

# CUTTING THROUGH THE NOISE:

LPG and its response, recovery & regeneration amid the COVID-19 crisis

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A World LPG Association (WLPGA) report with analysis provided by Ecuity Consulting

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## **Acknowledgements**

### **World LPG Association (WLPGA)**

The WLPGA was established in 1987 in Dublin and unites the broad interests of the vast worldwide LPG industry in one organisation. It was granted Category II Consultative Status with the United Nations Economic and Social Council in 1989. The WLPGA promotes the use of LPG to foster a safer, cleaner, healthier and more prosperous world. This report was prepared with analysis and input from Ecuity Consulting LLP, a firm of energy policy experts based in the United Kingdom. We would also like to thank representatives of DCC LPG, Epic Gas, Equinor, Liquid Gas Europe, National Propane Gas Association (NPGA), Propane Education and Research Council (PERC), SHV Energy, Suburban Propane, UGI International, Omera LPG, Salam Gaz, Aygaz, and Ultragas for their valuable contributions and support.



# CONTENTS

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<b>Executive Summary</b>	<b>04</b>
<b>Introduction</b>	<b>06</b>
1. The LPG industry's role in supporting lasting environmental improvement	<b>08</b>
2. The LPG industry's role in supporting a sustainable economic recovery	<b>16</b>
3. The LPG industry's role in responding to the 'new normal'	<b>24</b>
<b>A Final Word</b>	<b>32</b>

# EXECUTIVE SUMMARY

**The Coronavirus (COVID-19) crisis is a global health crisis of unique reach and severity, and has impacted nearly all countries globally. The crisis hit during a year in which an oil price crash had already disrupted LPG production. In the midst of unprecedented challenges, the LPG industry continued to supply, and was designated as an essential service by governments across the world.**

This report is the first step in an important discussion amongst key stakeholders about the impact of the crisis on the LPG industry, examples of challenges faced and solutions delivered that can define best practice moving forward. As markets look set to enter the 'new normal,' this report comes at a time when the industry can position itself as a provider of cost-effective, resilient and clean energy solutions.

The report is informed by research undertaken for this project. Survey results, included in a separate document available exclusively for WLPGA members, describe the industry's response to the crisis and expectations of a long-term role

in helping build a sustainable recovery, one that takes in the development targets associated with the United Nations' Sustainable Development Goals (SDGs). The document available for WLPGA members also includes several case studies from countries around the world. This report includes economic scenario analysis to evidence the environmental and economic benefits of switching to LPG from more polluting fuels as governments consider how to structure crisis recovery policies.

The LPG industry has demonstrated its importance as a provider of essential energy services to households and businesses in a time of need. As countries look to move forward from



SOME OF THE KEY FINDINGS FROM THE STUDY INCLUDE:

- ▶ **ESSENTIAL** – THE LPG INDUSTRY PROVIDED ESSENTIAL FUEL SUPPLIES TO MEDICAL FACILITIES, BUSINESSES AND HOMES ACROSS THE WORLD AT TIMES OF NEED. DURING THIS PANDEMIC, LPG WAS DEEMED TO BE AN ESSENTIAL PRODUCT BY NEARLY EVERY NATIONAL GOVERNMENT IN THE WORLD.
- ▶ **RESILIENCE** – WHILST SURVEY RESPONDENTS NOTED SUPPLY CHALLENGES, THE INDUSTRY IS RESILIENT TO RAPID CHANGES AND CONTINUED TO SUPPLY CUSTOMERS GLOBALLY. DEMAND PATTERNS CHANGED DRASTICALLY (SHIFT FROM B2B TO MORE B2C) CREATING SHORT-TERM CHALLENGES FOR THE INDUSTRY WHICH IT OVERCAME.
- ▶ **LONG-TERM ROLE** – THE LPG INDUSTRY IS WELL-PLACED TO CONTRIBUTE TO A SUSTAINABLE ECONOMIC RECOVERY WHICH CONTRIBUTES TO ACHIEVING THE SDGS. FROM AN INCREASING PROPENSITY TO WORK FROM HOME, TO AN INCREASED DEMAND FOR LOW EMISSION ENERGY, THE INDUSTRY IS WELL-PLACED TO CONTINUE TO INNOVATE AND DELIVER VALUE FOR CUSTOMERS.

the COVID-19 crisis, this report illustrates several areas where the industry is well-placed to support a clean, cost-effective and resilient recovery.

Through cooperation with organisations such as the WLPGA, industry leaders have the opportunity to come together, share experiences and re-build markets and communities.

# INTRODUCTION



**The impact of the COVID-19 crisis has been felt across the world and by all industries. The LPG industry has been subjected to variations in demand, as well as challenges with both supply and transporting fuel. The introduction of social distancing restrictions has also presented some unprecedented difficulties.**

However, the sector has acted quickly to adapt to the changing environment both at a local and a global level and suppliers have introduced a range of measures to ensure that customers continue to be serviced safely. This introduction outlines the response of the LPG industry to the pandemic and explains the procedures introduced to ensure that households and businesses have access to clean, portable fuel during these uncertain times. WLPGA members participated in an online survey to provide a snapshot of the current situation, the findings inform the analysis in this report.

With uncertainty all around, the LPG industry has stepped up its game to ensure millions of households and businesses across the world are able to continue heating, cooking and return to work.

With COVID-19 impacting the health of millions globally, LPG remains the fuel of choice being a clean-burning and low pollutant heating fuel. For the poorest in society, the use of LPG is a direct health benefit measure. Research has shown, so far, that those exposed to air pollution are more susceptible to COVID-19.

It is imperative therefore that the health and environmental benefits of COVID-19 are communicated as widely and intensely as possible to ensure households and businesses are using the best fuel for their homes and businesses.



