFNBOs). This categorisation introduces interpretative uncertainty and administrative complexity. The Directive draws a sharp distinction between “biofuels” (liquid) and “biomass fuels” (gaseous or solid), which does not align with LPG’s dual identity as a gas molecule that is physically managed in liquid form. By classifying it as “biogas”, RED III implicitly assumes it can be injected into the natural gas grid and structures incentives around that model, an approach that does not align with how LPG is produced, handled or distributed in practice. Sustainability and GHG-intensity rules differ between liquid and gaseous categories, meaning that the same renewable molecule may be subject to different requirements depending on its end use.

For heating applications, which constitute the vast majority of current LPG use for energy purposes, RED III does not set binding targets to provide predictability for demand in heating and additional requirements become unclear or impossible to implement practically. Article 29(10) requires GHG-intensity baselines to be tied to the date on which each consuming installation began using biomass fuels, which fuel suppliers cannot feasibly track. Article 29(1) states that sustainability and GHG emission reduction criteria for gaseous biomass fuels in heating applications apply only when consumption is in an installation with rated thermal input above 2MW, implying that fuels consumed in domestic and small commercial boilers are out of the scope of these criteria. Annex VI further requires suppliers to consider the efficiency of each consuming installation when calculating the GHG intensity of the biomass fuel, another obligation that is not possible to implement in practice.

Moreover, RED’s strong policy emphasis on electrification and RFNBOs risks relegating rLG to residual niches unless Member States deliberately recognise and value its contribution.

Why it is insufficient to drive substantial rLG deployment

RED III creates a market for renewables in aggregate and for transport only. Renewable LPG and all other compliance pathways, including renewable electricity, biomethane, HVO/HEFA, ethanol and RFNBOs, contribute towards the aggregate target. However, the strong demand signals created for many other pathways by RED III are absent for rLG.

The classification ambiguity contributes to uneven national implementation, delays in certification and slower investment decisions. Even where rLG counts toward targets, the Directive does not provide long-term offtake certainty for heating off



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
 ✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

the natural gas grid or industrial process heat, leaving such markets dependent on Member State discretion.

Delegated Acts under RED on RFNBO Methodology

What the legislation does

The Commission Delegated Regulations (EU) 2023/1184 and 2023/1185 establish the detailed EU framework governing the production and accounting of RFNBOs and certain recycled carbon fuels. They include the methodology for calculating GHG savings, verifying renewable electricity use, and determining eligibility.

How it relates to liquid gases

If synthetic rLG (often referred to as e-LPG or e-DME) emerges as a commercial product, producers will likely rely on these delegated acts to demonstrate compliance, either as a RFNBO or as a recycled carbon fuel depending on carbon source. This means that early rLG projects must follow these methodologies to be recognised within RED.

Limitations for liquid gases

Not applicable, as the Delegated Acts introduce no specific constraints for liquid gasses, and any practical or definitional issues lie beyond their scope.

Why it is insufficient to drive substantial rLG deployment

These acts allow producers to demonstrate GHG performance, but they do not create demand. Compliance requirements, particularly those related to proving renewable electricity inputs, may also introduce complexity that reduces bankability for early e-LPG projects.

ETS2 under the revised ETS Directive

What the legislation does

ETS2 creates a new EU emissions trading system covering CO₂ emissions from fuel combustion in buildings, road transport and certain smaller industries. It introduces a carbon price affecting fuels widely used in these sectors, including LPG.

How it relates to liquid gases

For heating markets off the natural gas grid, ETS2 introduces an EU-wide carbon cost on fossil LPG, which could improve the competitiveness of rLG vs fossil alternatives if the scheme recognises low-carbon alternatives appropriately.

Limitations for liquid gases

ETS2 functions as a penalty mechanism rather than a deployment mandate. A carbon price alone does not address certification challenges, appliance switching costs, distribution economics or other practical constraints associated with rLG uptake.

In addition, the carbon price required to make rLG cost-competitive with fossil LPG is far above the levels anticipated by the Commission, which intends to limit ETS2 allowance prices to around €45/tonne CO₂ (in 2020 euros) during the early years of operation.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
 ✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

Why it is insufficient to drive substantial rLG deployment

Carbon pricing rarely creates rapid uptake for a specific fuel type without complementary measures such as renewable fuel mandates, fiscal incentives or supportive infrastructure frameworks. ETS2 thus improves relative economics at the margin but does not provide the strong market signal needed for rLG scale-up.

Energy Taxation Directive (ETD)

What the legislation does

The ETD harmonises EU rules for taxing energy products and electricity, establishing structures and minimum tax rates. It defines energy products using Combined Nomenclature (CN) codes and grants Member States discretion to grant tax relief in specific circumstances.

How it relates to liquid gases

Taxation plays a decisive role in the delivered cost of LPG for off-natural-gas-grid heating and industrial applications. Article 16 allows Member States to reduce taxes on products containing biomass-derived components, providing a potential lever to favour biopropane and biobutane depending on national implementation.

Limitations for liquid gases

Article 16 is optional rather than mandatory, leading to fragmented national tax regimes and inconsistent treatment of rLG. The ETD is structured around product categories rather than lifecycle GHG performance, which limits the potential to reward rLG's lower emissions profile in a harmonised manner.

Why it is insufficient to drive substantial rLG deployment

In the absence of a consistent EU-wide fiscal framework for rLG, investment decisions remain dependent on fragmented national policies. Current and planned frameworks do not provide sufficient market signals to stimulate demand for rLG; additional, well-designed support measures and investment-enabling incentives will be needed to unlock meaningful market uptake.

Alternative Fuels Infrastructure Regulation (AFIR)

What the legislation does

AFIR sets binding EU requirements for deploying alternative fuels infrastructure across the TEN-T network and within Member States, with a strong emphasis on electric recharging and hydrogen refuelling.

How it relates to liquid gases

AFIR is one of the few remaining EU transport regulations that explicitly lists LPG within the definition of "alternative fuels." This recognition allows LPG and rLG to be considered part of Europe's wider alternative fuels landscape.

The explicit reference provides helpful recognition at a time when LPG's position in transport policy is increasingly challenged, and it helps support arguments that rLG should remain part of EU decarbonisation pathways.

Limitations for liquid gases

Although LPG is named as an alternative fuel, AFIR's binding requirements focus almost exclusively on electricity and hydrogen infrastructure. The Regulation explicitly positions LPG and CNG as transitional solutions, stating that sufficient LPG infrastructure already exists and that these fuels are expected to be gradually



replaced by zero emission powertrains. As a result, no provisions support maintaining or upgrading LPG infrastructure that could also enable rLG uptake.

Why it is insufficient to drive substantial rLG deployment

Since LPG infrastructure is already widely available and can be readily used for renewable liquid gases as drop-in fuels, AFIR largely excludes LPG from infrastructure rollout priorities.

Effort Sharing Regulation (ESR)

What the legislation does

The Effort Sharing Regulation (EU) 2018/842 (as amended under Fit for 55) sets binding national GHG emission reduction targets for Member States in non-ETS sectors, including buildings, road transport, agriculture, small industry, and waste. It requires a collective –40% emissions reduction by 2030 (vs. 2005), implemented through annual national emission allocations (AEAs) and compliance obligations. The ESR is the primary EU instrument driving decarbonisation in the buildings and heating sector, where most LPG consumption occurs, while allowing Member States flexibility in policy design.

How it relates to liquid gases

The ESR directly covers key end-use sectors for LPG and rLG, notably:

1. Buildings (heating) – including rural and off-grid households reliant on LPG.
2. SMEs and small industry – process heat applications
3. Agriculture – thermal uses (e.g. drying, heating)

Renewable liquid gasses can contribute to ESR compliance by enabling immediate emissions reductions in existing appliances and infrastructure, particularly in hard-to-electrify and rural areas, without requiring costly system transformation.

Limitations for liquid gases

The ESR is technology-neutral but policy-blind to fuel pathways, resulting in several structural limitations:

- No explicit recognition of renewable fuels, including rLG, as a compliance pathway.
- No EU-level demand signal (e.g. targets, sub-targets, or mandates for renewable fuels in heating).
- Strong reliance on Member State discretion, leading to fragmented and inconsistent treatment of LPG/rLG in national policies.
- Policy delivery is implicitly biased toward electrification, as it is more directly supported by other EU instruments (e.g. EPBD, Ecodesign).
- Lack of integration with RED targets in heating and cooling, limiting coherence across the framework.

Why it is insufficient to drive substantial rLG deployment

The ESR does not create a predictable or scalable demand signal for rLG, making it insufficient to drive investment and market uptake:

- It sets emission outcomes but not deployment pathways, leaving renewable fuels structurally underrepresented in national strategies.
- The absence of binding or indicative targets for renewable fuels in ESR sectors (especially heating) results in investment uncertainty.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

- Flexibility mechanisms allow compliance without structural fuel switching.
- Deployment depends on national policy choices, which often prioritise electrification due to clearer EU-level signals.

As confirmed by the LGE Impact Assessment, this leads to a misalignment between cost-efficient decarbonisation options (e.g. rLG in rural/off-grid areas) and actual policy delivery. As a result, ESR alone cannot unlock the scale of rLG deployment needed to contribute meaningfully to 2030 and post-2030 climate targets.

2. PROBLEM DEFINITION

2.1. What are the problems?

Role of LPG in the EU Energy System

Liquefied Petroleum Gas (LPG) is a widely used energy source across the European Union, particularly for heating. Around 7 million households rely on LPG, primarily for space and water heating, as well as cooking, while approximately 700,000 businesses use it to heat commercial premises or provide industrial process heat.

LPG use is concentrated in rural and off gas grid areas, where access to natural gas infrastructure is limited. In 2024, Eurostat data indicated that approximately 16 million tonnes of oil equivalent (Mtoe) of LPG were used for energy purposes in the EU. Of this, 10 Mtoe were used for heating and 5 Mtoe for road transport. Although LPG accounts for only around 2% of total EU heating energy demand, it remains a critical energy source for many of the 137 million EU citizens living or working in rural areas.

Evidence from EU Member States highlights the extent of this reliance. In France, a study by Mines Paris for France Gaz Liquide found that LPG and heating oil are the primary energy sources in 26% of households in off-natural-gas-grid areas, rising to over 35% in some communes¹. In Germany, 30% of households currently use oil or LPG boilers as their primary heating source.²

Climate targets and the importance of rural emissions

The EU has committed to reducing greenhouse gas (GHG) emissions by 90% by 2040 compared to 1990 levels. According to the European Commission's 2025 Climate Action Progress Report, domestic emissions had fallen by 39% by 2024. Achieving the 2040 target will therefore require delivering 1.3 times the emissions reductions achieved over the previous 34 years within just 16 years, across sectors where progress has often been limited.

Rural emissions will be central to this effort. Research suggests that 20-30% of the EU's GHG emissions originate from rural areas. Without effectively addressing these emissions, the EU's 2040 climate objectives are unlikely to be met.³

Challenges and constraints of decarbonising heating

The decarbonisation of heating and cooling is identified by the European Commission as a key priority for achieving climate targets. Heating and cooling account for approximately half of the EU's total energy use, with around 70% if this still derived from fossil fuels.⁴ At the same time, the share of renewable energy in this sector is increasing only slowly.

¹ France Gaz Liquides, *Energies & ruralité*. Available at: <https://www.energiesruralite.com>

² LPC Delta, (2024). *Analysis of the EU heating market*

³ European Commission, Joint Research Centre, (2025). *Highlights report 2024: From science to impact*

⁴ European Commission, (2025). *Call for Evidence for the EU Heating & Cooling Strategy*



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

The Commission's assessment of updated National Energy and Climate Plans (NECPs) underscores the need for additional action in the buildings sector, particularly to meet targets under the Effort Sharing Regulation.

Electrification is widely recognised as a central pathway for decarbonising heating and, in many contexts, represents the most practical and cost-effective solution. However, for many rural households and businesses currently reliant on LPG or heating oil, electrification may not be feasible due to cost, infrastructure, or technical constraints. In addition, alternative options such as district heating are often unavailable in dispersed rural settings, and the gas grid itself may reduce as a result of mandatory strategic network planning. Together, these trends are likely to leave a rapidly growing number of consumers without access to traditional networked energy solutions and therefore compelled to transition to alternative forms of heating.

Fully electrifying existing LPG demand would require significant additional firm power generation capacity to meet peak demand, placing further strain on energy systems. Electrifying all current LPG demand would increase annual electricity consumption by roughly 4.1% and raise winter peak demand by about 4.4%. Meeting system adequacy under this higher peak would require additional firm capacity.

Depending on the technology mix, indicative capital expenditure ranges from approximately €11-14 billion if met primarily with open-cycle gas turbines, €16-20 billion under a balanced gas portfolio, and up to €46-56 billion if delivered through a diversified low carbon firm capacity mix.⁵

These differences reflect the cost implications of technology selection rather than modelling uncertainty. Higher peak loads may also drive further reinforcement of distribution networks. In certain constrained areas, rLG can help ease pressure on peak electricity demand and reduce the scope of required grid upgrades by limiting additional electrified load. While the scale of this benefit is location-specific, it is particularly relevant where infrastructure expansion faces delivery constraints.

