Gas for off-grid Britain

the trade association for the UK LPG industry
**Introductory overview**

LPG supplies essential clean energy to off-grid homes and businesses.

The UK’s off-grid energy mix needs effective and efficient, low carbon fuels to meet domestic and commercial energy demand both now and into the future.

LPG ensures that off-grid homes and businesses can access gas and the significant advantages provided by gas powered systems and technologies.

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**Gas for off-grid Britain**

UKLPG is the trade association representing companies that operate in the Liquefied Petroleum Gas (LPG) industry in the UK. Members include LPG producers, distributors and equipment and service providers.

UKLPG member companies supply over 99% of the total LPG distributed in the UK.

LPG is a key component of the UK’s diverse energy mix ensuring that homes and businesses located off the mains gas grid have access to high grade heat and the most efficient gas powered technologies.

UKLPG is dedicated to LPG’s safe and progressive development, with a focus on its role in providing low carbon heat and energy for homes and businesses that are off the mains gas grid.

UKLPG takes a leading role in liaising and consulting with Government, legislators and policymakers with regards to energy policy, infrastructure and supply resilience on behalf of its member companies.

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**Liquefied Petroleum Gas (LPG)** is a low carbon, affordable and secure fuel which provides essential heat and energy to off-grid Britain.
Where is off-grid Britain?

There is a common misconception that off-grid domestic properties and commercial premises are situated only in the extreme fringes of the UK. This is not the case. There are off-grid homes and businesses where the grid does not reach all across the UK, even throughout ‘suburban’ England, Wales and Scotland.

The UK’s gas grid network extends to 84% of UK households. Of the remaining 16%, 2 million properties are rural off-grid homes that without LPG would not otherwise have access to gas as a clean, versatile and efficient fuel.

LPG is therefore a key feature of the UK’s energy mix ensuring that these homes can access gas and the advantages provided by gas powered systems and technologies.

Businesses situated off-grid also face the challenge of finding an efficient and reliable energy source to keep their businesses running and remaining competitive.

The off-grid location of these commercial enterprises is often intrinsic to their business type and operation. LPG is a failsafe fuel for these businesses.

For off-grid homes and businesses, LPG is the lowest carbon conventional energy source available and provides an immediate, expedient and cost-effective energy solution.

What is LPG?...

LPG is a blanket denomination for Liquefied Petroleum Gas which refers to two gases, propane (C3H8) and butane (C4H10), which occur naturally and are easily converted to liquid form through the application of moderate pressure.

LPG can be used practically anywhere. From emergency relief operations to isolated islands to ski resorts at altitude - LPG can reach places other energies cannot. LPG has a flexible and decentralised distribution network which reaches beyond energy grids, facilitating development in the most remote of areas.

LPG is a low carbon alternative to conventional fossil fuels. Its combustion emits 33% less CO2 than coal and 15% less than heating oil. It also emits no black carbon – a major contributor to climate change.

LPG is available right now in quantities that can service the energy needs of millions of citizens across Europe and the world. LPG will remain in global abundance for many years to come.

LPG is a clean burning smoke-free fuel that supports cleaner air quality. Unlike many other fuels, it contains low levels of NOx, particulate matter (PM) which means it is suitable for both indoor and outdoor use.

LPG has multiple sources, and because it’s easily transportable, it offers a secure alternative to other energy sources.

LPG has many varied potential applications. From domestic heating and cooking, to commercial heat and power as well as thousands of portable applications.

Gaseous fuels inherently offer high efficiency which supports optimised performance in the newest boilers, heating technologies and renewable/LPG hybrid systems which promote reduced energy consumption.
What is LPG?
Attributes and applications

LPG is a key feature of the UK’s energy mix and ensures that homes and businesses off the mains gas grid can access gas and the advantages provided by gas powered systems and technologies.

LPG - Powering UK homes...

LPG FOR HEAT & HOT WATER
Households use LPG for space and water heating, in the same way as natural gas.

LPG FOR TRANSPORT
Autogas is the world’s most widely used alternative transport fuel.

LPG FOR REFRIGERATION
LPG powers refrigerator units for food distribution, catering vans and trailers.

LPG FOR COOKING
LPG is the only gas that keeps those living off the grid ‘cooking on gas’!

LPG FOR GARDENING
LPG powers mowers, strimmers, log splitters, shredders, leaf blowers and more...

