LPG and bioLPG are two of the few alternative energies immediately available and cost-effective to heat and decarbonise off-grid homes and businesses, while cleaning the air in European rural areas today.

Towards a **Decarbonised Future in Rural Europe** with LPG

Liquid Gas Europe

> **The European LPG industry can deliver both substantial short-term solutions to meet 2030 goals as well as realistic near-zero carbon solutions for households and businesses in Europe's rural areas.**

LPG: Delivering Europe's Decarbonised Future

01.

Europe has embarked on an ambitious journey with a goal to decarbonise by 2050.

The European Green Deal creates a unique framework for a European society that is climate neutral, innovative, forward looking, fair and circular. It outlines a Union where citizens, industry and biodiversity can thrive. It sketches a future where no one is left behind: the less fortunate in society, small businesses and our rural communities should all be given opportunities to grow.

2050 seems far away. Yet, at the time of the writing of this document, 2050 is as far in the future as 1990 is in the past and some of us remember 1990 as if it were yesterday. If we are to achieve our ambitious goal, we would need to start today.

The European LPG industry can deliver both substantial short-term solutions to meet 2030 goals as well as realistic near-zero carbon solutions for households and businesses in Europe's rural areas.

Long-term solutions, today

A SWITCH FROM HEATING OIL OR COAL TO LPG

Millions of European rural homes still rely on coal or heating oil (also known as diesel) for space heating. A switch to LPG would deliver an immediate and substantial reduction in emissions and improvement in air quality.

COMBINE LPG WITH RENEWABLE ENERGY

LPG is the perfect partner for renewable energy. It can complement, support or back up renewable energy. For example, your water can be heated by solar thermal panels and the LPG boiler will kick in when needed.

BIOLPG

An increased amount of bioLPG is being produced in Europe which today can reduce CO_2 emissions by up to 80%.

INNOVATIVE SOLUTIONS

Several innovative solutions that help further reduce emissions are commercially available and are already being installed at scale. These solutions include microCHP, gas and hybrid heat pumps and fuel cell engines.

Short-term solutions, today

The European LPG industry is more than a fuel, it is an extensive network that delivers energy to even the most remote areas, a tried and tested logistics operation than can easily be adapted to the delivery of new fuels. The European LPG industry is actively increasing production and sourcing of bioLPG. Substantial investments are being made in other renewable fuels.

A just transition for rural areas

In our drive for decarbonisation, we need to ensure that rural areas do not get left behind. Europe's rural areas generally have lower average incomes, higher rates of energy poverty and houses that are more expensive to heat and renovate and its specificities should be considered. The European LPG industry is deeply rooted in its rural fabric. Many companies have known their customers for generations and are now helping them with integrated solutions that include renewable energy, energy efficiency and a high-density LPG boiler. Many other energy options, including piping natural gas, district heating or supplying large amounts of electricity might not be practical or economically viable in rural areas. A cost-effective transition to a cleaner and ultimately renewable fuel combined with energy efficiency allows for a more affordable solution for many rural households.

// Energy in Rural Europe

Decarbonisation without the cost of new infrastructure

The European LPG industry can help deliver decarbonisation in rural areas without major infrastructure costs and in many cases a limited cost to citizens.

- In the short-term, the cost of the switch from heating oil or coal to LPG can be subsidised by a capital grant or partly born by the LPG distributor.
- In the longer-term, the switch to renewable fuel would not require any additional publicly funded infrastructure since existing infrastructure such as storage tanks, rail tankers and trucks can be adapted at minimal cost only boilers would need to be retrofitted.

Evolution rather than revolution

For Europe's rural areas, as well as range of other applications such as static engines, LPG offers solutions that are based on evolving existing installations or technologies rather than switching to a completely new fuel for which the infrastructure would need to be developed. Especially for less densely populated areas, LPG-powered solutions proved that they can make a difference today, are easy to adopt, are affordable and can build the perfect platform for renewable fuels in the long run.

The European LPG industry is looking forward to working with policymakers and other stakeholders on finding solutions for today and tomorrow.

LIFE INTEGRATED PROJECT
"Implementation of Air Quality Plan for Małopolska Region – Małopolska in a healthy atmosphere"

The purpose of Air Quality Plan is to achieve in the Małopolska Region by 2023 permissible levels of air pollutants like PM10, PM2.5, benzo (a) pyrene, nitrogen dioxide and ozone.

Residents of 55 municipalities in Malopolska can count on professional support of 60 Ecomanagers who help in the preparation of applications for co-financing, conduct educational activities, carry out inspections and professional research with a thermal imaging cameras.

Between 2013-2017, over 27,000 solid fuels boilers and stoves were replaced in the Małopolska region mainly by gas boilers.

Furthermore thermo-modernisation was carried on over 3,500 buildings and renewable energy sources were installed on 12,000 buildings.

The measures aimed at reducing emissions undertaken in Małopolska have resulted in the reduction of PM10 emissions by more than 900 Mg, PM2.5 emissions by 720 Mg and benzo(a)pyrene by 450 kg.