- ▶ THE LPG SECTOR HAS RESPONDED QUICKLY TO THE PANDEMIC ENSURING THAT HOUSEHOLDS AND BUSINESSES HAVE ACCESS TO CLEAN, AFFORDABLE AND LOWER CARBON HEAT. WLPGA MEMBERS PROVIDED FUEL IN A RANGE OF EMERGENCY SITUATIONS DURING THE COVID-19 CRISIS, PROVIDING HEAT AND POWER GENERATION TO HOSPITALS AND TESTING CENTRES AROUND THE WORLD. THIS IS DESPITE WLPGA MEMBERS REPORTING DELIVERY CHALLENGES DURING LOCKDOWN (60% OF SURVEY RESPONDENTS).
- ▶ WLPGA MEMBERS HAVE INTRODUCED VARIOUS MEASURES OVERCOME CHALLENGES POSED BY COVID-19 TO MAINTAIN FUEL SUPPLIES AND SERVICE CUSTOMERS SAFELY, WHILST KEEPING THEIR EMPLOYEES PROTECTED. THESE MEASURES INCLUDE PROVIDING PERSONAL PROTECTION EQUIPMENT FOR STAFF AND IMPLEMENTING SOCIAL DISTANCING PROCEDURES. OTHERS HAVE INCREASED FUEL STOCKPILES TO ENSURE AVAILABILITY OF FUEL AND INTRODUCED ADDITIONAL ONLINE CUSTOMER SERVICE SUPPORT TO LIMIT CONTACT WITH CLIENTS.
- ▶ OVER 65% OF WLPGA MEMBERS THAT RESPONDED TO THE SURVEY CONDUCTED FOR THIS REPORT CONSIDERED THAT THE DISTRIBUTION OF LPG DEMAND BY SECTOR HAD CHANGED AS A RESULT OF THE CRISIS. A COMMON POSITION WAS THAT LPG DEMAND HAD PARTIALLY SHIFTED FROM COMMERCIAL SECTORS (E.G. HOSPITALITY AND TOURISM) TO RESIDENTIAL SOURCES AS AN INCREASING NUMBER OF PEOPLE WORKED FROM HOME DURING THE PANDEMIC.

# 1. THE LPG INDUSTRY'S ROLE IN SUPPORTING LASTING ENVIRONMENTAL IMPROVEMENT



- The COVID-19 crisis led to a short-term reduction in greenhouse gas emissions (17% reduction in global daily emissions) and air pollution (e.g. in Delhi, particulate matter emissions halved). Whilst emissions are expected to rebound to an extent, as one WLPGA member noted, clean air and environmental arguments are being discussed again by society and policymakers.
- As countries and governments look to the 'new normal,' there is an opportunity to position the LPG industry in a positive role supporting key industries and communities with affordable and flexible energy, that also lowers emissions sustainably. For instance, there is a positive argument to be made for cleaner LPG and bioLPG heating in northern Italy where pollution levels have remained high during the lockdown.
- As a tangible example, this chapter includes a case study considering the positive impact of switching diesel school buses in the US to Autogas. Replacing these buses with LPG would see CO<sub>2</sub> emissions reduced by 31%. LPG buses also emit fewer pollutant emissions, reducing PM and NOx emissions by 67% and

98% respectively against diesel-fueled buses. Monetising the emission savings could save the US economy around \$8bn in damage costs (e.g. healthcare costs) inflicted by these emissions.

## THE IMPACT OF COVID-19- LOCKDOWNS ON GLOBAL ENVIRONMENTAL CHALLENGES

Governments around the world have been grappling with several urgent environmental crises. The COVID-19-lockdown and immediate restriction in economic activity created a unique opportunity to validate the impact of certain fuels on health and the environment. Be that in terms of localised air pollutants that cause health issues around the world, or greenhouse gas emissions.

During 2019, the issue of climate change captured popular imagination with protests attended by millions around the world<sup>1</sup>. Policymakers responded with new pledges, regulations and sources of funding for technologies, fuels and industries that can help deliver decarbonisation. New Zealand, France and the UK set net-zero emission targets in law, more than 70 other countries also

1. BBC (2019) Climate protests: Marches worldwide against global warming



announced their intention to move towards net zero by 2050<sup>2</sup>, and the European Commission announced its Green Deal and plan to mobilise at least €1 trillion of private and public funding in the next decade<sup>3</sup>.

National lockdowns have led to a sharp contraction in economic activity. Factories closed, restaurants shut, and many workers were placed on temporary leave. Early research suggests that globally, daily emissions decreased by 17% compared to the same month in 2019 at the peak of the lockdown in early April 2020 (see Figure 1).

The challenge for policymakers as countries exit lockdown, is to ensure that environmental benefits are secured, while still delivering essential economic growth. The LPG industry can play a positive role in supporting key industries and communities with affordable and flexible energy, that also lowers emissions sustainably.

The impact of COVID-19 lockdowns on air quality has been perhaps even starker, with the immediate benefit of cleaner air recognised in many parts of the world. According to India's Central Pollution Control Board (CPCB), lockdown cut fine particulate matter levels in half in Delhi –

**The LPG industry can play a positive role in supporting key industries and communities with affordable and flexible energy, that also lowers emissions sustainably.**

2. ISSD (2019) 73 Countries Commit to Net Zero CO2 Emissions by 2050

3. European Commission (2020) Financing the green transition: The European Green Deal Investment Plan and Just Transition Mechanism



see also Figure 2. Air quality improvements were also notably felt in China, North America and cities like Nairobi.