LPG SECURE & DISCREET
Storing LPG is easy and safe, and the storage tank can be conveniently installed above or below ground.

LPG ‘SMART’ & HIGH TECH
The newest LPG gas appliances are ‘smart’ capable, offer optimised efficiency and performance and support demand reduction in conventional and hybrid systems.

LPG RENEWABLE FRIENDLY
LPG is the perfect partner for domestic renewable energy users, ensuring that heat and hot water is always instantly available.

LPG - Powering UK homes...
LPG - Powering UK leisure time...

**LPG CLEAN**
LPG is an environmentally friendly, smoke-free fuel that supports cleaner air quality.

**LPG VERSATILE**
LPG is versatile & multi-purpose, making it perfect for a wide range of indoor and outdoor events.

**LPG PORTABLE**
Easily transportable, LPG cylinders are manufactured in sizes ranging from 3.9kg – 47kg to cater for both personal through to commercial use.

**LPG EVERYWHERE**
LPG can be used practically anywhere. From towns and cities to the remotest locations, LPG can reach places other energies cannot.

**LPG FOR CATERING**
Home barbecues, street food festivals, outdoor fetes and events all choose LPG for cooking.

**LPG FOR HOLIDAYS**
LPG is widely used in camping, caravanning, motorhomes and boating.

**LPG FOR GENERATING POWER**
LPG can generate power when other sources fail or cannot reach.

**LPG FOR HOSPITALITY & LEISURE**
Off-grid pubs, hotels, golf clubs and spas all depend on LPG.
LPG - Powering UK agriculture...

**LPG FOR FARMS & HORTICULTURE**
LPG is essential for processes such as crop drying, animal rearing and greenhouse heating.

**LPG FOR PORTABLE EQUIPMENT**
From water pumps, to pressure washers, log splitters to shredders, LPG powers these and many more...

**LPG BESPOKE**
Commercial LPG powered systems can be designed to meet any specification and demand.

**LPG SCALEABLE**
Fuel is delivered to 1 tonne (2000l), 2 tonne (4000l) or 4 tonne (8000l) tanks which can sit above or below ground. High volume users often choose to have multiple tanks installed.

**LPG FOR NON ROAD MOBILE MACHINERY (NRMM)**
LPG is widely used for fork lift trucks and mini transporters which require no charging and operate indoors and outdoors.
LPG - Powering UK industry

LPG FOR INFRASTRUCTURE
For the highways and construction industry, LPG is the choice for building, maintenance and emergency repairs.

LPG FOR INDUSTRY
In offices, factories and warehouses, LPG heats, cools and powers many essential processes and operations.

LPG POWERFUL
LPG fuels large manufacturing plants and factories to provide space and process heating and power for industrial machinery.
UK Energy Challenges

A key priority for the UK Government's Department for Business, Energy and Industrial Strategy is to ensure an affordable, clean and secure energy supply for the UK.

Targeting buildings off the gas grid

"The Government will need to consider how to reduce the use of coal and oil in buildings, and how best to promote a transition away from high fossil fuel heating over the coming decades. We need to consider which kind of policy interventions could support this change, and how to ensure such changes are aligned with our industrial strategy and an economy that works for everyone." (BEIS December 2016).

A reliant and resilient energy system

Energy Security (reliability) – the need for a resilient and dependable fuel that can meet the UK's diverse short and long-term demand

Energy Affordability – the need for fuels that domestic and commercial consumers can afford

Environmental Sustainability – the need for fuels that reduce the levels of carbon and other greenhouse gas (GHG) that are emitted into the atmosphere in order to diminish negative impacts

International Climate Change and cost-effective carbon reduction in the home

LPG can address the trilemma for the off-grid sector

Secure
Multiple production methods and supply routes ensure LPG security

Competitive
Multiple players in the market drive competitive pricing

Sustainable
LPG is low in carbon, Nitrous Oxide (NOx) and particulate matter (PM)
LPG Sustainability

The Committee on Climate Change recognises that in order to achieve harmful emissions reduction the following must be found:

• Solutions which use a combination of improved energy efficiency and use of low-carbon energy

• Fuels and technologies that keep consumers at the heart of decisions; customer choice that meets customer need

LPG is the cleanest, most efficient and effective fuel compared to conventional off-grid coal, oil and electricity

UK ratification of Paris agreement - to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels

5th Carbon Budget - to slash carbon emissions by 57 per cent against 1990 levels by 2032. The law legally binds the UK to a carbon budget of 1,725 MtCO2e for the period 2028 to 2032.