02. Energy in Rural Europe

Rural Europe

When thinking of Europe's countryside, many of us picture rolling hills, tree-lined country roads, picturesque farms and charming towns. Europe's rural areas are much more than a romanticised image. Rural Europe covers most of our territory; it is home to 30% of Europe's population and a key part of our economy.

Yet, rural areas have often been left on the wayside when it comes to policy. Policies were often designed by urban dwellers for urban dwellers. Solutions that work in cities or even towns might not be effective in rural areas. Rural areas deserve tailored policies and a bespoke approach to challenges from transport to employment, and combatting climate change and energy.

Rural buildings are significantly older than urban ones. For example, in France, half of them predate 1950

30%
of Europe's population lives in rural areas

1,5
trillion EUR of Gross Added Value is generated each year

The income per inhabitant is 21% to 62% lower in rural areas

Rural Energy

One area where the difference between Europe's more densely populated and rural areas is most obvious is energy.

What energy is used for, which energy is used and how it is transported are fundamentally different.

What makes rural energy different?

OFF-GRID

The vast majority of rural areas in Europe are not connected to the natural gas grid. It was never, and will probably never be, economically viable to pipe natural gas to sparsely populated areas.

ENERGY INTENSIVE

Commercial, industrial and agricultural energy use in rural areas is marked by the fact that a lot of energy is needed in remote locations. For agricultural applications, energy use can also be very intense for short amounts of time, as is the case for applications like crop drying. Also, in rural areas 94,5% of the dwellings are single family houses that require more energy for space heating.

RELIANCE ON POLLUTING FUELS

Many of Europe's rural areas rely on polluting solid or liquid fuels, especially in rural homes. For example, in Poland and Belgium, 75% of off-grid heating comes from heating oil and even coal. In Germany and France, the percentage of households relying on these fuels stands at 68% and 42% respectively.

OLDER AND ENERGY WASTEFUL BUILDING STOCK

In rural areas, 80,7% of families live in houses, as opposed to 30,1% in urban areas. These houses will typically use, and loose, more energy than the smaller apartments typical in cities.

MORE REMOTE

The lower populating density presents several challenges in terms of energy:

- Efficiency
  How can you get energy to households and businesses efficiently, both in terms of the investment the infrastructure needs and potential energy loss in getting the energy to where it is needed.
- Transport
  The very fact that distances between, for example, people's homes and their places of work, are much longer in rural areas changes the transport challenge. One only needs to think of the difference in distance a nurse making house calls needs to cover in the countryside as opposed to the city. The rural transport challenges are further marked by a limited availability of public transport options.
- Fewer Energy Options
  Rural homes and businesses do not have the same energy options available in urban areas. Many are not connected to the natural gas grid and in sparsely populated areas, district heating is inefficient. Power outages are also more frequent in rural areas.
- Reliability
  Ensuring the reliability of energy supply is more challenging in rural areas.

ENERGY POVERTY

Many Europeans in rural areas face systemic energy poverty in rural areas, especially in, but not limited to, Southern and Eastern Europe.

> **Commercial, industrial and agricultural energy use in rural areas is marked by the fact that a lot of energy is needed in remote locations. For agricultural applications, energy use can also be very intense for short amounts of time, as is the case for applications like crop drying.**

Europe's Rural Energy Transition: 7 Guiding Principles

Europe has set ambitious targets in terms of energy and emissions, leading the world in vision and policy on the road to carbon neutrality. Reducing emissions in rural areas today and tomorrow will require a bespoke approach.

1

TAILORED POLICIES

Europe's rural areas need tailored policies to ensure a good fit.

A one size fits all energy policy therefore runs the risk of having perverse effects in Europe's rural areas ranging from excessive costs for infrastructure that would translate in people's energy bills to a net-negative carbon impact.

2

WASTE NOT WANT NOT

The first step in rural energy policymaking should be to address energy being wasted. The old and energy inefficient building stock in rural areas is literally throwing money and emissions out of the window. Renovating this building stock will avoid waste and improve comfort. Avoiding waste, be it of energy or public funds, should be our first priority.

3

LOW HANGING FRUIT

The majority of rural homes, as well many rural businesses, still rely on heating oil and coal. Switching to gaseous fuels combined with modern boilers and renewable power generation will deliver immediate benefits in terms of emissions as well as reducing people's energy bill. This switch will deliver results today. And time is of the essence.

4

A BIRD IN THE HAND...

Because of the unique specificities of rural energy, the perfect zero-carbon solution might not be possible today. However, simple, proven solutions can reduce emissions on a rural home by 85%. We can wait for a perfect solution which might take decades to develop or we could build upon solutions that are available today.

5

ONE BRICK AT THE TIME

Europe's energy future should be built on robust solutions that work today and serve as a foundation for a further reduction of emissions. For instance, improved insulation, energy efficient glazing, a switch from using coal or heating oil to LPG, a modern efficient boiler combined with renewable energy or a heat pump can substantially reduce emissions. Furthermore, this solution enables a seamless switch to renewable bioLPG. Renovations are generally done gradually, depending on available finances. We should promote solutions that deliver substantial reductions now and serve as a stepping stone to new technologies.