Air pollution contributes to over seven million premature deaths per year globally, with nine out of ten people breathing air that contains high levels of pollutants<sup>4</sup>. The World Economic

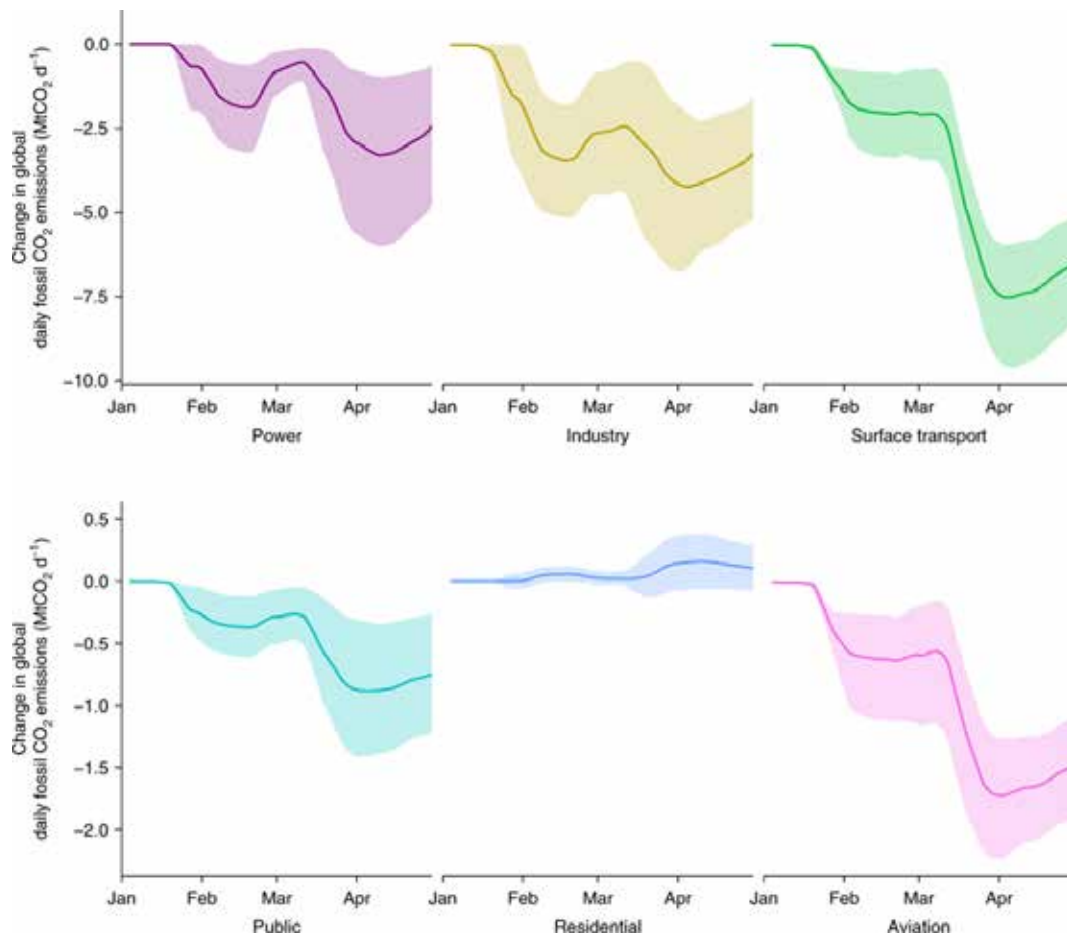


Figure 1 - impact of COVID-lockdown on daily CO<sub>2</sub> emissions (Le Quéré et al, 2020)

4. World Health Organisation (2018) 9 out of 10 people worldwide breathe polluted air, but more countries are taking action



Forum projects that air pollution is costing the world economy more than \$5 trillion a year in reduced productivity as a result of ill-health<sup>5</sup>.

Therefore, the positive impact of improved air quality has been significant. Indeed, the Centre for Research on Energy and Clean Air (CREA) consider that 11,000 premature deaths have been avoided in Europe as a result of the improvement to air quality caused by

the lockdown<sup>6</sup>. Reduced air pollution avoids negative health impacts such as asthma, heart conditions and other respiratory illnesses. The virus has of course however caused many additional deaths in this period.

The air quality benefit has not been felt consistently across countries. However whilst Italy has benefited from reduced emissions from vehicles, [Figure 3](#) illustrates that fine