Opportunities and barriers for renewable liquid gas

Renewable Liquid Gas (rLG) presents a practical alternative pathway for decarbonising heating in off natural gas grid areas. It offers a drop-in solution for existing LPG users, with the potential to be cost competitive while reducing the need for major investments in electricity generation, transmission, and distribution infrastructure.

However, several barriers currently limit the scale-up of rLG, which include:

1. **Limited supply** - Current EU production of rLG, primarily as a co-product of renewable diesel and sustainable aviation fuel production, accounts for less than 2% of LPG demand for energy purposes.
2. **Weak demand signals:** The higher cost of rLG relative to fossil LPG suppresses consumer demand, which in turn discourages investment in large-scale production capacity.
3. **Policy gaps:** There is limited policy recognition of the role rLG could play in decarbonising heating. In contrast, targeted measures under the Renewable Energy Directive (RED) have successfully stimulated demand and production of renewable fuels in road transport, while initiatives such as RefuelEU Aviation and FuelEU Maritime are beginning to drive similar progress in the aviation and maritime sectors.

2.2. What are the problem drivers?

Decarbonisation alternatives for rural areas

⁵ Frontier Economics, (2026). *The Role of Renewable Liquid Gases in Europe's Energy Transition – Pathways, Benefits, And Policy Priorities for Scaling Up*



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

While electrification is a key decarbonisation pathway, it may be technically or financially infeasible for many rural domestic, commercial, and industrial users.

Rural buildings are typically older and often require costly and disruptive fabric upgrades for a heat pump installation to replicate the heating performance of an LPG system. Without subsidies, a heat pump installation may cost several times more than a replacement boiler, while fabric upgrades may in some cases require tens of thousands of euro. This level of upfront investment can make heat pumps unviable for many rural households.

Analysis by Frontier Economics finds that with a supportive policy environment, rLG heating systems can be broadly cost-competitive with heat pumps on a total cost of ownership basis, even where heat pumps can be installed without costly fabric upgrades. However, lifetime cost comparisons do not fully capture the significance of upfront investment. For many households, particularly in rural or off-natural-gas-grid areas, rLG-based systems may therefore represent a more accessible decarbonisation pathway.

Economically feasible decarbonisation pathways for domestic heating in rural and off-natural-gas-grid segments often include combustible low-carbon fuels such as liquid gas or rLG, either as standalone solutions or in hybrid systems with heat pumps. A more detailed breakdown below of the country level evidence referred to reinforces this conclusion:

- **France** – Rural single-family homes represent around 25% of the housing stock, or approximately 8.5 million homes. Many are energy inefficient (BER F or G) and exhibit high peak heat losses. Even after renovation, heat pumps with electric backup can be difficult to size effectively.⁶
- **Germany** – There are approximately 620,000 domestic liquid gas fired appliances in use. Rural areas account for 68% of land, but only 32% of the population. Around 4.6 million buildings are heated with oil, with median boiler ages exceeding 20 years. Even under optimistic electrification scenarios, around 830,000 buildings will still require decentralised solutions such as liquid gas.⁷
- **Italy** – Liquid gas is used in 5.6% of dwellings. Electrification is constrained by housing structure, with over 60% of dwellings in condominiums, many lacking outdoor space. Of 10.3 million low-efficiency dwellings (BER F or G), heat pumps are technically feasible in 5.9 million, but only 1.76 million are realistically able to adopt them when income constraints are considered. A BIP study for Federchimica Assogasliquidi and partners also found that heat pumps were practically or economically suitable for fewer than 20% of Italian households.⁸
- **UK** - A study by Gemserv (now Talan), conducted on behalf of Liquid Gas UK, found that up to 36% of UK homes not connected to the gas grid may face technical and/or financial barriers to heat pump installation.⁹
- **Ireland** - A report by the Economic and Social Research Institute (ESRI) found that the median cost of a deep energy retrofit in Ireland ranges from €23,000 for an apartment to €66,000 for a detached house. Even after subsidies, this represents a significant financial burden. Loan repayments could equate to 35% and 97% of average monthly mortgage repayments respectively, even when financed through government backed schemes.¹⁰

Renewable liquid gasses can also be economically attractive for certain industrial uses, including medium to high temperature processes and sites with limited electricity capacity. From a system perspective, increased

⁶ COSTIC for Antargaz, (2023). *Analyse de scénarios de rénovation de maisons individuelles*.

⁷ Deutscher Verband Fluessiggas (DVFG), (2026)

⁸ BIP Consulting, (2024). *Decarbonizzazione dei consumi termici residenziali*.

⁹ Liquid Gas UK, (2024). *The industry's Journey to 2050*

¹⁰ Lynch, M., Tovar Reañós, M., and Farrell, N. (2026). *A review of residential heat decarbonisation in Ireland*, QEC Special Article, Dublin: ESRI.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

use of rLG could help reduce pressure on generation capacity and distribution infrastructure associated with large scale electrification of heating.

For industry, electrification is more viable for processes requiring temperatures below 200°C. However, for higher-temperature applications, heat pumps are insufficient and alternative electrification technologies are significantly more expensive. This reinforces the potential role of rLG in industrial decarbonisation.

Potential of rLG in rural decarbonisation

For current LPG users, switching to rLG offers a cost-effective alternative to electrification. rLG can be used as a drop-in fuel without requiring modifications to existing heating equipment, storage, or distribution infrastructure. It can reduce GHG emissions by more than 80% compared to fossil LPG. Importantly, consumers can achieve emissions reductions without significant upfront capital investment and can decarbonise progressively by blending increasing shares of rLG into their fuel mix and gradually improving energy efficiency through building upgrades. Analysis by Frontier Economics shows that:

- For domestic consumers, rLG can be broadly cost-competitive with heat pumps over the system lifetime on a total cost of ownership basis.
- In high-temperature industrial applications, rLG may be more practical and equally or more cost-effective than electrification.

Challenges to rLG supply growth

Despite its potential, rLG supply remains limited. It is currently produced almost exclusively as a co-product of biorefineries manufacturing renewable diesel (HVO) and sustainable aviation fuel (SAF).

Current EU production capacity is estimated at approximately 0.25 Mt, with projections of 1.0-1.6 Mt by 2030.¹¹ This would be sufficient to replace up to 15% of LPG used for heating, or around 10% of total LPG demand for energy purposes. Achieving higher shares will require large scale deployment of new production pathways, including technologies designed to produce rLG as a primary product.

In addition, at least 50% of rLG produced in biorefineries is currently consumed internally for process heat rather than supplied to the market. Without sufficient demand or price signals to incentivise producers to release this volume, supply growth will remain constrained and investment in new capacity is unlikely to materialise. As a result, rural consumers for whom electrification is not feasible may be unable to access rLG as a decarbonisation alternative.

Availability of sustainable biomass feedstocks for renewable liquid gas

Available evidence from recent EU-focused studies indicates that sustainable biomass feedstock availability is sufficient to support the scale-up of renewable liquid gases (rLG) through to 2050. Across multiple sources, including DI Fuels (2024) and Concawe/Imperial College analyses, sustainably accessible biomass for bioenergy in the EU27+UK is estimated in the range of approximately 120–440 Mtoe by 2030 across multiple literature sources, depending primarily on biomass mobilisation assumptions. When compared with projected total biomass demand for non-transport energy and transport biofuels (approximately 202–212 Mtoe), this demand is fully covered in all mid- and high-availability scenarios. This indicates that, under realistic policy and investment conditions, sufficient feedstock exists to support the expansion of bioenergy across both heating and transport sectors, including the deployment of renewable liquid gases in non-transport applications, with the primary constraint being the pace of industrial capacity deployment rather than resource availability.

Looking towards 2050, both biomass availability and demand increase, but the overall balance remains favourable under credible scenarios. Total biomass demand for energy purposes is projected at approximately

¹¹ LGE internal assessment



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

220–344 Mtoe, reflecting combined requirements for non-transport bioenergy and transport biofuels and varying according to assumptions on electrification and fuel mix. While the range of outcomes widens towards 2050 due to uncertainties in mobilisation rates and competing demand across sectors, the underlying resource base remains sufficient under credible scenarios. Improvements in conversion efficiency—from around 37% today to potentially 70% by 2050—further reduce the biomass input required per unit of fuel produced, strengthening the long-term availability outlook.

Within this broader system, the feedstock requirement associated with renewable liquid gases remains limited relative to total biomass availability. LGE's Outlook analysis indicates that rLG production could reach approximately 27 Mt (LPG-equivalent) by 2050 under a high scenario. Based on LGE analysis of production pathways, a substantial share of this production is expected to be derived from biomass-based routes, with the remainder from e-fuels. When considered in terms of decarbonising current LPG energy demand, this corresponds to an estimated biomass requirement of approximately 17–33 Mtoe, or around 5–10% of total sustainable biomass availability (300-350 Mtoe) in 2050. Overall, this demonstrates that rLG deployment in heating and other non-transport applications can be scaled without creating disproportionate pressure on biomass resources, with the key challenge being mobilisation of feedstock and investment rather than resource availability.

Cost challenges for rLG in rural decarbonisation

Like other biofuels, rLG is significantly more expensive than its fossil equivalent. In 2025, Argus price data showed that biopropane was priced at an average of 2.4 times fossil propane (a price differential of approximately €700 per tonne). A typical household consumes around 0.75 tonnes of LPG annually.

This price differential is consistent with other sectors. For example, data from the EU Aviation Safety Agency (EASA) show that in 2024, sustainable aviation fuel (SAF) cost on average 2.8 times more than fossil jet fuel.¹²

The primary driver of this price gap is the higher cost of renewable feedstocks. Between January 2021 and February 2026, used cooking oil (UCO) averaged 2.1 times the price of Brent crude. Over a longer period (2005–2026), rapeseed oil averaged 1.9 times Brent's price.

Future policy instruments may partially close this gap. From 2028, ETS2 will require fuel suppliers in heating and transport to purchase emissions allowances. However, current estimates suggest that a high carbon price would be required for rLG to reach price parity with fossil LPG.

Cost competitiveness of rLG vs other decarbonisation pathways

Despite its current price premium, rLG can be broadly cost-competitive with electrification in certain applications. However, both pathways are likely to result in higher overall costs compared to continued use of fossil LPG.

For electrification, upfront costs are significant. Heat pump installations may cost several times more than a replacement boiler, with additional fabric upgrades potentially requiring tens of thousands of euros. While lower operating costs can offset some of this over time, Frontier Economics' analysis indicates that the total cost of ownership remains 20-50% higher than continued fossil LPG use. For rLG, the total cost of ownership is estimated to be 30-50% higher than fossil LPG, even when accounting for expected increases in fossil fuel prices under ETS2.

Although many Member States provide subsidies to support heat pump adoption, no equivalent incentives are widely available for consumers switching to rLG or rLG blends. This disparity may result in continued reliance

¹² EASA, (2025). *RefueEU Aviation Annual Technical Report 2025*



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

on fossil LPG among rural consumers who cannot feasibly electrify, leading to missed opportunities for emissions reductions in the heating sector.

Lack of policy recognition of rLG's decarbonisation potential- RED II and RED III

The Renewable Energy Directive (RED) framework has historically placed stronger emphasis on transport than on heating and cooling.

RED II established binding renewable energy targets for 2030, with detailed and enforceable mandates in the transport sector. RED III strengthens the overall ambition, raising the renewable energy target to at least 42.5%, with an aspiration of 45%. It also extends transport-related mandates to aviation and maritime through RefuelEU Aviation and FuelEU Maritime.

While RED II required Member States only to “endeavour to increase” renewable energy in heating and cooling, RED III strengthens this to a binding requirement to “shall increase,” alongside a requirement to implement at least two supporting measures. However, the framework remains comparatively weak.

In particular:

- Provisions for buildings (Article 15a) and industry (Article 22a) rely on indicative targets and general obligations.
- Policy design continues to favour electrification pathways.
- There is limited recognition of the role of renewable fuels such as rLG for sectors where electrification is not practical or cost effective.

The contrast with transport is clear. Transport fuel mandates under RED III, which now extend to aviation through RefuelEU Aviation and to maritime through FuelEU Maritime, are set to drive a substantial increase in demand for renewable fuels. These mandates require fuel suppliers to blend progressively higher shares of renewable energy into conventional fuels, creating a guaranteed market for biofuels and supporting investment in new production capacity and supply chains.

Both transport and heating sectors rely on similar advanced biofuel feedstocks, many of which face intrinsic supply limitations. As mandates tighten, competition for waste and residue-based feedstocks will intensify. A coordinated mandate framework would allow the EU to prioritising uses where electrification is not feasible and enabling investment in feedstock diversification (e.g., advanced waste streams, renewable hydrogen pathways). Without alignment, heating fuels risk being crowded out as transport obligations escalate.

There is a clear contrast between the EU's prescriptive mandates for transport and their approach to the heating sector, where targets have largely been left to Member State discretion. This approach has not, so far, created supportive conditions for renewable heating fuels. A likely explanation is that many Member States consider their Effort Sharing Regulation targets achievable without expanding renewable fuel use in heating. However, emerging national measures such as Ireland's planned Renewable Heating Obligation and Germany's incoming renewable blending quotas for domestic heating, may indicate a growing recognition that additional action in the heating sector is necessary for the heating sector to play its role in achieving set emission reduction targets.