6

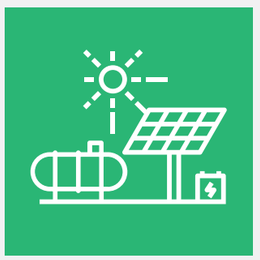
A JUST TRANSITION

Almost 25% of people in rural areas are already at risk of poverty or social exclusion. Any energy transition should be a just one that improves the lives of European citizens and does not shift the cost of the transition onto their energy bills.

7

GO LOCAL

Europe's rural areas cover a very wide area. An energy model whereby energy is generated centrally and distributed over long distances, like the spokes on a wheel, will often not be the most efficient solution. Locally generated or stored energy can avoid unnecessary investments and potential energy losses. Hybrid systems that can combine solar with micro-CHP, fuel cells, heat pumps are the perfect for rural areas.



03. LPG in Europe

What is LPG?

LPG is a portable, clean and efficient energy source which is readily available. LPG is primarily obtained from natural gas and oil production but is also produced increasingly from renewable sources. Its unique properties make it a versatile energy source which can be used in more than 1.000 different applications.

EFFICIENT

LPG is an energy-rich fuel source with a higher calorific value per unit than other commonly used fuels. This means that an LPG flame burns hotter, an advantage that can translate into higher efficiency. Its efficiency is even more highlighted with the emergence of performance-optimising technology such as condensing boilers and renewable/LPG hybrid systems.

ACCESSIBLE

LPG can be accessible to everyone everywhere today without major infrastructure investment. Nothing needs to be invented and there are enough reserves to last many decades.

CLEAN

LPG is a clean burning fuel that is low carbon, emits virtually no black carbon and does not spill. Its use improves air quality, reduces the emission of GHGs and protects the environment.

AVAILABLE

LPG is a fuel that is available in even the remotest of areas, improving the lives of millions of European citizens providing a further impetus to regional development. It can be transported using sea, rail or road from anywhere in the world.

// Energy in Rural Europe

“Propane and butane, or a mix of the two. Propane and butane are chemically quite similar but the small differences in their properties mean that they are particularly suited to specific uses.”

WHAT’S IN THE NAME?

LPG stands for “Liquefied Petroleum Gas” and the term is used to describe two Natural Gas Liquids: Propane and butane, or a mix of the two. Propane and butane are chemically quite similar but the small differences in their properties mean that they are particularly suited to specific uses. Often, Propane and Butane will be mixed to get the best energy yields and properties.

WHERE DOES LPG COME FROM?

LPG has two origins: approximately 60% is recovered during the extraction of natural gas and oil from the earth, and the remaining 40% is produced during the refining of crude oil. LPG is increasingly being manufactured from renewable sources as well.

WHERE IS LPG USED?

Hundreds of millions of people currently use LPG and depend on it for thousands of applications, in commercial business, industry, transportation, farming, power generation, cooking, heating and for recreational purposes.

What is bioLPG?

WHAT IS BIOLPG?

BioLPG is a gaseous fuel that is made from organic feedstocks and potentially from renewable electricity and CO_2. It is chemically identical to conventional LPG.

HOW IS BIOLPG DIFFERENT FROM REGULAR LPG?

BioLPG and conventional LPG are chemically identical but produced from different feedstocks. This makes bioLPG an ideal drop-in fuel that can be blended at any rate and still be used in existing infrastructure and appliances. It means that distributors and consumers do not need to change or upgrade their equipment or appliances to switch to a renewable energy solution.

WHAT ARE THE BENEFITS OF BIOLPG IN TERMS OF CO_2 AND OTHER EMISSIONS?

The carbon footprint of today's bioLPG is up to 80% lower than that of conventional LPG, dependent on the feedstock used.In the long run, bioLPG has the potential to become carbon neutral depending on the development of new production processes.

As bioLPG is chemically identical to conventional LPG, it carries the same low NOx, SOx and PM as conventional LPG.

HOW IS BIOLPG MADE?

BioLPG can be produced in several processes where it is a by-product. Currently the only process to produce biopropane that is operating at a commercial scale is bio-refining – the hydrogenation or hydrotreating of vegetable oils (HVO), waste materials, fats and biomass-derived oils.

BioLPG can be also produced in the gasification or pyrolisys of lignocellulosic biomass, conversion of biogas and the power-to-x technologies (using renewable energy).

WHERE IN EUROPE IS BIOLPG MADE?

BioLPG is currently produced in France, Italy, Spain, Sweden and The Netherlands.

HOW MUCH BIOLPG IS AVAILABLE ON THE MARKET?

In 2018, it was estimated that consumption of branded bioLPG, a product available on the market explicitly labelled as such, was at about 100 kilotonnes a year. The rest of the produced bioLPG, another 100 kilotonnes a year, is used today internally as a process fuel.

The quantities of bioLPG are small but steadily growing. It is currently available in several European markets: France, Denmark, Spain, Sweden, Germany, Ireland, the UK, the Netherlands, and Belgium.

WHAT FEEDSTOCKS ARE USED TO PRODUCE BIOLPG?