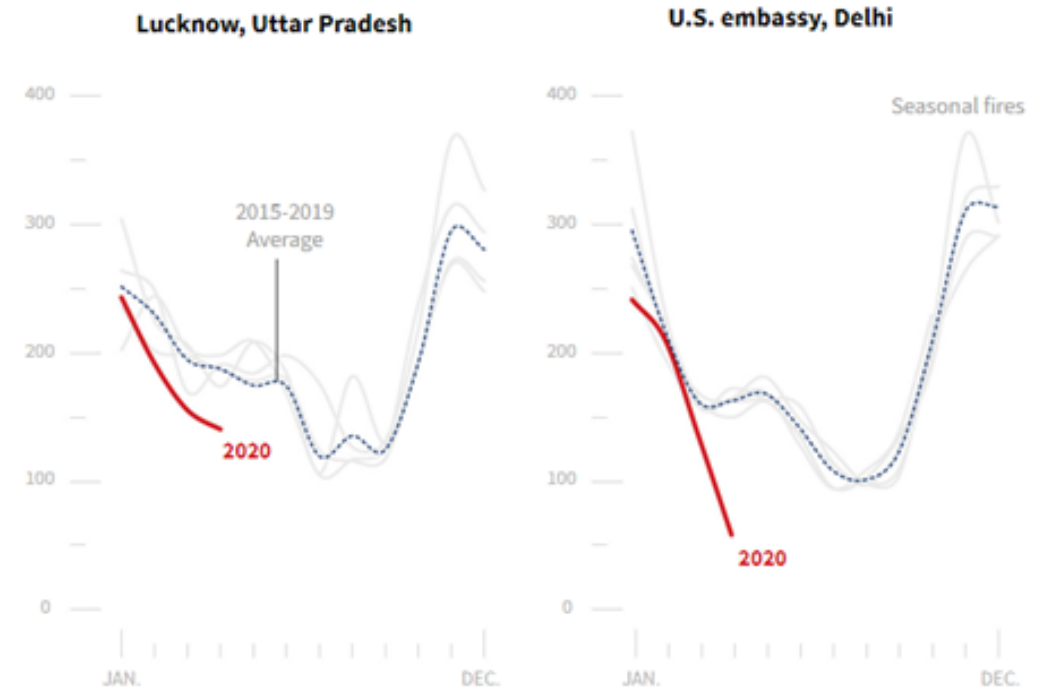


Figure 2 - Monthly average PM2.5 levels between 2015-2020 (Source: Reuters)

5. World Economic Forum (2020) *The Global Risks Report 2020*

6. CREA (2020) 11,000 air pollution-related deaths avoided in Europe as coal, oil consumption plummet

particulate matter (PM<sub>2.5</sub>) emissions from rural measurement stations have on average increased between 2020 and 2019. Our analysis of European Environment Agency (EEA) data suggests that on average rural stations have – year to date – report a 12% increase in PM<sub>2.5</sub> emissions.

This is significant, as it suggests that heating choices have had a direct impact on air pollution levels. The results of the survey carried out for this report show that while industrial, commercial and transport energy consumption has fallen, residential energy consumption has increased owing to remote working and consumer stockpiling. In Northern Italy, where many households use solid fuels and woody biomass for heating, the data suggests that this type of heating has had an adverse impact on air quality levels. Other heating options, such as using LPG, result in far lower rates of PM<sub>2.5</sub> emissions (see [table 2](#)).

As we enter a period when policymakers will be tasked with developing new regulatory responses to unique health, economic, social and environmental circumstances, the challenge will be to balance these objectives. The LPG industry can play its part in delivering cost-effective emission reductions.

## LPG'S ROLE IN CREATING LASTING ENVIRONMENTAL BENEFIT

The LPG industry can play an active and positive role in creating lasting environmental benefit as economies look to reset after COVID-19 lockdowns. Most immediately, a transition to clean heating, cooking and transport-use across sectors and countries could dramatically reduce emissions cost-effectively (see chapter 3 for more on cost-effectiveness).

LPG is a clean burning fuel that can deliver substantial emission savings against equivalent oil, coal and biomass appliances. While emission factors vary substantially by technology, analysis suggests that a LPG boiler can deliver 90%+ particulate matter emission savings when compared with a wood burning stove. This result is important, as particulate matter emissions contribute to over 400,000 excess deaths a year in Europe. Switching from biomass heating in northern Italy, or coal heating in Poland to LPG would potentially save lives.

In addition, with the development of bioLPG which is increasingly being brought to market in Europe, the LPG industry can go even further

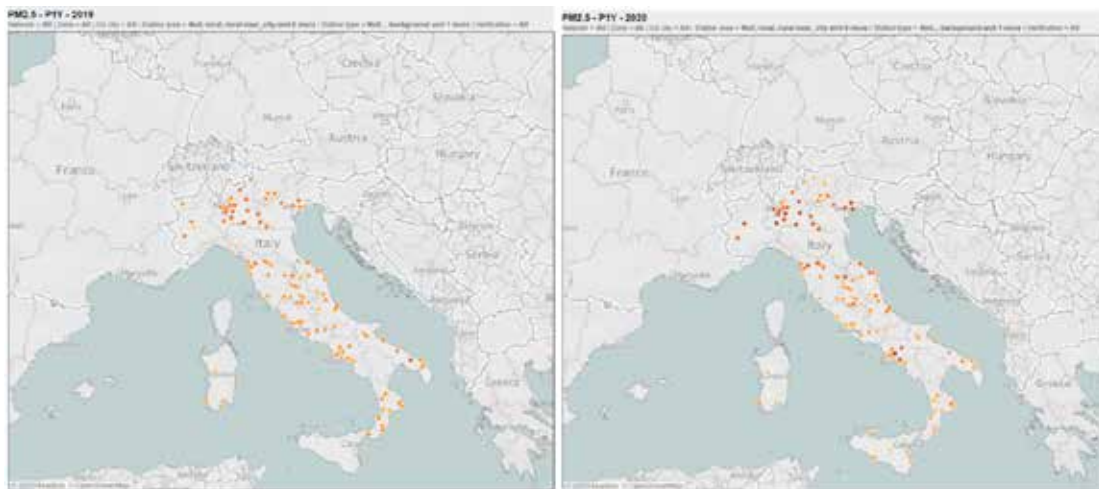


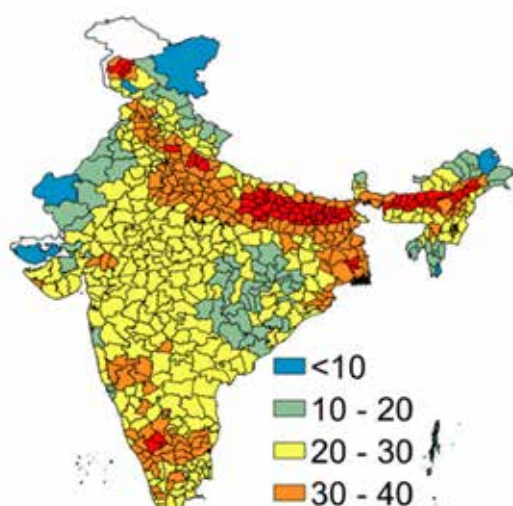
Figure 3 - Comparison of PM<sub>2.5</sub> levels from rural air quality measurement stations in 2019 and 2020 (source: EEA)

“The clean air argument is being discussed again, with a visible reduction in pollution across many parts of the world... If there exists a tangible link between COVID-19 recoveries and clean air, we must do all we can as an industry to ensure LPG remains part of the solution.”