A detailed outline of how the problem will continue to evolve under a 'Business as Usual' scenario with little to no policy change is set out below under Section 5.1.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

3. REASONS FOR EU ACTION

3.1. Legal basis

While a full legal analysis will be required, Liquid Gas Europe understands that its proposal to introduce a blending mandate under RED IV for renewable liquid gas (rLG) used in heating sector falls within the EU's shared competence under Article 194 TFEU, which empowers the EU to adopt measures to ensure the proper functioning of the energy market, promote renewable energy, improve energy efficiency, and support cross-border energy security and sustainability. While Member States retain the right to define their national energy mix, the EU can adopt binding measures to achieve objectives that require coordinated action across the internal market, particularly in areas such as decarbonisation and the deployment of renewable fuels.

The initiative is consistent with the legal framework established under the Renewable Energy Directive (RED II and RED III), which sets binding targets and mandates for renewable energy use in transport, heating and cooling. RED IV will likely build on this framework, providing the EU with the competence to introduce harmonised measures, including sustainability criteria, CO₂ accounting methodologies, and blending mandates for renewable liquid gases. Implementing an EU-wide rLG mandate ensures that market signals are consistent, predictable and cross-border, enabling economies of scale in production and investment that could not be achieved by Member States acting independently.

Subsidiarity is respected because the objectives of increasing rLG deployment and achieving EU climate targets cannot be sufficiently attained at the national level alone. A coordinated EU mandate is necessary to provide a large, integrated market, avoid fragmentation of demand, and unlock investment in dedicated production pathways. Proportionality is maintained as the initiative targets only sectors and applications where rLG can make a meaningful contribution to decarbonisation, primarily hard-to-electrify segments, without unnecessarily restricting Member States' freedom to pursue complementary policies or energy solutions. The measure is thus limited to what is necessary to achieve the EU's 2040 and 2050 climate objectives while leveraging the advantages of the single market.

3.2. Necessity of EU action

Existing provisions under RED III have not generated sufficient momentum in the decarbonisation of liquid and gaseous heating fuels. The broad requirement for Member States to increase the share of renewables in heating and cooling has proven too weak to drive meaningful change. Eurostat data show that bioliquids and biogases accounted for just 0.25% of liquid and gaseous heating fuels consumed in 2024.

In contrast, binding EU-level mandates in the transport sector have delivered measurable results. Eurostat SHARES data indicate that biofuels accounted for over 11% of road transport fuels in 2024, representing an increase of almost 5 percentage points since 2014. This divergence highlights the effectiveness of clear, enforceable EU-wide measures compared with the largely discretionary framework applied to heating and cooling.

Further evidence points to the limitations of fragmented national approaches. Analysis from the European Renewable Gas Registry show that inconsistent treatment and recognition of Guarantees of Origin across Member States has created barriers to investment in and uptake of biomethane¹³. This persists despite the requirement under RED (Article 19) for mutual recognition of Guarantees of Origin. While this issue is not yet directly relevant to the rLG market, it illustrates the importance of clearly defined and consistently applied EU-

¹³ ERGaR & European Biogas Association (2026). *Webinar: Make Biomethane Count - Climate Reporting and Compliance*.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

wide standards for scaling up emerging renewable energy markets. Conversely, regulatory fragmentation can significantly hinder market development.

The case for EU-level action is reinforced by the integrated nature of the LPG market. Eurostat trade flow data show substantial cross-border movements of LPG within the EU. A total of 22 Member States are net importers, collectively importing around 15 million tonnes, of which approximately 30% is sourced from other EU countries. In this context, a consistent regulatory approach to promoting rLG is essential to maintaining efficient cross-border trade, minimising market friction, and enabling producers to de-risk investments by accessing a broader and more predictable demand base.

3.3. Added value of EU action

An EU-level approach would create a larger and more predictable demand base than could be achieved by individual Member States acting alone. This would provide stronger and more reliable investment signals to prospective producers, enabling the development of large-scale production facilities in optimal locations. Such locations are typically characterised by strong logistics infrastructure, efficient access to feedstocks, and the ability to operate at economies of scale.

A useful parallel can be drawn from the transport fuels sector. Evidence shows that investment in renewable fuel production has been concentrated in a limited number of Member States with favourable conditions, supported by EU-wide demand frameworks. For example, nearly 85% of projected HVO and SAF production capacity in the EU-27 in 2030 is expected to be located in just six Member States, despite these countries accounting for less than 50% of the EU's fossil refining capacity.¹⁴

This pattern demonstrates the importance of coordinated EU-level policy in creating sufficiently large and stable markets to attract investment. Instruments such as the RED transport fuel mandates and RefuelEU Aviation have played a key role in enabling this outcome by providing long-term demand certainty across the single market.

More broadly, it illustrates how EU-level action allows capital to be allocated more efficiently, maximising the benefits of the single market. By enabling production to develop where it is most cost-effective, a coordinated approach can reduce the overall cost of decarbonisation while supporting the scale-up of emerging technologies such as rLG.

4. OBJECTIVES: WHAT IS TO BE ACHIEVED?

4.1. General objectives

The objective of this initiative is to introduce policy measures that enable rLG to realise its full potential as a meaningful contributor to the decarbonisation of heating in the EU. In doing so, it supports the EU's broader climate objective of achieving a 90% reduction in GHG emissions by 2040 compared with 1990 levels.

Achieving this objective requires the creation of predictable and long-term demand for rLG. Establishing such demand is essential to enable the scale-up of production capacity and to support the uptake of rLG among existing LPG users, particularly in rural and off natural gas grid areas where electrification may not be technically feasible or cost-effective.

¹⁴ S&P Global Commodity Insights (2025). *Plants producing Renewable diesel/SAF*

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

4.2 Specific objectives

The specific objective of this policy is to create firm, long-term demand signals for rLG, thereby enabling investment in production at scale and supporting its deployment as a direct replacement for fossil LPG in EU homes and businesses.

Today’s energy-related LPG demand corresponds to roughly 50 Mt CO₂e of GHG emissions annually, providing the baseline against which the potential impact of rLG should be viewed. With an appropriate and supportive policy framework, rLG could substitute around 50% of fossil LPG currently used for energy purposes in the EU by 2040. This would reduce GHG emissions by approximately 20 MtCO₂ compared with 2025 levels.¹⁵

According to EEA GHG Inventory data, the sectors in which LPG is most relevant for heating (manufacturing & construction, residential buildings, commercial buildings, and agriculture) had collectively reduced emissions by 619 Mt in 2023 compared with 1990 (-44%). The additional 20 Mt reduction achievable through rLG substitution would deepen this to approximately -46%, representing a further two-percentage-point contribution toward the 2040 target of -90%.

EEA – GHG inventory 1990-2023				rLG reduction potential	
Mt CO ₂	1990	2023	Reduction	2024-2040	
1.A.2 – Manufacturing Industries and Construction	715	358		-20	
1.A.4 – Other Sectors					
1.A.4.a – Commercial/Institutional	170	101			
1.A.4.b – Residential	426	252			
1.A.4.c – Agriculture/Forestry/Fishing	88	70			
	1399	780	-619		-639
			-44%		-46%

However, these emissions impacts must be considered alongside the wider system-level challenges facing Europe’s heating transition.

Electrification is widely recognised as a central pathway for decarbonising heating and is often the most practical and cost-effective solution. Yet for many rural households and businesses currently reliant on LPG or heating oil, full electrification may not be feasible due to cost, infrastructure constraints, or technical limitations.

From a system adequacy perspective, fully electrifying existing LPG demand would also require significant additional firm power generation capacity. Electrifying all current LPG use would increase annual electricity consumption by roughly 4.1% and raise winter peak demand by about 4.4%, necessitating additional firm capacity to maintain security of supply.¹⁶

Looking further ahead, rLG has the potential to replace most, if not all, fossil LPG used for energy purposes in the EU by 2050, delivering emissions reductions of around 40 MtCO₂ relative to current levels.¹⁷ This

¹⁵ Liquid Gas Europe, (2025). Outlook for the Production of Renewable Liquid Gases in 2040 and 2050. Available at: <https://www.liquidgaseurope.eu/resource/outlook-for-the-production-of-renewable-liquid-gases-in-2040-and-2050/>

¹⁶ Frontier Economics, (2026). *The Role of Renewable Liquid Gases in Europe’s Energy Transition – Pathways, Benefits, And Policy Priorities for Scaling Up*

¹⁷ Liquid Gas Europe, (2025). *Outlook for the Production of Renewable Liquid Gases in 2040 and 2050*



Liquid Gas Europe Rue d’Arlon 80, 1040 Brussels, Belgium
 ✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

underscores the role of rLG in supporting a balanced and resilient decarbonisation pathway and providing a low-carbon liquid energy vector that alleviates pressure on electricity grids, serves consumers for whom electrification is not feasible, and complements the broader transformation of Europe’s energy system.

A further objective of this policy is to establish the enabling conditions for efficient rLG deployment across all Member States. This means avoiding fragmented or inconsistent national approaches, reducing the transaction costs associated with regulatory divergence, and fully leveraging the benefits of the Single Market to support scale, efficiency, and investment certainty.

Finally, the policy seeks to ensure explicit recognition of rLG as a credible decarbonisation pathway. This includes enabling rLG to access support schemes on an equivalent basis to other solutions, such as electrification, so that consumers and businesses can choose the most appropriate and cost-effective option for their specific circumstances.

The Outlook for the Production of Renewable Liquid Gases in 2040 and 2050 shows that, with strong policy support and continued technological progress, Europe could produce a median 7,543 LPG-eq kt (96.4 TWh) of renewable liquid gases annually by 2040. Aligning demand signals with this sustainable supply potential and recognising the cross-sector role that rLG can play in supporting system resilience will be essential to realising the full decarbonisation benefits.

5. WHAT ARE THE AVAILABLE POLICY OPTIONS?

The future deployment of renewable liquid gases, including rLG and rDME, will depend to a large extent on the broader policy framework governing low-carbon and renewable fuels in Europe. Current market dynamics alone are unlikely to support significant investment in dedicated rLG production pathways. As a result, policy design will play a decisive role in determining whether rLGs remain niche co-products or develop into scalable, mainstream solutions for hard-to-electrify sectors.

To illustrate the range of possible outcomes, three policy scenarios can be considered. These reflect differing levels of policy coherence, ambition, and cross-sector alignment, and their implications for technology development, production scale, and market uptake:

- **Business as usual** – A continuation of current trends, in which low-carbon molecules remain peripheral in policy frameworks. Electrification continues to receive structural preference, reducing optionality for hard-to-electrify sectors and constraining the development of rLG as a decarbonisation pathway.
- **Fragmented policy** – An inconsistent policy landscape in which some Member States prioritise electrification exclusively, while others adopt more technology diverse approaches. This fragmentation creates uncertainty for investors, limits economies of scale, and slows the development of integrated EU-wide markets for rLG.
- **Supportive policy** – A coherent enabling framework that recognises the complementary roles of electrification and low-carbon molecules across the energy system. Technology neutral approaches support cost optimisation, system efficiency, and resilience, while providing clear long-term signals for investment in rLG production and deployment.

	Business as Usual	Fragmented Policy	Supportive Policy
Technology innovation &	No specific targets for LG industry, technologies remain niche, with	Some European countries advance strongly with decarbonisation policies	Coordinated EU mandates and incentives accelerate commercial deployment and

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

market scale up (BioLPG / rDME)	isolated pilots and no meaningful commercial ramp up of rLGs.	including mandates while others stagnate, limiting regional scale for rLG production pathways.	multi market rollout of new rLG pathways.
Feedstock availability & mobilisation	Limited mobilisation and persistent competition with adjacent sectors.	Uncoordinated national rules, local constraints, and uneven implementation create variability and competition between sectors.	Strong mobilisation enabled by concrete targets for rLGs, coordinated and practical sustainability rules, waste / residue utilisation strategies, and supply chain incentives.
Investment certainty & capital deployment	Capital deployment remains limited, opportunistic, and short-term resulting in mainly co-product volumes of rLGs.	Inconsistent national frameworks increase risks and delay FIDs in on-purpose production routes.	Stable long-term signals unlock large capital flows into production routes and downstream supply chain readiness.
Cost competitiveness	Small volumes prevent cost decline and rLGs remain high premium.	Partial improvements in supportive markets; persistent cost premiums elsewhere.	Significant improvements driven by scale, learning curves, and consistent carbon pricing / tax reforms.
Consumer uptake & adoption	Weak/uncertain price signals and misaligned levies undermine the value propositions of LG industry.	Adoption patterns depend heavily on national price signals and local incentive structures.	Predictable carbon pricing, aligned energy taxes / levies, and targeted CAPEX / OPEX incentives enable strong adoption of rLGs in priority sectors.
Cross-sector policy alignment (heating, industry, transport, agriculture)	Minimal coordination across sectors. Competing uses for biofuels are unmanaged, leading to inefficient deployment and inconsistent standards.	Sectors move at different speeds due to divergent priorities. Lack of harmonised policies results in rLGs flowing into sub-optimal channels.	Aligned, harmonised policies direct rLGs into the most effective uses. Standards are consistent across sectors and sectors work together rather than in isolation.