In the current production processes a combination of around 60% waste and residue materials and 40% renewable vegetable oils is used.

In practice, this translates to the following feedstocks, which are currently transformed to produce bioLPG: fatty acid distillate and stearin, technical corn oil, tall-oil pitch, rapeseed oil, crude palm oil, waste materials from the food processing industry, waste fat from the fish processing industry, soy oil, jatropha oil and camelina oil.

All organic feedstocks used to produce bioLPG meet strict sustainability standards. They are fully traceable, sustainable and well managed. With time, first generation crop-based feedstocks will gradually be phased out and replaced by waste and residue materials.

The European LPG Industry

The European LPG industry is a diverse and dynamic constellation of multinational, medium-sized and smaller companies. Some companies are listed but most are family or privately owned and all are customer focused.

WHERE YOUR ENERGY SUPPLIER KNOWS YOUR NAME

Several of the biggest LPG companies in the world are European but even if large in scale, our roots are firmly planted in the local communities where we operate. It is not uncommon for the LPG delivery driver to know all the customers in his or her area.

[1]Measuring emission performance of Autogas cars in Real Driving Conditions (2016) Liquid Gas Europe

04. Why LPG?

We truly believe that LPG and renewable LPG, as clean-burning, versatile, and resource-efficient gaseous fuels are perfectly placed to help reaching Europe's ambitious energy and climate goals, especially in rural areas and in road transport. We particularly would like to highlight three fundamental issues, which we see crucial if the EU is to deliver the sustainable, cost-efficient, healthy and secure long-term energy transition that it is aiming for:

- **CLIMATE CHANGE AND AIR POLLUTION ARE TWO SIDES OF THE SAME COIN**
- **THE SHIFT TO DECENTRALISED ENERGY SYSTEMS WILL REQUIRE COMBINING TECHNOLOGIES**
- **LONG-TERM POLICY VISIBILITY IS KEY TO EXPLOIT ALL RENEWABLE FUELS POTENTIAL**

EU energy, climate and environmental policies tend to focus on the needs of urban areas. On that basis, certain technological options are often favoured by EU energy and climate policies fitting the characteristics and requirements of these areas, such as district heating, electric heating, or electromobility. While all these solutions have evident merits, they require dedicated and costly energy infrastructure, which are often not adequate for sparsely populated areas.

This is in stark contrast with the reality of the residential energy mix in rural areas, where the natural gas grid is generally unavailable and where two thirds of the energy needs are covered by using high-carbon fuels such as heating oil and coal, or by burning biomass.

The "electrification of everything," which implies vastly strengthening the grid, might not be a realistic option in rural areas considering that the existing electric networks would require huge investments for taking the necessary increased load and for optimising its distribution.

At the same time, experts seem to agree on the need to switch to a more decentralised energy system, where prosumers, users locally producing renewable energy would take a larger role. Due to the intermittent nature of decentralised renewable electricity, the move towards this model will also require the inclusion of low-carbon fuels to act as a partner or back-up. In addition to being clean-burning, LPG is an extremely versatile energy source, which can be used everywhere it is needed. LPG is largely available – either in cylinders or in bulk - across all European territories, even in areas where the availability of diversified energy sources is scarce.

LPG is a perfect fuel for the most modern low or zero carbon heating appliances such as hybrid and gas heat pumps, hybrid systems with solar thermal installations, fuel cells and micro-CHP.

"LPG is a perfect fuel for the most modern low or zero carbon heating appliances such as hybrid and gas heat pumps, hybrid systems with solar thermal installations, fuel cells and micro-CHP."

// Energy in Rural Europe

05. LPG: An Important Part of the Energy Policy Puzzle

SMART SECTOR INTEGRATION

This strategy aims to better link the different energy sectors in the EU (electricity, gas, buildings, transport, industry) to help them reduce carbon emissions. This means replacing fossil fuels with renewable electricity, or with other renewable and low-carbon fuels where electrification is not possible, while ensuring that energy remains secure and affordable.

'WHERE' AS WELL AS 'WHAT'

LPG and bioLPG are a perfect fit for energy uses that are hard to decarbonise. However, we see this apply the 'where' as well as the 'what'. There are indeed certain sectors, such as aviation that are difficult to electrify, however there are also places where this is the case. With increase demand for electricity across the board it will not be technically possible or economically viable or sustainable to transport centrally generated electricity to sparely populated areas.

For industries situated off the gas grid, especially those using relatively large amounts of space and process heat, there are limited options for decarbonisation. Businesses located in rural areas rely on some of the highest carbon fuels, such as heating oil and coal.

They will increasingly be required to switch away from those energy sources, to comply with decarbonisation policies. To achieve climate neutrality, industrial users whose processes require an essential source of heat, not easily replaceable with electricity, should be in a position to choose a cost-effective route to deep emission reductions.

BIOLPG

The growing availability of bioLPG means that today's investments in LPG supply chain and appliances are future-proofed as they can operate on bioLPG without any additional upgrading costs. BioLPG can seamlessly be stored in existing bulk tanks and cylinders and transported using today's infrastructure and skilled workforce.