Nitrous Oxide (NOx)

LPG offers significant reductions in NOx emissions compared to other conventional fuels.

Measured emission factors (EF) in the study of Innovhub-SSI (2016) NOx emissions g/GJ

<table>
<thead>
<tr>
<th>Fuel</th>
<th>NOx EF (g/GJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pellet A2 high grade stove</td>
<td>+635%</td>
</tr>
<tr>
<td>Pellet A1 high grade stove</td>
<td>+501%</td>
</tr>
<tr>
<td>Wood logs</td>
<td>+440%</td>
</tr>
<tr>
<td>Oil</td>
<td>+50%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>+43%</td>
</tr>
<tr>
<td>LPG</td>
<td>+33%</td>
</tr>
</tbody>
</table>

Particulate matter (PM)

LPG combustion emits almost no PM

Oil emits 10x more and coal emits 100x more PM

A biomass stove can generate up to 4000 times higher PM than an LPG appliance for the same thermal output
LPG Supply Security

LPG is derived through the exploitation of natural gas (the origin of 62% of global LPG supply; 47% in Europe) or as a by-product from oil extraction and refining.

As a by-product of two large energy industries, LPG was previously burned off and wasted until its value as a versatile, low carbon fuel was realised and it quickly became established globally as a widely available exceptional energy source that is perfect for a wide variety of applications.

Relationship with Government’s Energy Resilience Teams

LPG remains a key feature of the UK’s energy mix and resilience infrastructure. UKLPG remains actively engaged and committed to continued dialogue with HM Government, BEIS and Government officials in respect of energy supply, distribution and development.

UKLPG is an active member of BEIS’ Downstream Oil Industries Forum (DOIF) and has contributed to Government’s 2017 review of the National Emergency Plan for Fuel (NEP-F).

How is LPG sourced for the UK?

LPG is either produced at one of the UK’s 6 oil refineries or is imported to one of its 5 import points as identified in the map overleaf.

Large quantities of LPG are transported directly to distribution depots across the country. There are also three major storage facilities which are used to ensure secure supply and support peak demand throughout the winter months.

Global production of LPG continues to rise and so the security of supply of LPG remains strong.

*Argus 2015*
United Kingdom
LPG Supply Infrastructure
Large volumes of bulk LPG are distributed in tanker lorries to meet commercial scale demand.

For domestic bulk LPG deliveries and for rural off-grid locations with smaller access roads, smaller tanker trucks are used to ensure safe, convenient delivery.

A varied fleet of road haulage vehicles distributes LPG cylinders in sizes ranging from 3.9kg to 47kg capacity.

UKLPG has more than 100 member companies consisting of LPG producers, distributors, equipment manufacturers and service providers: a third of which have business operations that ensure supply and distribution of LPG from the 112 distribution depots across the UK.

This active market promotes healthy competition within the industry and drives diversification and innovation of products and services.

A single portal on the UKLPG website provides public access to a list of all UKLPG member companies, the sectors that they supply and the regions and postcodes that they distribute fuel to.
Future of off-grid energy

The UK Government is keen to take steps to reduce carbon and pollutant emissions from buildings in the off-grid sector.

The Heat in Buildings Consultation series - The Future of Heat: Domestic & Non-domestic buildings has highlighted Government's ambition to reduce and make the transition away from coal and oil, the most polluting fossil fuels.

To achieve an effective off-grid solution, it is important that Government recognises that off the gas grid there is no 'typical' property. Heat and energy demand can vary dramatically as off-grid properties are diverse in size, fabric and geographic location.

Gas technologies are versatile and highly effective in heating all types of property – even those that are hard to heat and difficult to insulate such as those with solid walls.

Low carbon LPG already fuels highly efficient gas boilers and heating systems, akin to those endorsed by Government for 84% of those domestic properties connected to the gas grid.

The gas industry remains committed to developing LPG powered domestic and commercial appliances, technologies and hybrid systems to deliver continued advancement in performance and efficiency.

LPG therefore remains the lowest carbon, most efficient and effective conventional fuel for off-grid consumers.
Off-grid green gas solutions

It is one of Government’s key aims to deliver affordable energy and clean growth whilst keeping costs down for consumers, and securing the transition to a low-carbon economy.