WLPGA member

on greenhouse gas emission reductions. BioLPG is a drop-in solution that can be used in existing LPG appliances with no modifications or costs required. The biofuel is equally as clean burning as LPG with low air pollutant emissions, but one which can take greenhouse gas emissions savings even further.

In India, research suggests that annual ambient air quality standards could be met if households switched away from using solid fuels for cooking



**Figure 4 - Percentage of ambient PM2.5 exposure that can be attributed to household PM2.5 sources at baseline, 2015 (source: PNAS)**

and heating. Figure 9 illustrates the percentage of ambient particulate matter pollution that can be attributed to household emissions – with substantial proportions (>40%) in northern parts of India in particular.

LPG has been identified by the Indian Government as a clean source of energy and solution to the considerable health problems caused by solid fuel combustion. The Pradhan Mantri Ujjwala Yojana policy has supported over 30 million LPG connections, and has been as a catalyst for social change as a result of the transformative impact clean air has had on the lives of women and families.

Governments can support sustained air quality improvements by encouraging a switch from heavily polluting fuels to LPG. This has substantial environmental, health, social and economic benefits. Studies of fruit pickers in the US have shown that a marginal increase in particulate matter (PM<sub>2.5</sub>) decreases labour productivity by 6%<sup>7</sup>.

Additionally, as economies exit lockdown and people return to work, transport activity is expected to increase to pre-lockdown levels. Indeed, with a likely shift in consumer

7. Zivin, J. G & Neidell, M. (2012) The Impact of Pollution on Worker Productivity. *American Economic Review*

preferences away from public transport and shared mobility, congestion and air pollution from vehicles becomes an increasing problem for policymakers – many of which have air quality targets to meet.

The LPG industry has an opportunity to show leadership on air quality and support government efforts to tackle air pollution

through the supply of clean energy solutions. The industry can raise awareness of the effect of energy choices on local air quality and public health through consistent messaging in consultation responses, impact assessments and external communications. The economic scenario below quantifies the benefits that could be unlocked through switching from diesel to Autogas in the US.

## SCENARIO ANALYSIS: SWITCHING TO AUTOGAS SCHOOL BUSES IN THE US

Across the US, there is a trend to move away from diesel and towards cleaner burning fuels in the school bus industry. As an industry that transports 25 million school children to and from school every day, it is vital that the health of these children is maintained as they are the future of any nation.

LPG (or 'Autogas' when used in transport applications) is a promising and clean-burning alternative to diesel for the school bus industry to consider. There are currently just under 20,000 Autogas school buses on American roads transporting nearly 1.2 million children each day in almost 1,000 school districts.

The COVID-19 pandemic in the US has led to the unemployment rate to peak to 14.7% in April, the worst since records began. Today unemployment continues to remain stubbornly high. As the virus is brought under the control and the economy begins its recovery, creating sustainable jobs for the unemployed will be an imperative.

What if all the diesel school buses in the US were replaced by new Autogas buses? What impact would this have on the economy and environment?

Research from the US Department of Energy found that nearly all school districts who replaced their diesel school buses with LPG buses did so because of financial reasons. These fleets have saved between \$400 and \$3,000 per LPG bus per year, with the range of savings dependent on local fuel prices and maintenance cost savings. If all diesel school buses were replaced with Autogas buses, this could save schools between \$184 million and \$1.38 billion (depending on the savings realised). This saving is equivalent to having funding for an additional 23,425 schoolteachers (assuming the maximum saving of \$3,000 is achieved). Replacing diesel school buses with Autogas alternatives can unlock funding for many schools. This could be used to hire more teachers creating employment opportunities in a country ravaged by the COVID-19 pandemic.

In addition to the financial and economic benefits, switching from diesel to Autogas can unlock significant environmental benefits. The use of LPG can reduce greenhouse gas emissions (GHG) and lower petroleum dependence. Argonne National Laboratory for the Clean Cities programme estimates that an Autogas school bus can reduce lifecycle GHG emissions by 15% compared to a diesel bus (if the fuel economy is the same) and reduce lifecycle petroleum use by 99% when LPG is derived from natural gas processing - 70% of LPG produced in the US is from natural gas processing. As a clean-burning fuel, switching to LPG can also lower NOx (oxides of nitrogen) and PM (particulate matter) emissions compared to a diesel-fuelled school bus. The GREET model for heavy duty vehicles found that an LPG school bus emits up to 99% less NOx per mile and up to 67% less PM (per mile) compared to a diesel school bus.

Emitting one tonne of NOx and PM can impose significant damage on an economy. If all diesel school buses were replaced with Autogas, this would save the US economy \$7.7 billion in avoided damage costs from emitting a tonne of NOx and PM. The carbon savings would amount to \$151m in avoided carbon emissions from switching to LPG.