The LPG industry's pledge is to transition to 100% bioLPG by 2050. To do this, LPG and bioLPG must be recognised within policy frameworks and regulations. The producers need to be able to secure the necessary feedstock and sustain a stable business model backed by a supportive, clear and predictable EU legal framework.

// Energy in Rural Europe

> **"The growing availability of bioLPG means that today's investments in LPG supply chain and appliances are future-proofed as they can operate on bioLPG without any additional upgrading costs."**

CIRCULAR ENERGY

LPG, as clean burning gaseous fuel is already extensively used in a more 'circular way'. For example, the clean flue gases from LPG heating system for greenhouses are pumped into the very same greenhouses to promote, photosynthesis.

This is only possible because these flue gases contain virtually no particulates. In LPG-powered CHP systems as well as many other industrial applications, heat is recovered for secondary uses or power generation. Because of the clean combustion, LPG or bioLPG are perfectly suited for 'circular' energy use.

The production of bioLPG improves the efficiency of the European energy sector by making it more "circular". BioLPG is a by-product of several processes using a range of biological and renewable feedstocks, increasing their resource efficiency.

The feedstocks most likely to contribute to the commercial production of bioLPG are bio-based oils (e.g. vegetable oils, used cooking oils (UCO), waste animal fats), followed by waste and residues – woody biomass, municipal solid waste, or glycerine and sugars.

Furthermore, LPG has this policy in its DNA: a large portion of global LPG production is a by-product for natural gas extraction which was often flared. This by-product is now channelled, processed and used by billions across the world for cooking, heating, transport and thousands of other applications.

Zero Pollution Ambition

The EU's Zero Pollution Ambition goes hand in hand with all Green Deal objectives and will build on initiatives in the field of energy, industry, mobility, agriculture, biodiversity, and in particular climate. The roadmap outlines EU plans to achieve zero pollution by better preventing, remedying, monitoring and reporting on pollution.

The European LPG Industry fully supports this approach. As a clean burning fuel, LPG has always contributed to reducing pollution.

AIR POLLUTION

Contrary to liquid and solid fuels, LPG also emits virtually no black carbon. Whether used as a heating fuel, in a barbecue, generator or to power a small leisure craft, switching to LPG substantially reduces pollution.

Switching from an oil or coal boiler to an LPG one can reduce emissions respectively by 25% and 50%. In addition, boilers fuelled by LPG emit 80-99% less PM and 50-75% less NOx than solid and liquid fuel boilers (such as coal, heating oil, peat, and biomass).

As a transport fuel, recent real driving emission tests have shown that LPG vehicles produce 98% less NOx emissions than diesel cars. In, addition, they emit 90% less particulates and 45% less carbon monoxide than gasoline cars .

GROUND POLLUTION

LPG storage tanks do not leak. Contrary to, for example, heavy fuel oil or diesel tanks, there is no risk of ground pollutions when LPG is stored on site.

WATER POLLUTION

LPG can never pollute water, whether it is open water or the aquifer. This is why LPG is increasingly used as a portable fuel in environmentally sensitive areas for heating, lighting or power generation. Marine LPG, both for small vessels and large ships, is also gaining traction to reduce sulphur emissions and prevent spillage.

PACKAGING POLLUTION

LPG is stored in bulk tanks or in cylinders that are recovered, re-used and ultimately recycled. The industry uses virtually no secondary packaging and is moving a lot of its traditional paperwork online.

> **"LPG can never pollute water, whether it is open water or the aquifer."**

Channelling the Renovation Wave

The Renovation Wave initiative is a priority under the European Green Deal and the recovery plan for the EU that aims to increase the rate and quality of renovation of existing buildings and help decarbonise the building stock. Since renovation is labour-intensive and tends to rely on locally produced materials, it is also a driver for economic recovery.

40%

The EU building sector is responsible for approximately 40% of EU energy consumption and for 36% of the EU greenhouse gas emissions.

75%

of existing buildings are energy inefficient.

80%

of today's buildings will still be in use by 2050

LPG AND THE RENOVATION WAVE

Switching to an LPG boiler for households that currently rely on coal or heating oil, is part of the low hanging fruit of home renovation. Together with loft insulation and glazing, a fuel switch and highly efficient boiler deliver substantial savings in emissions and the energy bill without disrupting the life of the owner/ occupier or the tenant.

// Energy in Rural Europe

THE IMPACT OF BIOLPG

Ireland

Liquid Gas Europe estimates that if 500,00 homes switched from using oil-fired central heating to bioLPG by 2040, it would save about 1.9 million tonnes of CO_2 emissions per year

Germany

Deutscher Verband Flüssiggas estimates that 3.08 million kilotonnes could be converted to LPG, thus saving around 4 million tonnes of CO_2 in residential buildings every year

France

If the residential heating systems using heating oil were to be replaced by installations fuelled by bioLPG, it is estimated that 4.9 million tonnes of CO_2 could be avoided by 2028.

A deep renovation project, whilst ideal from an energy efficiency point of view, will require the occupants of the house to move out of the house for day if not weeks which creates a barrier to starting the renovation project. A deep renovation also requires a substantial capital outlay.