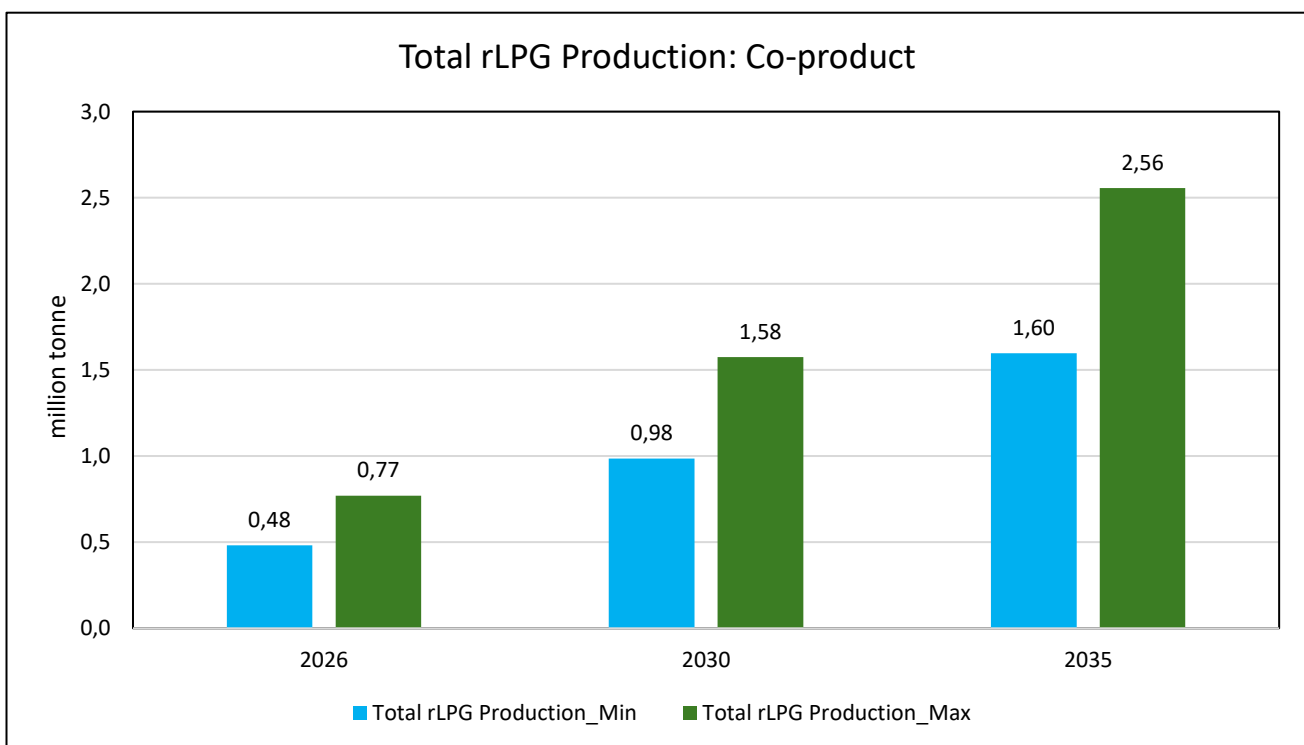
5.1. Business as Usual scenario

Under a Business as Usual or baseline scenario, rLG is expected to be produced predominantly through established biofuel pathways, such as HVO/renewable diesel and HEFA/SAF production. In these processes, rLG arises only as a co-product rather than a primary output.

Investment decisions and policy incentives remain primarily driven by the need to maximise production of Sustainable Aviation Fuel (SAF) and renewable diesel, reflecting binding mandates in the transport and aviation

sectors. As a consequence, there is limited economic or regulatory incentive to develop new production pathways in which rLG, or renewable liquid gases more broadly (including rDME), is the main product.

This dynamic constrains the growth trajectory of rLG supply. Production increases are therefore expected to be incremental and linked to the expansion of existing biofuel capacity, rather than driven by dedicated investment in rLG technologies. As a result, only modest organic growth in rLG supply is anticipated, with no significant breakthrough in production pathways capable of delivering large-scale volumes of renewable liquid gases.



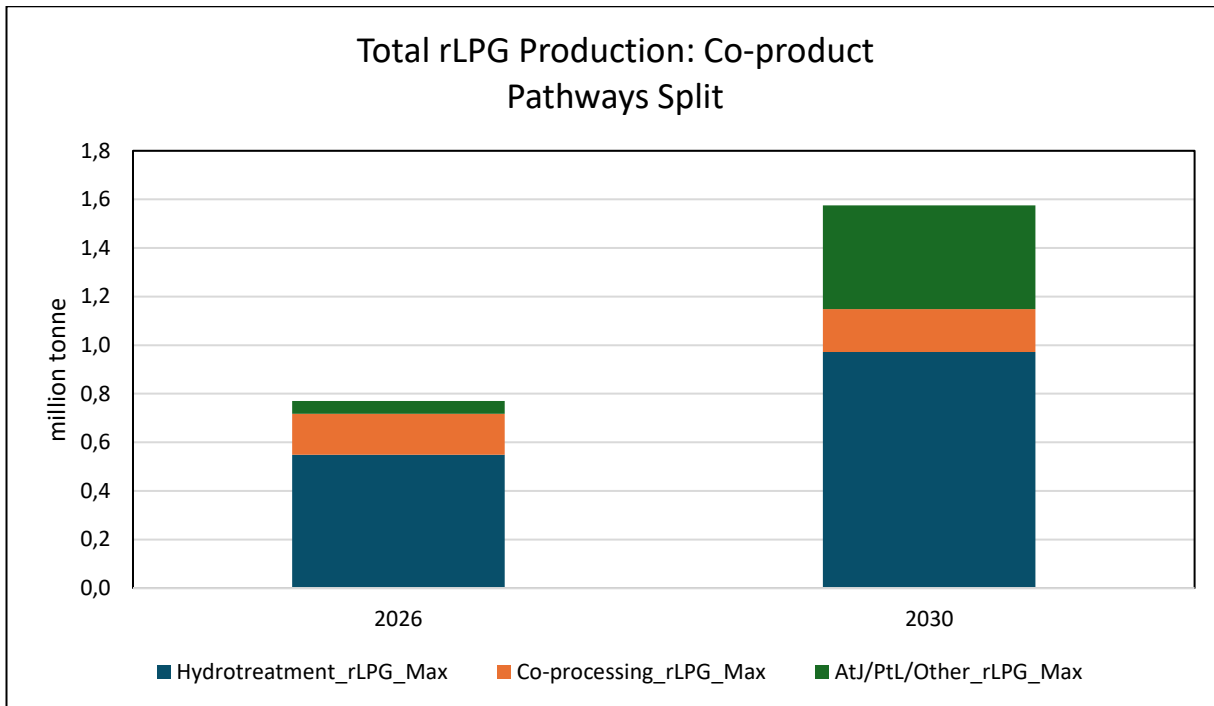
Current projections indicate that co-product rLG from established renewable diesel and SAF production pathways could reach 1.0–1.6 million tonnes by 2030, increasing to 1.6–2.5 million tonnes by 2035. While these volumes represent a meaningful contribution, they are unlikely to be sufficient to align the LPG sector with the EU’s 2040 climate targets or the longer-term objective of climate neutrality by 2050.^{18,19}

In the absence of new, dedicated rLG production pathways capable of delivering significantly larger volumes, and without policy frameworks that actively stimulate demand, the sector risks facing a structural supply gap. This would constrain its ability to transition in line with broader decarbonisation pathways.

The robustness of these projections also varies over time. Estimates up to 2030 are based on refineries and production projects that are already operational, under construction, or formally announced, and therefore provide a relatively reliable outlook for near-term co-product rLG supply. Beyond 2030 however, projections are increasingly based on assumptions rather than confirmed investments, meaning that expected volumes should be understood as indicative rather than committed capacity.

¹⁸ The range is derived using typical rLG yield of 5-8% from refineries making SAF or renewable diesel.

¹⁹ Figures are based on Argus (2026), Global SAF & RD refinery database



For the purposes of this analysis, the upper end of the projected range is used to illustrate the potential contribution of co-product rLG from different production pathways. The majority of rLG volumes toward 2030 are expected to originate from the hydrotreatment route, which currently dominates renewable diesel and SAF production.

By contrast, co-processing volumes are expected to remain relatively stable over the period, as they are constrained by structural factors such as refinery configurations and blending limits. Growth in total rLG production is therefore primarily driven by the expansion of hydrotreatment capacity, as well as the emergence of new SAF and renewable diesel technologies, such as Alcohol-to-Jet and Power-to-Liquid, which are projected to scale up significantly toward 2030 in response to binding mandates and increasing demand for drop-in renewable fuels. As a result, future rLG availability is closely linked to the growth of these mandated fuel pathways, rather than to the development of dedicated rLG production technologies.

A more detailed breakdown of projected volumes for 2030 highlights differing levels of certainty across the project pipeline. Operational capacity, reflecting plants already in production, accounts for approximately 0.55 million tonnes of rLG. Planned capacity, including projects under construction or with final investment decisions, adds a further 0.64 million tonnes. In addition, provisional capacity, comprising announced or early-stage projects, could contribute a further 0.38 million tonnes, although these volumes remain uncertain.

However, a significant share of currently produced rLG does not reach the market. Within existing operational capacity, approximately 50% of output is made available externally, with the remainder typically consumed onsite as process fuel or converted into hydrogen for refinery operations. This creates a structural risk that even planned and provisional capacity, while substantial on paper, may not translate into market-available supply for the LPG sector. Under a Business-as-Usual scenario, this constraint is likely to persist, reinforcing the expectation of limited rLG availability.

Addressing this challenge requires the creation of stronger market incentives for rLG. At present, refiners often have limited economic motivation to supply rLG externally. By establishing clearer market value, particularly in



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

hard-to-electrify segments such as off-grid and rural heating, where rLG can directly displace fossil fuels and deliver measurable decarbonisation benefits, policymakers can shift this dynamic.

Such demand side signals would encourage producers to treat rLG as a valuable market product rather than an internal energy source, increasing the likelihood that planned and announced capacity translates into real, accessible supply. This type of market pull is most likely to emerge under a supportive policy scenario, where coherent and technology-neutral measures create a level playing field for renewable liquid gas molecules and facilitate their uptake across the energy system.

5.2 Fragmented policy scenario

A Fragmented Policy scenario would be characterised by uneven progress across Member States, with some advancing ambitious decarbonisation policies, including mandates, while others lag behind. This limits the development of a sufficiently large and coherent EU-wide market for rLG, constraining economies of scale and slowing the emergence of dedicated production pathways.

Uncoordinated national rules, local constraints, and uneven implementation create variability in demand signals and competition between sectors, increasing investment risk and delaying final investment decisions in new production capacity. As a result, deployment of rLG progresses unevenly across the EU, with uptake concentrated in more supportive markets, while persistent cost premiums and weak incentives in others limit adoption.

5.3 Supportive Policy scenario

A supportive policy scenario would be characterised by coordinated EU-wide mandates and incentives that accelerate the commercial deployment and multi-market rollout of new rLG production pathways. Clear and ambitious targets for rLG, combined with practical sustainability rules, strategies for waste and residue utilisation, and targeted supply chain incentives, create a stable and predictable policy environment.

This, in turn, unlocks large capital flows into production routes and ensure that supply chains are prepared to scale efficiently. Consistent carbon pricing, aligned energy taxes and levies, and tailored CAPEX and OPEX support further strengthen market signals, making investment in rLG economically viable across diverse regions and sectors.

In such an environment, adoption of rLG is driven by both scale and learning effects. Production efficiencies, cost reductions, and accelerated technology deployment are reinforced by coherent and predictable policies, enabling rapid uptake across priority sectors such as off natural gas grid residential heating, commercial buildings, and industrial processes.

Strong alignment between Member States ensures that rLG can be deployed across multiple sectors and borders, maximising the benefits of the single market and supporting a substantial contribution to EU climate targets. Over time, this coordinated approach enables the transition of rLG from a niche co-product to a mainstream, scalable solution for hard-to-electrify segments.

The Renewable Liquid Gas Outlook presents a comprehensive analysis of the potential for renewable liquid gases (rLG), such as renewable LPG and renewable dimethyl ether (renewable DME), to contribute to Europe's decarbonisation efforts. The study's key finding is that, with strong policy support and technological advancements, Europe could produce a median annual production of 7,543 LPG-eq kt (96.4 TWh) of renewable liquid gas (rLG) by 2040.