**Table 1 - Comparison of diesel and LPG emissions and damage costs (source: Ecuity Economics)**

	Emissions			Damage cost		
	All school buses are diesel	All school buses are LPG	% difference, LPG vs diesel	Total damage cost – diesel bus	Total damage cost – LPG bus	Difference – LPG vs diesel
<i>Units</i>	<i>Tonnes</i>	<i>Tonnes</i>	<i>% change</i>	<i>\$m</i>	<i>\$m</i>	<i>\$m</i>
NOx	48,068	677	98.6% lower	661	9	+652
PM	40,621	13,540	66.7% lower	10,646	3,549	+7,097
CO <sub>2</sub>	9,931,726	6,852,891	31.0% lower	486	335	+151

Switching to LPG has clear financial and environmental benefits and government should incentivise switching to lower-carbon and lower pollutant fuels such as LPG. In France, the government offers a grant to switch to a car that emits carbon emissions below 130 g/km. As far as Autogas vehicles are concerned, these are eligible if they emit carbon emissions below 130 g/km.

French regulation (decree 2014-1672) on the incentives for the purchase of environmentally friendly vehicles was modified to include Autogas-electric hybrids in the bonus specified for hybrid electric vehicles<sup>8</sup>. This suggests that the French government see a role for Autogas in facilitating CO<sub>2</sub> emission reduction. This regulation does not consider pollutant emission however, if it were to, then the case for Autogas would be even stronger. Data from

the European Environment Agency (EEA) shows that a new medium-sized passenger Euro 6 LPG vehicle emits around 92% less NOx (per km) and around 12% less PM (per km) compared to a new Euro 6 diesel vehicle<sup>9</sup>.

There are around 250 million passenger cars in Europe, many of which could be converted to run on LPG – immediately lowering air pollution and greenhouse gases. Indeed, the average age of a passenger car in Europe is around 11.1 years<sup>10</sup> which means there are many Euro 5 (2009 onwards) diesel cars still being used on European roads emitting dangerous air pollutants – impacting the respiratory health of millions of Europeans. LPG vehicles perform even stronger compared to older Euro 5 diesel cars emitting around 40% less PM (per km) and up to 94% less NOx (per km).

8. LPG-electric hybrids eligible for grants in France – [Auto-gas](#)

9. EMEP/EEA air pollutant emission inventory guidebook – European Environment Agency (EEA)

10. Average vehicle age – European Automobile Manufacturers Association (ACEA)

## 2. THE LPG INDUSTRY'S ROLE IN SUPPORTING A SUSTAINABLE ECONOMIC RECOVERY



- The COVID-19 crisis and resultant national lockdowns led to economic disruption, business closures and unemployment. It is highly uncertain what longer term impact COVID-19 will have on many businesses. Certain industries are likely to recover and return to growth much quicker (e.g. Autogas, manufacturing) compared to other industries. The virus has affected nearly all parts of the hospitality supply chain - an industry reliant on LPG to power operations.
- In the post-COVID-19 recovery, the LPG industry can play an active role in supporting industries to reopen by flexibly powering operations with a lower-carbon and cost-effective fuel source. A big advantage with using LPG is the versatility and storage-potential it offers, and this is even more important given that industries may need flexibility in responding to changing consumer demand and lockdown arrangements.
- COVID-19 recovery planning should also take into account the development targets outlined in the 17 SDGs that were defined by the United Nations' 2030 Agenda for Sustainable Development. Thousands of applications using LPG contribute to all the SDGs either directly or indirectly in a range of ways advancing

progress on health, poverty, women, children, deforestation, energy and climate and should be considered part of any post-COVID-19 recovery.

- Additionally, LPG and bioLPG appliances are be the most cost-effective technology option for decarbonising certain sectors. For instance rural, hard-to-reach homes and mobile generator-sets. If all European households and businesses were to replace their biomass, coal and oil boilers with LPG, this could reduce carbon emissions by 17%, and particulate matter emissions further. This is equivalent to saving the European Union around €23 billion in avoided societal damage costs.

In 2018 around 313 million tonnes of LPG was consumed globally. Households and businesses in the Asia-Pacific region consumed the most LPG (43%) followed by North America (18%) and Europe & Eurasia (17%). The Middle East and South & Central America accounted for around one-fifth of global LPG consumption.

Consumption across sectors was dominated by households who accounted for 44% of total global demand. This was followed by the chemical (28%) and industrial sectors (11%).



Consumption of LPG for use in vehicles (Autogas) was just under one-tenth of global LPG demand in 2018.

For homes that are situated in off-gas grid areas, LPG is a popular choice given its low upfront cost, competitive running costs and its ability to satisfy