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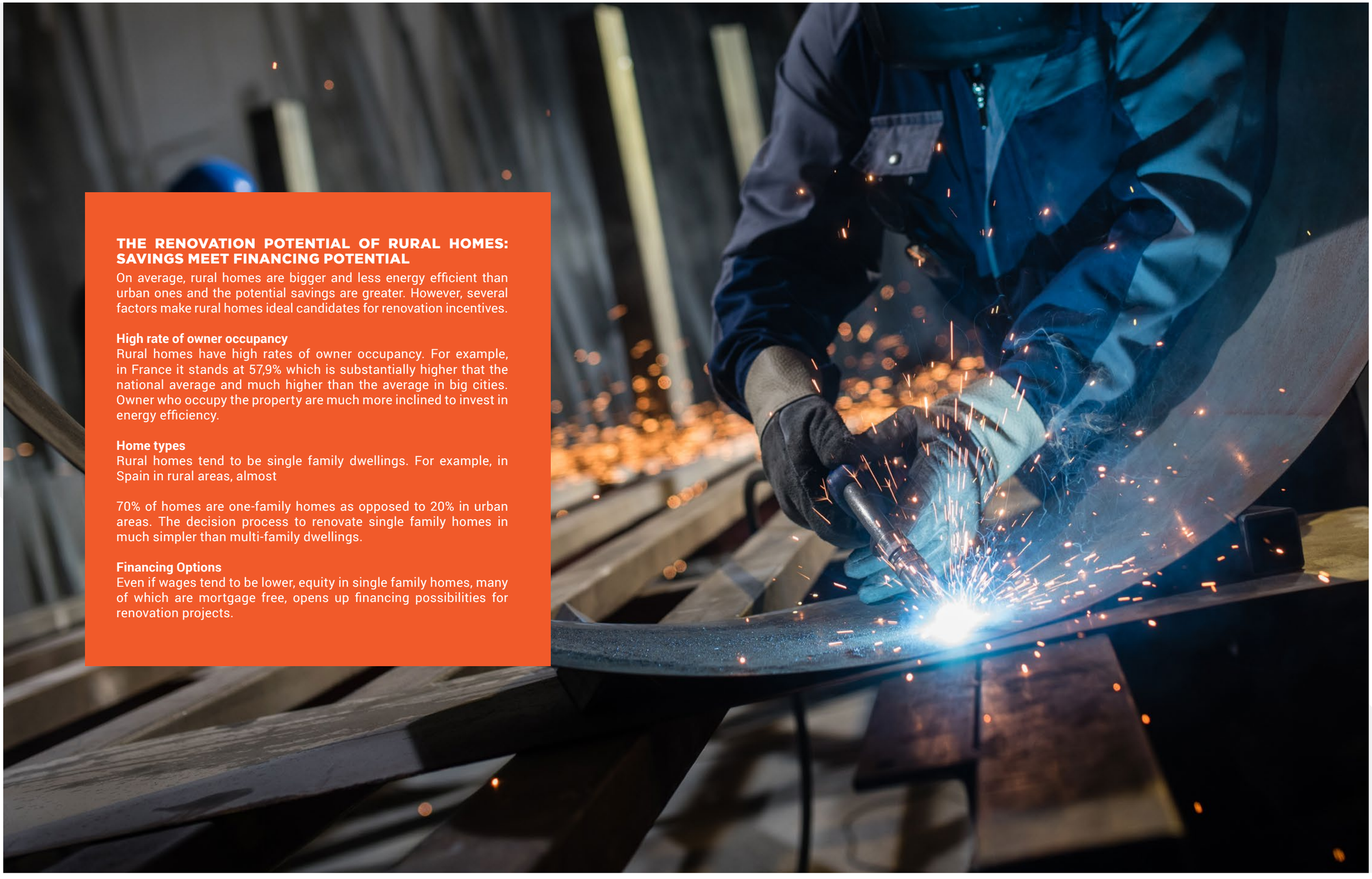


THE RENOVATION POTENTIAL OF RURAL HOMES: SAVINGS MEET FINANCING POTENTIAL

On average, rural homes are bigger and less energy efficient than urban ones and the potential savings are greater. However, several factors make rural homes ideal candidates for renovation incentives.

High rate of owner occupancy
Rural homes have high rates of owner occupancy. For example, in France it stands at 57,9% which is substantially higher that the national average and much higher than the average in big cities. Owner who occupy the property are much more inclined to invest in energy efficiency.

Home types
Rural homes tend to be single family dwellings. For example, in Spain in rural areas, almost

70% of homes are one-family homes as opposed to 20% in urban areas. The decision process to renovate single family homes in much simpler than multi-family dwellings.

Financing Options
Even if wages tend to be lower, equity in single family homes, many of which are mortgage free, opens up financing possibilities for renovation projects.

06. Sustainable heating solutions with LPG

LPG is a perfect fuel for the most modern low or zero carbon heating appliances such as hybrid and gas heat pumps, hybrid systems with solar thermal installations, fuelcells and micro-CHP's.