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

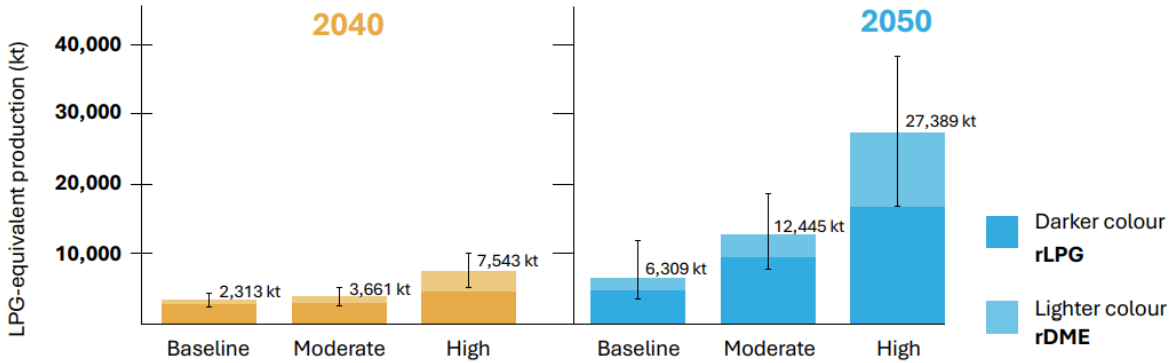


Chart 2: Production scenarios for renewable liquid gas production in 2040 and 2050, Source, NFCC and Frazer Nash

Several studies have also assessed the potential to produce advanced biofuels from sustainable biomass within the EU. Two recent studies, DI Fuels (2024) and Imperial College for Concawe (2021), produce broadly aligned estimates of total theoretical biomass potential. Concawe projects 0.98–1.2 billion dry tonnes per year (EU27+UK)²⁰, while DI Fuels estimates around 1.3 billion dry tonnes per year (EU27).²¹

Even under high-end projections for combined transport and non-transport biofuel demand in 2050, total biomass requirements are expected to remain within the estimated sustainable availability envelope. Under such conditions, eLG would constitute an additional supply option rather than draw upon constrained biomass resources. Furthermore, the anticipated feedstock requirements for BioLPG and bioDME would represent only a minor proportion of the approximately 200 Mtoe of projected non-transport biofuel demand in 2050.

As the electrification of road transport accelerates, the availability of ethanol and the introduction of more stringent SAF mandates are expected to drive greater deployment of Alcohol-to-Jet and other SAF production technologies. Between 2030 and 2040, SAF mandates will likely result in a significant increase in renewable liquid gas (rLG) generated as a co-product of SAF production, supported by multiple technology pathways including Alcohol-to-Jet, power-to-liquid (e-fuels), and biomass gasification.

Feedstock availability will make power-to-liquid and biomass-based routes commercially critical, while technologies such as pyrolysis may also play an important role. Dedicated DME production pathways could contribute a substantial share of the renewable liquid gas mix.

By around 2040, power-to-liquid technologies are expected to mature and begin achieving commercial deployment at scale, contingent on access to low-cost renewable energy. This would enable the production of renewable and recycled carbon LG as a co-product, or renewable and recycled carbon DME as a dedicated output.

Overall, the data indicates that the EU has strong potential to meet bioenergy feedstock needs to 2030 under mid and high availability cases. Looking to 2050, both availability and demand ranges widen materially, driven by assumptions on mobilisation and the pace of electrification and RFNBO deployment. Realising the higher

²⁰ Concawe (2021). *Sustainable biomass availability in the EU, to 2050*

²¹ DI-fuels (2024). *Development of outlook for the necessary means to build industrial capacity for drop-in advanced biofuels.*



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

end of sustainable biomass potential will require a supportive regulatory framework, continued technological progress, and investment in supply chains and production capacity. Higher demand for advanced biofuels is likely to strengthen incentives for mobilisation and conversion efficiency improvements.

5.4. Scope of the proposed blending mandate and alignment with long-term targets

The introduction of a blending mandate under RED IV for renewable liquid gases used in heating sector should be considered as part of a Supportive Policy scenario, in which coordinated EU-wide measures provide predictable demand signals, clear sustainability rules, and aligned incentives across Member States. Under such a scenario, the mandate would accelerate investment in production pathways, facilitate multi-market rollout, and enable rLG to contribute meaningfully to decarbonisation in hard-to-electrify sectors.

Potential design and preferred option

Several European countries have already demonstrated the effectiveness of renewable fuel mandates in accelerating uptake. Ireland is finalising its Renewable Heat Obligation (RHO) Scheme, covering all heating fuels, while other Member States are investigating quota-based approaches. These national experiences provide valuable blueprints for designing an EU-wide rLG mandate under RED IV.

A well-designed EU mandate would create predictable demand signals that would unlock investment and support the scaling of production, while remaining technology neutral and fully compliant with EU sustainability criteria. By giving upstream producers a firm demand signal, the mandate would stimulate supply growth, enabling fuel suppliers to meet their obligations efficiently. Specific blending or GHG reduction targets should be set in consultation with industry stakeholders, aligned with realistic rLG availability and designed to count towards overall renewable energy (RES) targets under RED IV. Compatibility with existing fuel standards and established GHG accounting methods is essential to ensure that the climate benefits of rLG are accurately recognised and credited within national and EU-level energy statistics.

Purpose and application

The mandate should apply to suppliers of liquid gases for heating and other stationary uses, as they are best placed to manage volumes, compliance, and blending. Compliance could be structured either through a rising minimum rLG share or, preferably, a portfolio-wide GHG reduction target. While volume-based approaches are simple and predictable, they do not reflect lifecycle differences between renewable fuel pathways. A GHG-based system, although more complex, better captures the climate benefits of different rLG sources, aligns with EU RES accounting rules, and supports broader climate and energy policy objectives.

A phased implementation trajectory is essential to balance ambition and practicality. Gradual ramp up allows suppliers and producers to scale production, ensures achievable blending targets, and avoids sudden cost spikes for households and businesses. It provides market certainty for investors, supports the development of supply chains and infrastructure, and allows for periodic review and adjustment based on evolving technology, fuel availability, and lessons learned from early deployment.

Alignment with EU climate, environmental, and economic objectives

An EU rLG blending mandate would directly support long-term climate targets, including the 2040 objective of reducing greenhouse gas emissions by 90% compared with 1990 levels and the broader goal of climate neutrality by 2050. By displacing fossil LPG, the mandate would contribute to emissions reductions in hard-to-electrify sectors, particularly rural households, commercial buildings, and industrial processes, without requiring costly infrastructure upgrades.

Environmentally, the mandate would promote the use of sustainably sourced feedstocks, including residues and waste streams, in compliance with RED IV sustainability criteria, helping to minimise land-use impacts and



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

avoid indirect emissions. Economically, stable and predictable demand would accelerate economies of scale, reduce production costs, and support investment in new production capacity, while harmonising deployment across Member States to strengthen the single European energy market.

From an international perspective, the measure would demonstrate the EU's commitment to its obligations under the Paris Agreement and the European Green Deal, showing leadership in deploying renewable fuels in sectors where electrification is technically or economically challenging. By explicitly aligning with EU climate targets, RES counting rules, fuel standards, and GHG accounting methodologies, the mandate ensures that rLG deployment delivers verifiable climate benefits and contributes to EU and Member State compliance with binding climate and renewable energy objectives. It would also complement EU ETS2 by aligning carbon pricing signals with renewable fuel adoption, enhancing policy coherence across climate, energy, and industrial frameworks.

Flexibility and market mechanisms

To manage variability in supply and cost, the mandate should incorporate flexibility mechanisms such as certificate trading, limited banking and borrowing, or buy-outs.

A buy-out mechanism provides flexibility for obligated parties by allowing them to pay a set fee instead of meeting their target through physical volumes. This approach is commonly used in transport fuel mandates, where buy-outs act as a safety valve to manage supply variability and prevent excessive compliance burdens.

Applying the mandate to fuel suppliers, aligned with EU ETS2, ensures administrative efficiency by covering the same entities across the value chain. Such design would maximise deployment potential, support gradual decarbonisation, and provide a clear, predictable pathway for rLG to contribute meaningfully to the EU's climate, environmental and economic objectives, while fully respecting the EU renewable energy framework and associated accounting rules.

The policy mechanism being sought is a binding EU wide blending mandate for suppliers of liquid gas heating fuels, designed to mirror the successful approach applied to transport fuels under RED III. To ensure that renewable fuels are rewarded for their true climate contribution, a GHG-intensity approach is preferred, reflecting the lifecycle emissions performance of different rLG pathways.

Harmonised sustainability certification and mass-balance accounting would facilitate efficient cross-border trade, supporting a coherent and integrated single market for renewable fuels. The mandate should be complemented by targeted support measures to accelerate rLG production, strengthen supply chains, and enable scale-up in line with the EU's climate and energy objectives.

By recognising renewable fuels alongside electrification, this approach would provide rural and off-gas-grid consumers with practical, cost-effective decarbonisation options, protecting them from disproportionate transition costs while advancing the EU's long-term climate, environmental, and economic goals.

Financial measures

A coherent package of financial measures will be essential to accelerate the uptake of rLG and to ensure that both producers and consumers can participate on fair terms with other decarbonisation options. First, cost support mechanisms for rLG adopters should be introduced that are equivalent to those already available to heat pump adopters, for example through instruments such as the Social Climate Fund. Providing comparable consumer incentives would help overcome upfront cost barriers, broaden access to low carbon heating choices, and support households and businesses, particularly in sectors that are difficult to electrify.

Second, revenue certainty mechanisms for rLG producers are needed to give investors confidence to develop new production capacity. Similar to the model being developed in the UK for sustainable aviation fuel producers, long-term price stability tools such as contracts for difference, fixed-premium schemes, or



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

guaranteed offtake agreements can reduce market risk and attract private capital. These mechanisms enable producers to plan effectively, scale production, and reduce costs over time.

Finally, dedicated capital from major EU funding streams, such as the Innovation Fund, should be allocated specifically to rLG projects. This could take the form of ring-fenced funding windows or minimum allocation thresholds to ensure that rLG technologies are able to compete with more established solutions. Such targeted support would accelerate early deployment, help demonstrate diverse production pathways at scale, and contribute to the development of a competitive rLG market that aligns with wider decarbonisation goals.

Enabling policy required

To enable effective implementation, policy updates are required, including amendments to Regulation 996 to reflect the practical dynamics of LG supply chains and logistics within mass-balancing frameworks. In addition, targeted revisions to the RED sustainability and GHG criteria for heating fuels are needed to address elements that are currently infeasible, as outlined in Section 1.2. These changes would ensure that regulatory requirements are aligned with operational realities and support achievable compliance. At the same time, broader policy instruments, including CO₂ standards for cars and vans, Ecodesign and Ecolabelling measures that favour higher-efficiency, low-carbon technologies will also influence the demand outlook for liquid gases across both transport and heating sectors.

Building on this assessment, the key policy asks below outline the regulatory and market instruments necessary to support an EU-wide rLG blending mandate.

Key policy asks for an EU-wide blending mandate

The measures below define the regulatory, market, and support mechanisms required to scale renewable liquid gases across Europe in line with EU climate and energy objectives:

1. **Introduce an EU-wide renewable mandate for liquid gas heating fuels based on volume blending or GHG reduction**, aligned with the approach applied to transport fuels under RED III which ensures that rLG pathways delivering higher emissions reductions are more effectively incentivised.
2. **Incorporate flexibility and market-balancing tools** such as tradable certificates, limited banking and borrowing, and cost-effective buy-out options.
3. **Implement a phased ramp-up trajectory** to allow supply chains to scale, avoid sudden consumer cost increases, provide investor certainty, and enable periodic policy review and adjustment.
4. **Promote harmonised certification and mass-balance systems across the EU**, enabling efficient cross-border trade and supporting the development of a fully integrated renewable gas market.
5. **Provide targeted consumer support**—equivalent to heat-pump incentives—and ensure **revenue certainty for producers** through instruments such as contracts for difference, fixed-premium schemes, or guaranteed offtake agreements.
6. **Update enabling policies and regulations**, including Regulation 996, RED sustainability and GHG criteria, CO₂ standards, and Ecodesign and Ecolabelling to support rLG deployment.
7. **Recognise renewable liquid gases (rLG) as a complementary decarbonisation pathway**, ensuring rural and off-gas-grid consumers maintain access to cost-effective and practical low-carbon heating options alongside electrification.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

6. WHAT ARE THE IMPACTS OF THE PREFERRED POLICY OPTION?

A report commissioned by Liquid Gas Europe members DCC and SHV Energy and developed by Frontier Economics sets out the economic viability, system implications and climate impact of renewable liquid gas (rLG) across the EU27, the United Kingdom, Norway and Switzerland, which focuses on residential heating and selected industrial process-heat applications. Using the findings of this report as an anchor point, this section of the impact assessment provides an outline of the cost and emissions reductions that could be positively influenced through the introduction of a blending mandate for rLG under RED IV as part of a supportive policy scenario.²²

6.1. Economic viability – end use cost assessment of rLG

To reflect realistic market uptake, the subsequent application-level analyses by Frontier Economics are based on a central liquid gas blend, in which the share of rLG relative to conventional LPG increases gradually over time, rather than assuming an immediate switch to 100% renewable supply.

Driven by rising carbon prices, fossil LPG prices are expected to increase over time for both household and industrial users. Fossil LPG therefore serves as a key reference point for estimating end user prices of rLG blends. Country specific LPG prices are derived by adjusting observed household and industrial prices from public sources to remove taxes, VAT, and existing carbon costs, and then benchmarking against wholesale prices to estimate distribution and retail margins.