KPMG’s report ‘2050 Energy Scenarios - The UK Gas Networks role in a 2050 whole energy system’ highlighted that the lowest cost route to heat homes and supply energy to businesses and industry, whilst also meeting our carbon reduction targets, is to use the existing gas network as the foundation of the UK’s future low carbon energy system.

This method incurs minimal costs and disruption, two of Government’s key aims.

The report finds that evolution of gas, such as by injecting green gas into the grid, offers significant cost savings against alternative low carbon heating sources.

For off-grid Britain ‘biopropane’ provides a green gas solution.

Biopropane

Biopropane and bioLPG are terms used to describe LPG which is derived from production processes that use a variety of biological materials as feedstocks, including waste streams.

Importantly biopropane or bioLPG is chemically indistinct from LPG and so can be used as it is, just like conventional LPG. This means that it can be ‘dropped-in’ to existing supply chains and appliances without the need to modify existing infrastructure or the technical specifications of LPG gas appliances, a huge advantage over other bioliquid fuels.

Unlike other forms of bioenergy bioLPG is non-corrosive and so existing LPG storage and distribution infrastructure does not require any upgrade investment.

How is bioLPG produced?

There are several ways to make biopropane, using different technologies and a variety of thermal and chemical processes.

UKLPG member companies are investing in a range of different production methods including both imported and localised UK production.

The chart above provides for an overview of the main technologies being used or developed across the world to produce bioLPG.

UKLPG members are actively involved in developing processes which shift the conventional production methods onto waste and residue based production that would ensure a truly biological fuel source.

One LPG supplier in the UK is invested in a process of biopropane production which is soon to be imported to the UK from Neste’s Rotterdam Refinery. Another source of biopropane is being developed jointly with the Institute of Biotechnology at Manchester University. This production method builds on UK Government funded research which demonstrates that biopropane can be produced from fermentation processes of a variety of feedstocks (including multiple waste streams). The fermentation process used emits little to no extra carbon into the environment meaning that production is effectively carbon neutral.

To reduce carbon and pollutant emissions from buildings steps need to be taken by Government now to reduce the use of coal and oil in the off-grid sector. LPG offers substantial and immediate carbon and pollutant emission savings for both homes and off-grid businesses.

In the future, biopropane as a ‘drop-in’ bio-gas offers further significant decarbonisation potential to LPG consumers.

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Process</th>
<th>Outputs</th>
<th>Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetable oil/animal fat</td>
<td>HVO</td>
<td>Biodiesel, biopropane (5-8%)</td>
<td>Neste Oil (NExBTL), UOP/Eni Dynamic Fuels, ConocoPhillips, Diamond Green</td>
</tr>
<tr>
<td>Cellulosic biomass (wood/lignin/ starch/crops)</td>
<td>MTG gasification</td>
<td>Gasoline, biopropane (10-30%)</td>
<td>ExxonMobil (MTG), Haldor Topsoe (TIGAS)</td>
</tr>
<tr>
<td>Glycerine</td>
<td>Gasification/direct synthesis</td>
<td>DME, gasoline or biopropane (significant%)</td>
<td>Japan Synthesis Gas Co.</td>
</tr>
<tr>
<td>Glycerine</td>
<td>Fischer-Tropsch gasification</td>
<td>Diesel, naphtha, lubes, biopropane (small volumes)</td>
<td>Shell (RTP), UPM Maverick Fuels</td>
</tr>
<tr>
<td>Various including glucose, sugar and cellulose biomass</td>
<td>Pyrolysis/hydrogenation</td>
<td>Gasoline, diesel, kerosene biopropane (up to 15%)</td>
<td>Enyn (RTP), GTI (IH2)</td>
</tr>
<tr>
<td>Various including glucose, sugar and cellulose biomass</td>
<td>Methanol gasification</td>
<td>Biogas or biopropane</td>
<td>Bio-Fuel Solution</td>
</tr>
<tr>
<td>Various including glucose, sugar and cellulose biomass</td>
<td>Aqueous Phase Reforming</td>
<td>Methanol, DME biopropane (small volumes)</td>
<td>BioMCN</td>
</tr>
<tr>
<td>Sugar/starch (crops)</td>
<td>Superritical fermentation</td>
<td>Various fuels including biopropane</td>
<td>VES (BioForming)</td>
</tr>
<tr>
<td>Sugar/starch (crops)</td>
<td>Biological/metabolic conversion</td>
<td>Various fuels including biopropane</td>
<td>C3 Bioenergy (US)</td>
</tr>
<tr>
<td>Various including glucose, sugar and cellulose biomass</td>
<td>Various including glucose, sugar and cellulose biomass</td>
<td>Biopropane</td>
<td>C3 Biotechnologies Ltd (UK)</td>
</tr>
</tbody>
</table>
Social and Corporate Responsibility