LPG-powered solutions are diverse, practical, proven and affordable. There is a solution for every type of climate or geography, and they can be combined and integrated with other technologies delivering additional benefits in terms of both efficiency and decarbonisation.

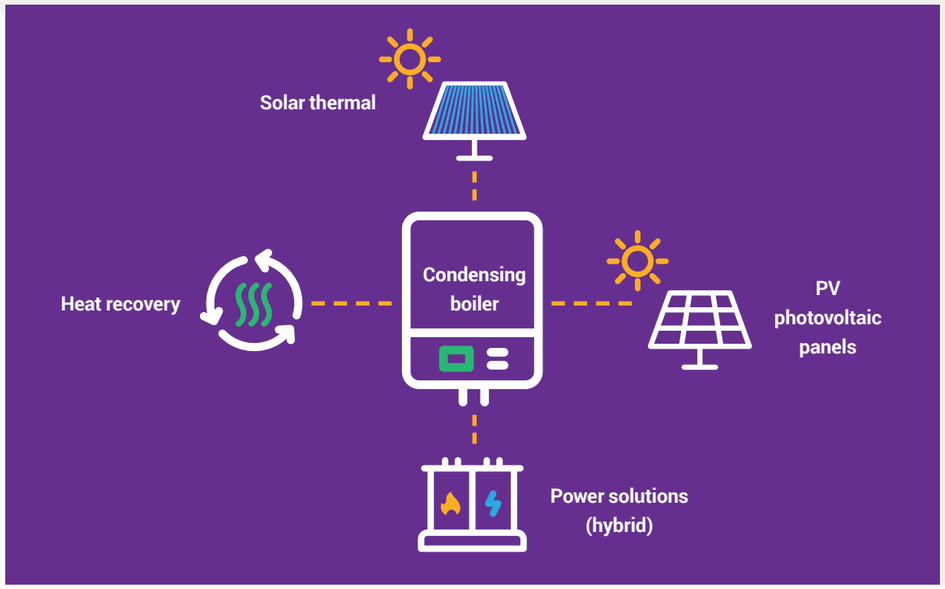
Furthermore, LPG's flexibility as a primary energy source will enable other low-carbon technologies, including locally produced renewable electricity, to reach a wider uptake.

LPG & THERMO-SOLAR INSTALLATIONS

We all know the solar thermal installations, most frequently used in Southern Europe. In the sunnier parts of the EU solar thermal systems can provide up to 80% of a home's hot water needs. However, when the sun does not shine the result might come as a bit of a cold shower.

Therefore, many systems are now coupled with an auxiliary energy source which has in turn boosted the use of solar thermal across all regions of Europe, even in more northerly areas.

In areas where natural gas in not available, LPG is the auxiliary fuel of choice for these hybrid systems.



MINI- AND MICROGRIDS WITH LPG

In areas which the natural gas grid does not reach, an LPG network can be developed to serve a community via underground pipelines. For example, a mini grid can supply an entire remote municipality from on-site storage. Each property is fitted with its own domestic smart gas meter and billed based on actual consumption. In France, almost 50.000 households are currently connected to 3.900 mini LPG networks of which 290 are municipal.

LPG small scale grid have several advantages:

- Cost savings: because there is no need for individual tanks and because LPG is ordered and delivered in large quantities, the price will be more competitive.
- Hybrid systems: especially for newly built communities, these grids can easily be combined with solar thermal, heat pumps or other renewable energy sources.
- Locally stored, locally used: LPG can be safely stored locally over extended periods of time and transported to even the most remote location with virtually no loss between production and use.
- Ready for renewable LPG: Like all LPG applications, small scale grid can switch to bioLPG without making any changes to the storage tanks, grids, boilers or appliances.

FUEL CELLS AND ENGINE-BASED COGENERATION

Often referred to as micro-combined heat and power (micro-CHP), this highly efficient technology is a residential scale version of co-generation which is widely used in industrial processes.

The main output of a micro-CHP system is heat, with some electricity generation as a by-product of heat generation.

A typical domestic system will generate up to 1kW of electricity once warmed which can be used or sold back to the grid. Since electricity is a by-product this will result in savings, both in terms of emissions and costs.

Micro-CHP units are commercially available from a range of suppliers and have a relatively short payback period of 5 to 7 years.

The latest generation of microCHP boilers integrate advanced fuel cells that generate power significantly more efficiently than the Stirling engine. This is because fuel cell CHPs convert chemical energy directly to an electrical current, maximising efficiency.

HYBRID AND GAS HEAT PUMPS

Heat pumps are an innovative approach to the problem of meeting space heating demand. Instead of using a boiler to provide heat, a heat pump recovers heat from natural sources in the air, water or underground, and transfers it using a refrigerant gas which exchanges heat during its compression/ decompression phases. A heat pump works like an air conditioner in reverse. Indeed, heat pumps can be switched over to work as air conditioners during the summer months.

LPG-powered heat pump are efficient, cold resistant, responsive and LPG can deliver exactly the right amount of energy needed to supplement the heat or cooling provided by the ground or air.