Wholesale LPG prices are based on published Argus quotations and projected in line with crude oil trends, reflecting the strong linkage between LPG and oil markets, while lower distribution costs are assumed for industrial users due to economies of scale. This methodology ensures that rLG price estimates are consistent, comparable, and reflective of real market conditions across Member States.

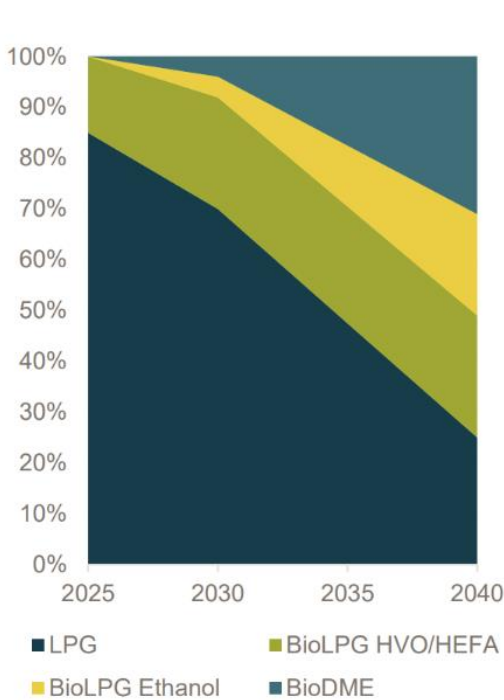
Impact of rising renewable share on liquid gas blend costs

End-user prices for rLG are derived by applying pathway-specific cost mark-ups to fossil LPG, reflecting the higher production costs of renewable feedstocks. In practice, the transition to low-carbon liquid gases is expected to occur gradually through increasing blends of fossil LPG and rLG, rather than through an immediate full substitution. The Frontier Economics analysis looks at the impact to households of using a liquid gas blend with a rising renewable share over time, with the fossil share declining from around 85% in 2025 to 25% by 2040 and reaching 0% by 2050.

This blend reflects a potential purchasing choice at the consumer level rather than overall market penetration, recognising that individual users may adopt higher shares of renewable fuels even where system-wide availability remains limited. Over time, the blend shifts from fossil LPG and mature pathways such as BioLPG (HVO/HEFA) toward a fully renewable mix by 2050, with emerging pathways gaining importance as they scale and costs decline.

The resulting blended prices show a gradual increase in renewable content without sharp price disruptions. While higher renewable shares increase costs relative to fossil LPG, this is partly offset by expected cost reductions in rLG production. Overall, the blended approach provides a consistent and realistic reference point for assessing transition pathways, without implying specific forecasts of market penetration or regulatory outcomes.

²² Frontier Economics, (2026). *The Role of Renewable Liquid Gases in Europe's Energy Transition – Pathways, Benefits, And Policy Priorities for Scaling Up*



Source: Frontier Economics

Residential case studies: Germany and Poland

Frontier Economics’ economic viability review of rLG in residential heating was assessed using a total cost of ownership (TCO) framework, which captures both upfront capital costs and ongoing operating expenses over the lifetime of heating technologies. Costs are expressed as annualised averages for investment years 2025, 2030, and 2040, enabling comparison over time.

Their analysis compares rLG-based boilers with air-source heat pumps on a technology-neutral basis, excluding subsidies and support schemes to reflect underlying cost structures. It focuses on representative single-family homes in Germany and Poland. These homes are typically older, moderately insulated, and located in rural or off-natural-gas-grid areas, based on European building typologies.

Heating demand is held constant over time, with cost variations driven by changes in technology performance and energy prices. Operating costs are calculated using country specific thermal demand profiles and efficiency assumptions, including temperature dependent performance for heat pumps, which are modelled with backup electric heating to reflect real world conditions in existing building stock. Capital cost assumptions for heat pumps do not take into account any necessary building fabric upgrade costs.

German reference house

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

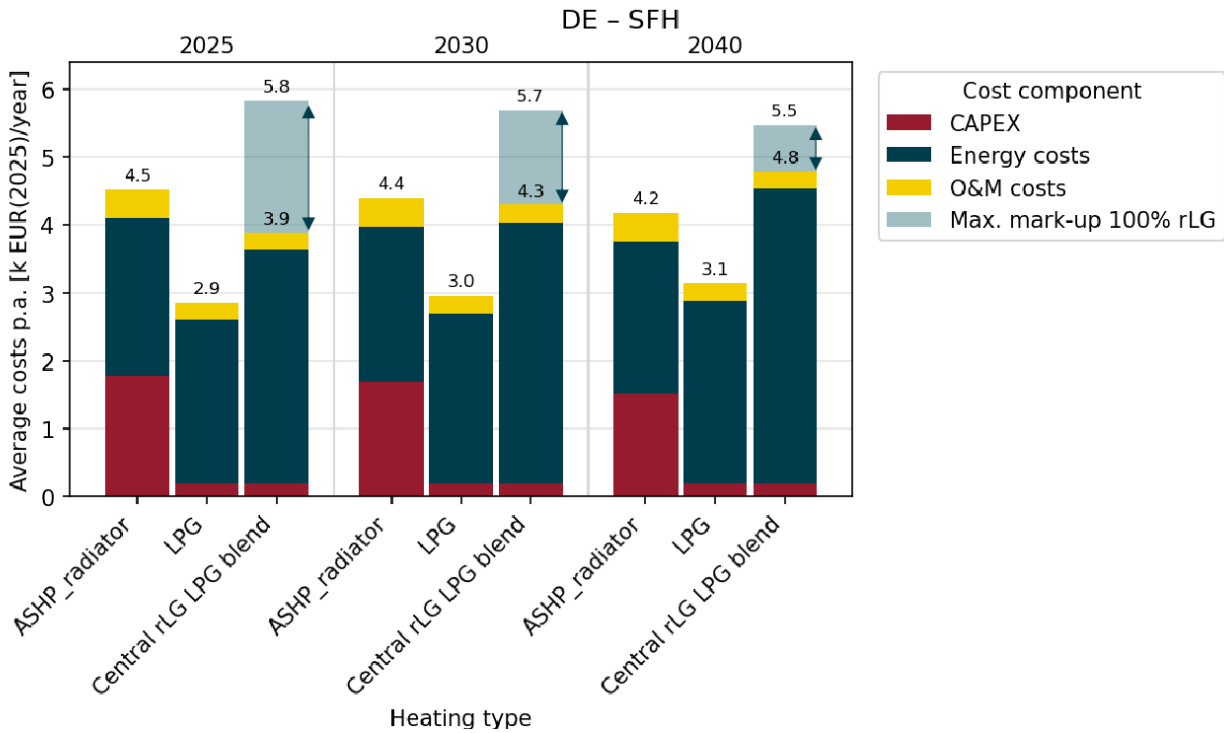


The German reference single-family house has a floor area of 121m² and a peak heating demand of 7.9 kW. Under bivalent operation, the heat pump is sized at 5 kW.

House profile

- A representative German single family house constructed between 1958 and 1968, assuming an average renovation rate.
- It has a reference floor area of 121m², with a thermal demand for space heating of 133 kWh(th) per m², and a thermal demand for domestic hot water of 800 kWh(th) per person (for 3 persons).

Cost comparison



Polish reference house



The Polish reference single family house has a floor area of 98m² and a peak heating demand of 5.2 kW. Under bivalent operation, the heat pump is sized at 3.3 kW.

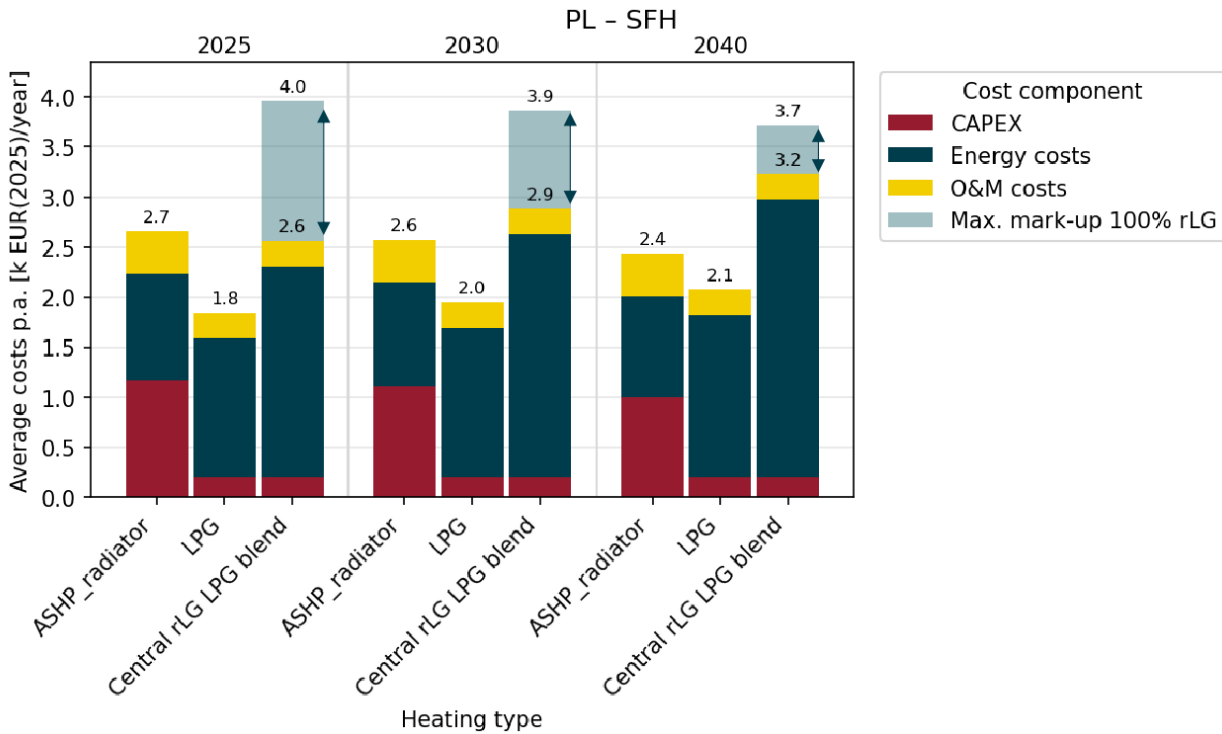
House profile

- A representative Polish single-family house constructed between 1946 and 1966, assuming an average renovation rate.
- It has a reference floor area of 98m², with a thermal demand for space heating of 104 kWh(th) per m², and a thermal demand for domestic hot water of 800 kWh(th) per person (for 3 persons).

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

Cost comparison



Residential cost comparison conclusions

Across the countries assessed, rLG-based heating systems are broadly cost-competitive with heat pumps over the assessment period. As the renewable share of the liquid gas blend increases towards 2040, a cost differential begins to emerge. However, this comparison does not fully account for wider system-level savings, as outlined in Section 2.1. Electrifying existing LPG demand would require substantial additional firm power generation capacity and place added pressure on electricity grid infrastructure. rLG also benefits from a generally favourable consumer cost structure, with no need for high upfront investments. When these broader system and consumer benefits are considered, the cost-competitiveness of rLG is further strengthened.

Cost structures differ significantly between liquid gas and heat pump technologies. Liquid gas boilers require substantially lower upfront capital investment compared with air or ground source heat pumps, allowing higher ongoing energy costs to remain economically viable when evaluated on a total cost of ownership basis. While heat pumps achieve high energy efficiencies, their elevated capital costs often result in total annualised costs that are comparable to or exceed those of rLG blend solutions. Consequently, blending rLG can provide a cost-effective pathway for households to reduce heating emissions without the need for major building retrofits or large upfront expenditures. However, enabling households to transition to an rLG blend, while ensuring sufficient rLG supply, will require a strong and supportive policy framework.

To capture different decarbonisation pathways and household preferences, the Frontier Economics analysis considers a range of renewable shares up to 100% rLG. It is technically feasible for individual households and industrial users to source high shares of renewable liquid gas, even full replacement, regardless of overall market penetration. By contrast, heat pumps connected to the electricity grid achieve full decarbonisation only once electricity generation is entirely renewable. For households prioritising rapid emissions reductions, rLG



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

therefore represents a high-value option for fully renewable heating, providing flexibility and control over decarbonisation pace.

rLG as an economically viable decarbonisation pathway for industrial processes

Industrial energy use remains heavily reliant on fossil fuels and is a major source of CO₂ emissions, with a large share of demand driven by heat requirements across a wide range of temperatures. While electrification, particularly through heat pumps, is increasingly viable for low and some medium temperature applications, its feasibility declines for higher temperature processes due to technical constraints, cost, and potential disruption to industrial operations.

Large industrial heat pumps can currently deliver temperatures of around 140–160°C, making them suitable for sectors such as food, paper, and chemicals. However, they are not a universal solution for all industrial heat needs, particularly at higher temperatures.

Frontier Economics' assessment of rLG in industrial heating begins with a qualitative screening to identify processes where LPG and therefore rLG may represent a viable decarbonisation option. This is followed by a comparative economic analysis of electrification, fossil LPG, and rLG pathways on a consistent per-tonne of product basis, incorporating both energy costs and capital expenditure.