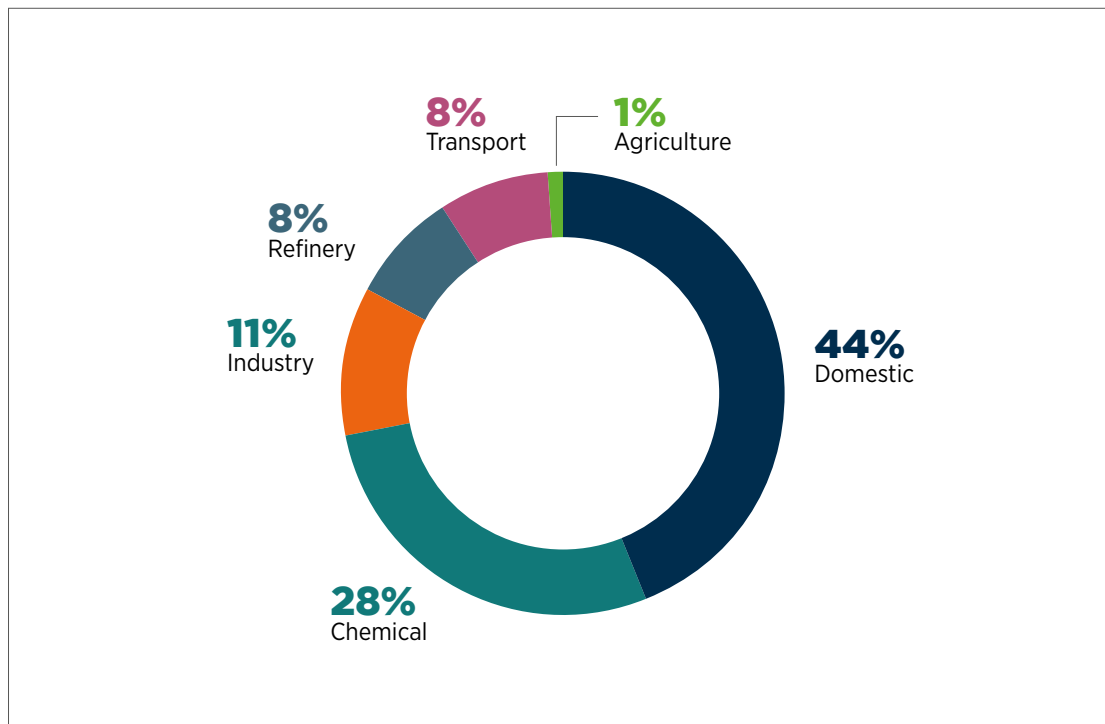


Figure 5 - LPG consumption by sector in 2018 (Source: WLPGA)

**Table 2 – LPG air quality emissions vs other typical off-grid fuels (source: EEA)**

	LPG vs Coal	LPG vs Oil	LPG vs Biomass (logs)	LPG vs Biomass (pellets)
NOx	54% lower	26% lower	36% lower	36% lower
PM	99.7% lower	20% lower	99.8% lower	98% lower

heating requirements more quickly than other heating technology options such as electric heat pumps and biomass.

In addition to the financial and heating strengths, the immediate environmental benefits of switching to LPG are appealing. Compared to high-carbon fossil fuels such as coal and oil, combusting LPG emits 34% and 15% less CO<sub>2</sub> (per kWh)<sup>11</sup>. The transition to bioLPG reduces emissions even further without the need for additional investment in new appliances or infrastructure.

Besides the carbon savings, LPG is also a clean-burning fuel emitting very little pollutant emissions.

LPG performs exceptionally well in terms of emitting less particulate matter (PM) compared to other typical off-grid fuels. Against biomass, in particular, LPG emits upto 99.8% less PM when combusted in a typical boiler per unit of heat. LPG also performs strongly in terms of NOx emissions against coal and oil.

Households in off-grid rural areas can be confident that using and switching to LPG to satisfy their heating requirements is compatible with climate targets. This is because in the medium and long term, LPG households could switch to bioLPG, the renewable equivalent of conventional LPG with emissions up to 80% less than conventional LPG. BioLPG is a ‘drop-in’ fuel for all existing LPG systems which means it can be combusted in any blend up to 100% in an existing LPG boiler without impacting

performance or reliability<sup>12</sup>. Being chemically equal to LPG, bioLPG also benefits from strong air quality strengths compared to other typical off-grid fuels (see table 2 above).

For industrial operators, LPG is used to power operations requiring low and high temperature process heating. These are critical processes which require a heating gas and where electric solutions (heat pumps) can only perform pre-heating functions. The additional benefit of powering high-temperature process heating with LPG is that it is a lower-carbon fuel source compared to oil and coal.

In commercial sectors such as leisure, hospitality and offices, LPG is used to satisfy heating, hot water and cooking (catering) requirements. In these sectors space can be at a premium and often the use of a LPG heating system ensures space is maximised due to its compact build and ability to be wall-hung.

More than 27 million vehicles use Autogas worldwide – almost four times more than in 2000<sup>13</sup>. A growing number of governments around the world actively encourage use of the fuel in recognition of its notable environmental benefits, as well as its inherent practical and cost advantages over conventional and other alternative fuels. Autogas also has strong applications as a fuel for forklift trucks providing round-the-clock support for logistics and manufacturing businesses. As a clean-burning fuel, Autogas-fuelled forklift trucks generally last longer than their diesel counterparts. It also does not leave residual soot on the materials

11. Default emission factors for local emission inventories – [Joint Research Centre](#) of the European Commission

12. Evidence Gathering For Off-gas Grid Bioliquid Heating Options – [NNFCC](#) (prepared for BEIS)

13. A global roadmap for Autogas - [WLPGA](#)

the Autogas-fuelled forklift truck handle – a major benefit for businesses moving products such as food, textiles and pharmaceuticals.

A 2019 survey by the European Commission found that 93% of EU citizens see climate change a serious problem and 79% see it as a very serious problem<sup>14</sup>. Around eight in ten respondents believe that taking action on climate change will make EU companies more innovative and competitive.

The wide variety of housing types and levels of thermal insulation found across Europe means electrified heating (i.e. heat pumps) is not the ‘silver-bullet’ approach to decarbonising heat. For new and existing homes in off-grid rural areas, where the electrical infrastructure is not mature, LPG is an ideal heating fuel choice where the building characteristics do not suit electrified heating (e.g. solid walls, low levels of thermal insulation). In Wales, where around 20% of homes are off-grid, a study by the Welsh

Government found that heating a typical off-grid home with LPG could be around 30% less expensive than using a heat pump<sup>15</sup>.

Additionally, whilst hydrogen heating is likely to play a role in Europe’s future energy mix – particularly providing high-temperature industrial heat and in some regions where gas-grid coverage is high – it is not a good solution for off-grid areas. Hydrogen is relatively expensive to transport and store, owing to its low volumetric density, and is therefore not best suited to rural areas which are remote and can be challenging to supply.