UKLPG Ombudsman Scheme

In 2017, UKLPG launched its UKLPG Ombudsman Scheme to ensure industrywide compliance with The Alternative Dispute Resolution for Consumer Disputes Regulations 2015. Alternative Dispute Resolution (ADR) refers to methods of resolving disputes between consumers and traders which prevent the need to go to court. ADR, and access to it, is good practice for all businesses that are committed to giving their customers the best possible service.

All UKLPG member companies remain committed to resolving customer grievances as quickly and efficiently as possible, however where customers require further recourse to resolution access to independent mediation is available free of charge. Administered by UtilitiesADR (a division of The Retail Ombudsman), the UKLPG Ombudsman Scheme will give the customers of UKLPG member companies that purchase domestic bulk LPG, LPG cylinders, Autogas and LPG equipment, access to independent arbitration should they wish to pursue this route to resolve their complaint.

Vulnerable Peoples Protocol

The UKLPG Vulnerable Peoples protocol encompasses a set of practice standards that UKLPG members are obliged to adhere to. The protocol details:

- customer protection embodied in contracted supply arrangements;
- assistance for customers with visual or aural impairments;
- best practice for dealing with customers in payment difficulties;
- priority delivery endeavours.

Switch Supplier Service

In adherence to the Competition and Markets Authority order that came into effect in April 2009, all bulk domestic LPG customers whose gas is supplied via a bulk tank are able to switch their LPG supplier along with the ownership of their tank once they are no longer bound by any exclusivity period in a supply contract, which can last no longer than two years.

LPG suppliers advise customers of this one month before they become eligible to switch. Details of this date are also included in customers’ supply contracts. UKLPG provides a ‘switch supplier service’ enabling LPG customers to ‘shop around’ by searching the list of UKLPG member companies that supply LPG to their postcode area. More details can be found at www.uklpg.org/advice-and-information/how-to-switch-lpg-supplier/

Cold Weather Priority Delivery

UKLPG member companies strive to ensure that they can deliver LPG to their customers throughout the year. In winter demand for LPG is at its highest and should there be severe enough weather to block roads, normal delivery patterns can become disrupted. At times of restricted supply the industry will seek to ensure that the following groups do not run out of energy:

- Those (account holder or permanent occupant of the residence) aged 75 or older
- Those who are chronically ill or registered disabled

In addition to the above criteria, UKLPG member companies are aware that there are other temporary extenuating circumstances which may warrant priority delivery treatment (e.g. pregnant mothers/households with children under 2 years old) and all reasonable endeavours will be taken to ensure such customers do not go without energy.

Each UKLPG member company will have its own policy on how it seeks to meet this commitment, including working with customers who fall into the above categories to help ensure that they go into winter with an adequate stock of LPG, or identifying at an early opportunity when they might need a further delivery.
UKLPG Codes of Practice

UKLPG’s Codes of Practice, which provide guidance on best engineering and safety practice are recognised and acknowledged worldwide. The Codes cover transportation, storage, installation, operations and utilisation of LPG.

The Codes of Practice have been developed by experts from within the industry with the UK Health & Safety Executive and other government authorities. They are used by industry sectors as guidance to develop industry specific standards of practice.

All UKLPG members comply with UKLPG Codes of Practice and UKLPG’s Technical and Safety Management Team ensure the continual monitoring and review of these codes in line with HSE best practice.

Executive Summary

LPG supplies essential clean energy to off-grid homes and businesses.

The UK’s off-grid energy mix needs effective and efficient, low carbon fuels to meet domestic and commercial energy demand both now and into the future.

LPG ensures that off-grid homes and businesses can access gas and the significant advantages provided by gas powered systems and technologies.

For the off-grid gas sector LPG is the lowest carbon conventional fuel available now that can provide an immediate, expedient and cost effective energy solution.