Operating costs are calculated using assumptions on specific energy consumption and projected fuel and electricity prices, with LPG benchmarked against natural gas where data is limited. Investment costs are annualised over a 10-year period, including operations and maintenance where relevant. The analysis assumes existing LPG based systems remain in place, meaning no additional conversion costs for fossil LPG or rLG scenarios. Total electrification costs, including energy, capital, and O&M, are then compared against LPG-based options to assess relative cost competitiveness.

Industrial case studies: Brick firing, asphalt production, aluminium melting, and distilleries

To assess the economic viability of rLG across different industrial applications, four case-study heating processes were selected by Frontier Economics, covering a range of temperature requirements and operational characteristics. Brick firing and asphalt production represent high-temperature, throughput intensive processes where electrification is technically feasible but would typically require significant plant modifications and substantial capital investment, making drop-in fuel switching a more practical option.

Aluminium melting provides an example of a high temperature process where electrification can be implemented with relatively limited retrofit requirements, although overall economics remain strongly influenced by energy price differentials. In contrast, distilleries represent a lower temperature application involving steam and process heat, where high temperature heat pumps can deliver significant efficiency gains. These case studies are presented in detail below.

Industrial case studies

Brick firing

Brick firing is a high-temperature industrial process, requiring temperatures above 1,000°C in tunnel kilns that are typically equipped with open gas burners. While electrification is technically feasible, it would generally require either significant retrofitting of existing kilns or full kiln replacement. Both options involve substantial capital expenditure and potential disruption during installation.

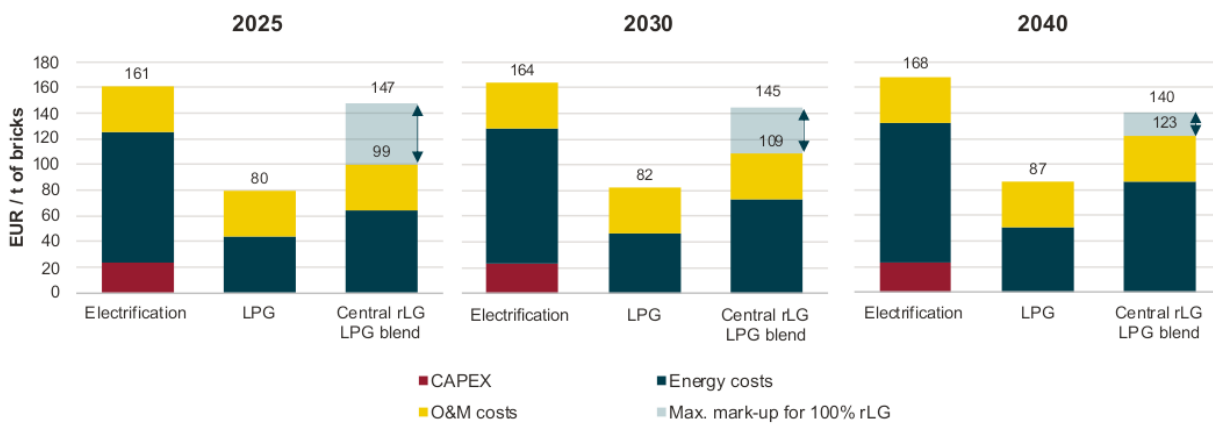
Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

In addition, brick production facilities are often located close to raw material sources, such as clay pits or sand quarries, to minimise transport costs. These locations may have limited access to high-capacity energy infrastructure, including high voltage electricity grids, further constraining the feasibility of electrification.

Against this backdrop, rLG offers a pragmatic decarbonisation pathway for LPG fired brick plants. Electrification delivers only limited efficiency gains in this application, meaning that energy costs per tonne of bricks are typically higher in electrified systems than in those using LPG or rLG blends. This cost disadvantage is further compounded by the additional capital investment required for electrification, estimated at around €23 per tonne of bricks (annualised over a 10-year period at a 5% discount rate).

Cost comparison



Source: Frontier Economics based on UBA (2023)

Note: Chart is based on energy price forecasts for Germany, results for other case study countries are comparable.

Asphalt production

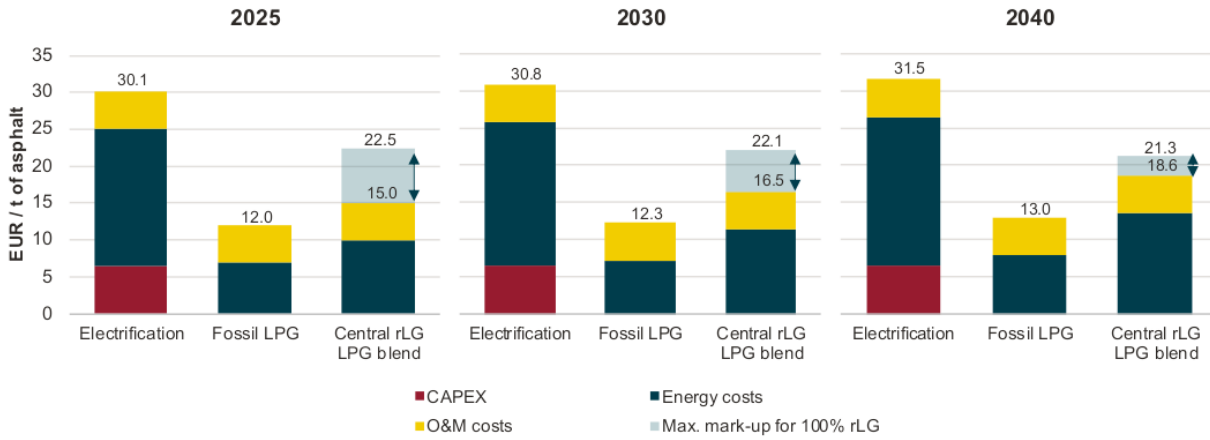
Asphalt production is an energy-intensive process, requiring significant heat for drying and heating aggregates in drum mixers. These systems typically rely on direct fired gas or fuel oil burners within rotating drums. While electrification, such as through electric resistance heating, is technically feasible, it generally requires substantial investment to modify or replace core plant components, along with potential changes to material handling and process control systems.

As in the case of brick firing, this creates a strong case for rLG as a practical decarbonisation option for LPG fired asphalt plants. Frontier Economics' analysis indicates that electricity-based heating results in significantly higher energy costs per tonne of asphalt under current price assumptions. This cost gap is further widened when accounting for the additional capital investment required for electrification, estimated at approximately €7 per tonne of asphalt (annualised).

Cost comparison

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu



Source: Frontier Economics based on Oliveira & Silva (2022)

Note: Chart is based on energy price forecasts for Germany, results for other case study countries are comparable.

Aluminium melting

Aluminium melting is a high-temperature process requiring stable and continuous heat input to melt and maintain metal at the desired temperature. It is typically carried out in gas fired crucible, reverberatory, or rotary furnaces. Electrification is feasible but generally requires retrofitting existing equipment or replacing it with electric induction or resistance furnaces, along with upgrades to on-site electrical infrastructure.

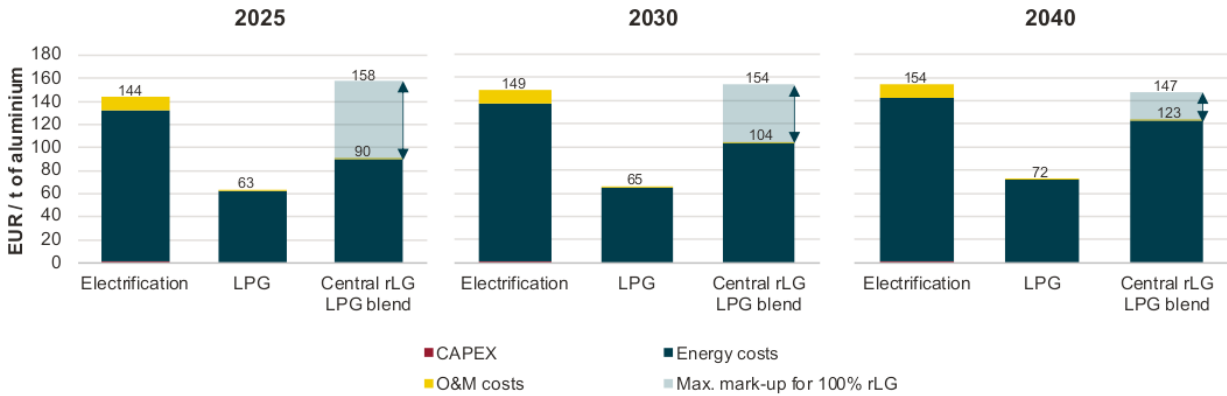
Evidence suggests that electrification can deliver efficiency improvements of around 13% compared to gas fired systems in terms of specific energy consumption. However, under current price assumptions, this efficiency gain is insufficient to offset the higher cost of electricity relative to LPG or rLG.

As a result, operating energy costs remain significantly higher in the electrified case. Given that retrofit capital costs for electrification are relatively modest in this application, the overall cost difference is primarily driven by energy price differentials rather than upfront investment requirements.

Cost comparison

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu



Source: Frontier Economics based on UBA (2023)

Note: Chart is based on energy price forecasts for Germany, results for other case study countries are comparable.

Distilling

Distilleries require heat for distillation processes, typically supplied via steam boilers or direct fired stills using fuels such as natural gas, fuel oil, or LPG. Electrification of this heat demand is feasible through high temperature heat pumps, which can deliver significant efficiency improvements, with coefficients of performance (COPs) of up to around 5. However, this transition requires substantial upfront investment in new equipment and may also necessitate upgrades to grid connections.

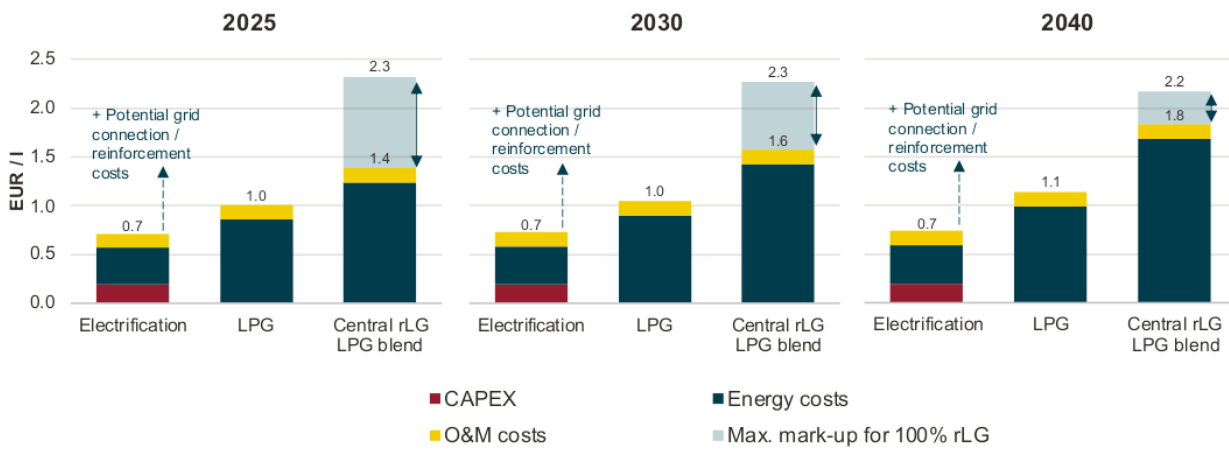
These efficiency gains translate into materially lower operating energy costs compared to combustion-based systems. As a result, electrification is the lower cost option on a total cost basis relative to both fossil LPG and rLG blends, despite higher initial capital expenditure. However, this outcome is sensitive to site specific factors, particularly the availability and cost of electricity connections. Where distilleries must invest in new or expanded grid infrastructure, the economic advantage of electrification may be reduced.

This is especially relevant given that industrial investment decisions are often driven by payback periods rather than lifetime cost optimisation. In the case analysed, the discounted payback period for a heat pump is approximately 3.4 years relative to fossil LPG and 2.6 years relative to an rLG blend. Assuming a typical three-year payback threshold, the implied maximum viable investment ranges from around €0.9 million to €1.2 million. With estimated heat pump investment costs of approximately €1 million, upfront capital requirements can therefore represent a significant barrier, particularly where additional grid-related costs are incurred.

Cost comparison

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu



Source: Frontier Economics based on IEA HPT TCP (n.d.)

Note: Chart is based on energy price forecasts for Germany, results for other case study countries are comparable.

Industrial cost comparison conclusions

Overall, the strategic role of rLG in industrial heating is best understood as a high value decarbonisation option in specific applications. In sectors and sites where LPG is already in use, rLG can deliver immediate emissions reductions with minimal disruption, as it can be deployed using existing equipment and infrastructure.

However, within the broader context of industrial decarbonisation, rLG is likely to account for a relatively modest share of total emissions abatement. Its cost value is most pronounced in medium to high temperature applications, particularly in off natural gas grid or grid constrained locations, and in retrofit scenarios where electrification would require substantial capital investment or operational downtime.

By contrast, in lower-temperature processes, where technologies such as heat pumps offer significant efficiency gains, rLG is less likely to be the most cost-effective solution. In these cases, electrification is typically preferred unless site specific constraints materially limit its feasibility.