// Energy in Rural Europe

07. Pledge from the LPG Industry

BioLPG pathway

While an increase in use of gaseous fuels instead of higher carbon liquid and solid fuels already offers promising benefits today, a large part of the long-term European decarbonisation potential will come with the development of equivalent fuels from renewable origins.

Such transition based on drop-in of renewable fuels allows to rely on an existing distribution infrastructure, to tap into a strong knowledge base from the original industry and to avoid technological lock-in, as new engines and high-efficiency heating technologies can generally function with renewable fuels the same way they do with its conventional equivalent.

However, the production of renewable fuels requires carefully planned investments which can only happen when a predictable legal and policy framework is in place, especially in regard to supportive measures and sustainability criteria of renewable feedstocks.

The first large scale distribution of bioLPG in Europe has started recently. BioLPG has the same chemical composition as LPG, and therefore is an equally low polluting fuel but has a much lower carbon footprint than conventional LPG thanks to its biological origin. A recent study shows that the carbon footprint of bioLPG can be up to 80% lower than conventional LPG. In the long run, bioLPG has the potential to become carbon neutral depending on the development of new production processes.

The gradual increase of the renewable content in LPG will have no impact on the end-user as it can be used with the same appliances and engines as conventional LPG.

The majority of bioLPG on the market today is produced from the hydrotreatment of biological oil and fats as a co-product of HVO biodiesel, but it is also being produced from the fermentation of glucose by bacteria, yeasts or other microorganisms.

Other renewable LPG innovative production processes combining atmospheric CO_2 with renewable hydrogen, produced from water hydrolysis are also being explored. In the longer term, the biggest potential of bioLPG production lies in advanced chemical processing of cellulosics and waste, which involves converting residues from agriculture and forestry or organic municipal waste into bioLPG.

The ambition of the European Union is to be climate neutral by 2050. The European LPG industry is committed to supporting this ambitious goal. Liquid Gas Europe is committed to ensuring that the European LPG market becomes 100% renewable by 2050. To get there, several critical policy interventions and industry actions will be necessary.

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Conclusion & Policy Recommendations

08.

1. TAILOR ENERGY TAXATION TO THE NEEDS OF RURAL AREAS

The current Energy Taxation Directive has incentivised the uptake of LPG and contributed to meeting EU climate objectives. To enable LPG, bioLPG and renewable LPG to fulfil their potential in contributing towards the European Green Deal, Liquid Gas Europe urges policymakers to consider the following recommendations:

- Create appropriate price signals enabling LPG to play its role in the energy transition: distinguish between low-carbon and high-carbon fossil fuels.
- Support alternative fuels with a track record of success.
- Give member states the necessary flexibility to tailor energy taxation to the needs of households and businesses.
- Ensure consistency with the Renewable Energy Directive.
- Ensure a level playing field for heating fuels.

2. ASSESS THE IMPACT OF CARBON PRICING ON VULNERABLE CONSUMERS

With the right design and implementation, carbon pricing can support decarbonisation in certain sectors. However, the European Commission's proposal to revise the current EU Emissions Trading System (ETS) and, specifically, with regards to the plan to create a new, separate ETS covering buildings and road transport, need to be carefully assessed from the vulnerable consumer perspective. Liquid Gas Europe calls to:

- Carefully assess the impact of the proposal on vulnerable consumers and small businesses.
- Use a level of free allocation of allowances in the initial stages of implementation to limit the impact on consumers and businesses.
- Stimulate the production and uptake of renewable gases.
- Avoid double taxation.

3. SUPPORT SCALING UP OF RENEWABLE GAS PRODUCTION

Renewable gases have a key role to play in reducing emissions in hard-to-decarbonise rural areas. To ensure the availability and to accelerate the uptake of renewable LPG, bioLPG and rDME in the European Union, Liquid Gas Europe urges policymakers to:

- Ensure a regulatory framework which supports production pathways of renewable liquid gas and R&D activities, and incentivises their uptake to help achieve the increased RES target.
- Recognise all relevant production pathways of bioLPG and rDME.
- Define renewable LPG and include its energy content alongside other terms such as 'bio-butane', 'renewable propane', and 'renewable butane'.
- Introduce stricter requirements for air pollution in sustainability criteria.
- Ensure that Guarantees of Origin and sustainability certificates are compatible and complementary.

4. ENSURE RURAL CONSUMERS CAN CHOOSE TECHNOLOGIES WHICH MATCH THEIR NEEDS AFFORDABLY

Electrification of heating is not possible for many off-grid customers, nor is it most efficient and cost-effective option in all areas. In industrial applications and in transportation, LPG can play an important role in reducing CO_2 emissions, hence we call to:

- Include renewable gas boilers in long-term heat planning. Policies should focus on carbon emission outcomes, rather than banning specific technologies.
- Respect the principle of technological neutrality and allow LPG and renewable fuels to play their role in decarbonising the transport sector.

> Renewable gases have a key role to play in reducing emissions in hard-to-decarbonise rural areas.

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LPG – The Smart Alternative, Everywhere You Need It