6.2. Emissions reduction impact

Frontier Economics' emissions assessment is guided by three key considerations which are:

1. Demand for liquid gases is expected to persist in certain segments, notably off-natural-gas-grid heating and specific industrial process heat applications, even as overall consumption declines.
2. The total cost of ownership scenario highlights a range of cases where high upfront capital costs, retrofit requirements, or site-specific constraints limit the feasibility of electrification, making rLG a more practical option.
3. A system level perspective points to delivery constraints associated with electrification, including the need for distribution grid reinforcement, as well as challenges related to winter peak demand and firm generation capacity.

Taken together, these factors suggest that while electrification, particularly via air-source heat pumps, will play a central role in decarbonisation, it is not universally feasible in the near term. In such cases, the relevant counterfactual is often the continued use of fossil fuels. Here, rLG can provide a pragmatic and scalable decarbonisation pathway, delivering immediate emissions reductions through drop-in use, while enabling



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

further progress over time as renewable blending shares increase and supply expands toward fully renewable liquid gas.

This complementary role is particularly evident in industrial applications. Where heat pumps are not technically viable or where electrification offers limited efficiency gains, rLG can achieve emissions reductions broadly comparable to electrification, while avoiding large capital investments and operational disruption.

It is important to recognise that rLG is not a zero-emission solution on a lifecycle basis, as some upstream emissions remain. For the purposes of the Frontier Economics' assessment, a conservative lifecycle carbon intensity of 24 gCO₂e/MJ is assumed. This level aligns with current EU sustainability thresholds, ensuring that qualifying fuels are recognised as renewable under the EU regulatory framework including RED and can contribute toward relevant targets. In practice, many existing rLG pathways report lower emissions intensities, meaning this assumption provides a cautious estimate of decarbonisation potential.

How switching to rLG compares with heat pump installation

Household heating transitions are expected to occur gradually rather than instantaneously, reflecting constraints such as installation capacity, renovation cycles, and diverse household financial circumstances. Not all households are able to undertake the upfront investment required for technologies such as heat pumps within a short timeframe, resulting in a staggered transition over time.

To capture this dynamic, Frontier Economics' analysis models an illustrative housing district of 100 identical homes from the German case study referenced above, all initially using LPG for heating. This approach provides a clear and intuitive way to represent phased technology adoption, for example, what it means for 30% of households to switch, and how emissions evolve as upgrades are progressively implemented.

Baseline scenario – Continued fossil LPG use

As a conservative benchmark, all 100 homes are assumed to continue using fossil LPG over the period 2025–2040. Under this scenario, cumulative emissions for the German reference case amount to approximately:

- 95 tonnes of CO₂ per household, and
- 9,500 tonnes of CO₂ across the district.

Transition Pathway 1 – Gradual heat pump uptake

A first transition pathway assumes a 2% annual upgrade rate, reflecting typical renovation cycles. In a district of 100 homes, this implies:

- 2 homes switching each year,
- 30 homes adopting heat pumps by 2040, and
- 70 homes remaining on liquid gas.

Upgraded homes are assumed to improve insulation and install efficient heat pumps with underfloor heating. Because upgrades occur incrementally, emissions reductions accumulate gradually. In this scenario, the pathway reduces cumulative emissions by approximately 1,300 tonnes of CO₂ over 2025–2040 compared with the fossil benchmark.

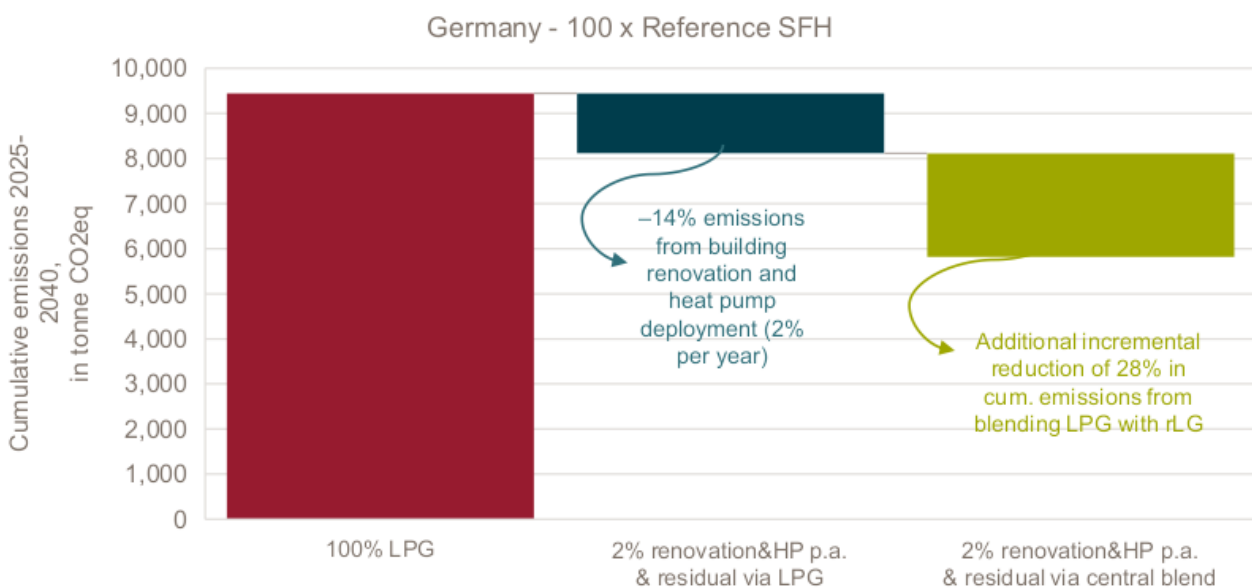
Transition Pathway 2 – Gradual heat pump uptake with an rLG blend

A second transition pathway assumes that in addition to a 2% annual upgrade rate, houses that are still using liquid gas introduce renewable liquid gas in line with blending assumptions. In a district of 100 homes, this implies:

- 2 homes switching each year,
- 30 homes adopting heat pumps by 2040, and
- 70 homes using an rLG blend.

Upgraded homes are assumed to improve insulation and install efficient heat pumps with underfloor heating. Because upgrades occur incrementally, emissions reductions accumulate gradually.

In this scenario, combining gradual heat pump uptake with rLG blending increases cumulative savings 2025-2040 to around 3,600 tonnes of CO₂eq per house relative to the fossil benchmark at district level. This is an additional 2,300 tonnes per district compared with heat pump uptake alone. Introducing rLG blending alongside realistic heat pump deployment therefore increases cumulative emissions reductions 2025-2040 by a factor of three compared with relying on heat pump uptake alone.



Source: *Frontier Economics*

Note: *In this assessment, renovated buildings are assumed to have improved insulation (i.e. lower energy demand) and to use an air-source heat pump (ASHP) with underfloor heating.*

Interpretation

In the German case, this combined pathway increases cumulative emissions savings to approximately 3,600 tonnes of CO₂ at district level over 2025–2040, an additional 2,300 tonnes compared with heat pump uptake alone. In effect, integrating rLG blending alongside realistic electrification rates triples total emissions reductions over the period.

This illustrative district approach reflects the gradual nature of real-world transitions while maintaining analytical clarity. It demonstrates that combining electrification with renewable fuels can significantly accelerate emissions reductions, particularly where full and rapid heat pump deployment is not feasible.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
 ✉ info@liquidgaseurope.eu

Contact Person:
 Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

Summary of potential emissions reduction achievable

Using the rLG supply potential outlined Liquid Gas Europe's Outlook 2040 report, Frontier Economics have estimated the indicative emissions reductions achievable if these volumes replace incumbent fossil fuels in heating and industrial end-use segments up to 2040. This timeframe reflects the near to mid-term period during which infrastructure deployment and delivery constraints are most relevant for real world decarbonisation decisions.

The CO2 equivalent emissions savings that can be attained through using renewable liquid gases produced within Europe instead of fossil alternatives are illustrated in the table below:

Scenario	2040		2050	
	Estimate (kt)	Bounds (kt)	Estimate (kt)	Bounds (kt)
Baseline	3,018	[2,976, 3,060]	9,352	[9,222, 9,482]
Moderate	7,672	[7,565, 7,778]	26,915	[26,542, 27,289]
High	20,467	[20,183, 20,751]	74,005	[72,979, 75,032]

Source: Liquid Gas Europe, Outlook for renewable liquid gas in Europe.

The analysis applies the rLG supply trajectories and assumes a conservative uniform life cycle carbon intensity of 24 gCO₂e/MJ, consistent with current EU RED greenhouse gas saving thresholds. Availability of sufficient low carbon feedstocks at scale is supported by the Liquid Gas Europe Outlook 2040 report, which underpins the supply assumptions.

Results highlight that the climate value of rLG depends both on supply volumes and deployment choices. Emissions savings are material when rLG displaces fossil LPG or natural gas and can be even greater when it replaces higher-carbon fuels such as heating oil.

This underscores a practical prioritisation principle where rLG supply is limited, near-term climate impact is maximised by targeting sectors where electrification is delayed, costly, or technically constrained. Under a moderate supply trajectory, cumulative emissions savings to 2040 reach approximately 76 MtCO₂e when rLG displaces fossil LPG. Overall, total reductions are shaped by two factors:

1. The volume of rLG available
2. The carbon intensity of the displaced fossil fuel, with higher supply volumes and substitution of higher carbon fuels producing the largest emissions benefits.

It is important to emphasise that the emissions reductions presented are illustrative. The examples are stylised to indicate the potential order of magnitude of savings achievable if rLG is deployed at scale, but they do not represent actual fuel substitution patterns. Real world outcomes will depend on system level factors, including relative fuel costs, infrastructure constraints, and competing decarbonisation options.



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium
✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

In practice, substitution of fossil fuels with rLG will be guided by market signals and carbon intensity. Where effective carbon pricing mechanisms, such as the EU ETS and the prospective EU ETS 2, are in place, rLG is likely to displace the most carbon intensive fuels first, thereby maximising the climate benefit of the available supply.

7. CONCLUSION

The analysis presented in this Impact Assessment shows that renewable liquid gases (rLG) have a meaningful and necessary role in the EU's transition to a climate-neutral energy system. Although electrification will remain central to the decarbonisation of heating, many parts of the building and industrial sectors face structural, technical or financial barriers that will delay or limit the feasibility of full electrification. In these areas, rLG provides a practical, immediately deployable and cost-effective route to reducing emissions without requiring disruptive infrastructure upgrades or major changes to consumer behaviour.

Under current policies, rLG supply is expected to remain limited and to rely mainly on co-product volumes from renewable diesel and SAF production. This trajectory is insufficient to deliver the level of emissions reductions needed to meet the EU's 2040 and 2050 climate targets. A fragmented policy landscape would further increase investment uncertainty, raise costs and hinder the development of an integrated EU-wide market capable of supporting dedicated rLG production pathways.

By contrast, a supportive and coherent policy framework that includes a binding EU-level blending or greenhouse gas intensity mandate for liquid gas heating fuels under RED IV would create the long-term demand signals required to unlock large-scale investment, drive technological innovation and enable rLG to contribute effectively across multiple sectors. Such a mandate would complement the approaches in the transport sector, support cross-border market integration and ensure that renewable fuels are rewarded for their actual climate performance. Additional measures such as harmonised certification rules, targeted consumer incentives and revenue certainty for producers would further strengthen market confidence and accelerate supply chain development.

This Impact Assessment shows that rLG can deliver substantial emissions reductions in both residential and industrial applications, particularly when combined with realistic electrification trajectories. In hard-to-electrify segments, rLG provides immediate and material climate benefits, reducing cumulative emissions more rapidly than relying on heat pump uptake alone. For many rural consumers, switching from conventional LPG to lower-carbon alternatives such as electrification or rLG is not yet affordable. However, for consumers and industries actively seeking lower-carbon solutions, rLG can be competitive with electrification on a total cost of ownership basis, provided supportive policy frameworks, sufficient scale, and technological maturity are achieved.

The proposed EU-wide rLG mandate, supported by targeted regulatory and financial measures, provides a balanced, technologically neutral and socially equitable route to decarbonising heating. It strengthens system resilience, alleviates peak-time pressure on electricity grids, supports rural and off-grid households and ensures the efficient use of sustainable feedstocks. It also enables renewable liquid gases to contribute meaningfully to the EU's climate goals.

In light of the Union's 2040 target to cut greenhouse gas emissions by 90% compared with 1990 levels, and its overarching objective of climate neutrality by 2050, a coherent EU-wide rLG mandate represents a timely, proportionate and effective policy measure. Within an integrated and supportive framework, it can deliver verifiable emissions reductions, attract investment, broaden consumer choice and ensure a fair and achievable heating transition.

Together, these elements form a coherent and forward-looking package that advances climate ambition, economic efficiency and social equity. An EU-wide blending mandate would strengthen Europe's energy



Liquid Gas Europe Rue d'Arlon 80, 1040 Brussels, Belgium

✉ info@liquidgaseurope.eu

Contact Person:

Ewa Abramiuk-Lété, General Manager ✉ ewa.abramiuk@liquidgaseurope.eu

resilience and technological leadership while enabling renewable liquid gases to play their full role in delivering a climate-neutral, integrated and inclusive energy system by 2050.