The environmental benefits to off-grid households and businesses of switching to LPG is to lower their carbon and air pollutant footprint. The economic scenario below quantifies the benefits that could be unlocked by a switch away from high air pollutant fuels (coal, oil, and biomass) to LPG and bioLPG in Europe.

## SCENARIO ANALYSIS: MONETARY BENEFIT OF SWITCHING TO LPG ACROSS OFF-GRID EUROPE

Across the European Union households and businesses consume around 1,440 TWh of oil, coal, and biomass to meet their energy needs, largely for heating and hot water. However, these are high pollutant fuels and are not sustainable or compatible with the EU’s long-term decarbonisation plan.

If these households and businesses switched to LPG and bioLPG, what would be the monetary benefit of doing so?

Two scenarios are modelled between 2020 and 2030 – a business-as-usual scenario and a switching scenario. In 2030, the two scenarios are netted against each other to estimate the difference in consumption levels, emissions, and damage costs to the EU economy.

The business-as-usual scenario models the consumption of oil, coal and biomass by households and businesses using the forecasted change in fossil fuels growth from the EU Reference Scenario 2016. This is the European Commission’s key analysis tools in the areas of energy and other sectors which helps policy-makers to analyse the long-term economic, energy, climate and transport outlook based on the current policy framework.

14. Citizen support for climate action – [European Commission](#)

15. Decarbonising Welsh Housing between 2020 and 2050 – [Government of Wales](#)

The switching scenario models the reduction in coal, oil and biomass and the uptake in LPG and bioLPG assuming typical replacement rates of heating systems. The share of bioLPG for use in heating is informed by WLPGA's work on bioLPG in 2018. It assumes that bioLPG accounts for one-third of LPG demand by 2030.

The analysis shows that if EU households and businesses were to begin replacing their existing coal, oil, and biomass heating systems with LPG and bioLPG, this would result in a 17% reduction in carbon emissions by 2030. This would save the EU economy ~€3,100 billion in societal damage costs which is equivalent to €6,900 per EU citizen.

Switching to LPG and bioLPG also improves air quality as oil, coal, and biomass are high pollutant emissions. By 2030, the EU economy could save €20 billion in damage costs associated with the emission of NOx and PM. This is equivalent to one-fifth of the Just Transition Mechanism fund – potentially providing additional financial support for the most vulnerable.

**Table 1 - Comparison of diesel and LPG emissions and damage costs (source: Ecuity Economics)**

Damage costs, €/bn	Business-as-usual	Switching	Difference
CO <sub>2</sub>	18,318	15,229	-3,089
NOx	6	4	-2
PM	39	21	-18

The LPG industry has been supporting homes and businesses located in off-grid rural areas by supplying them with a versatile and cost-effective fuel source. With relatively low installed costs, lower-carbon emissions and low pollutant emissions, LPG is being used by households and businesses to satisfy heating and hot water needs. LPG is easy to transport and can

be stored both overground and underground making it a flexible lower-carbon option for households and businesses. LPG also has a relatively high calorific value meaning lower storage needs, less frequent deliveries and it can be supplied by smaller trucks in off-grid rural areas which typically have severe road limitations.



**Table 4 - Evaluation of the key sectors LPG supports (source: WLPGA)**

Key sectors LPG supports	Key benefits of using LPG	Specific application
Agriculture	<ul style="list-style-type: none"> <li>• Lower CO<sub>2</sub> emissions</li> <li>• Low air pollutant emissions</li> <li>• Portability</li> <li>• Accessibility</li> <li>• Convenience of use</li> </ul>	<ul style="list-style-type: none"> <li>• Constant temperature control for brooders</li> <li>• Drying produce such as cotton, grains, milk products and nuts</li> <li>• Substitute to diesel fuel to reduce costs and emissions</li> </ul>
Commercial	<ul style="list-style-type: none"> <li>• Clean-burning</li> <li>• Portability</li> <li>• Flexibility</li> <li>• Reliability</li> </ul>	<ul style="list-style-type: none"> <li>• Instant and controllable cooking flame</li> <li>• Back-up power generation</li> <li>• Heating demand</li> </ul>
Industrial	<ul style="list-style-type: none"> <li>• Environmentally friendly</li> <li>• Lower-CO<sub>2</sub> emissions</li> <li>• Precision</li> <li>• Flexibility</li> <li>• Strong flame</li> </ul>	<ul style="list-style-type: none"> <li>• Space, process and water heating</li> <li>• Metal processing</li> <li>• Powering industrial ovens</li> </ul>
Recreation	<ul style="list-style-type: none"> <li>• Low pollutant emissions</li> <li>• Versatility</li> <li>• Ease of transport</li> </ul>	<ul style="list-style-type: none"> <li>• Instant ignition for barbeque grills</li> <li>• Quick heating in cold weather providing warmth to pools and spas</li> <li>• Attractive option for fuelling leisure-crafts</li> </ul>
Residential	<ul style="list-style-type: none"> <li>• Clean burning</li> <li>• Cost-effective</li> <li>• Performance</li> <li>• Versatility</li> </ul>	<ul style="list-style-type: none"> <li>• A first modern alternative to traditional cooking fuels in developing rural communities</li> <li>• Space and hot water heating</li> <li>• Can be tailored to individual home requirements</li> </ul>
Transport	<ul style="list-style-type: none"> <li>• Low emission</li> <li>• Environmentally friendly</li> <li>• Diverse application</li> </ul>	<ul style="list-style-type: none"> <li>• More than 27 million vehicles running on Autogas worldwide</li> <li>• Autogas outperforms petrol and diesel cars on environmental performance</li> <li>• Power ATVs, taxis, school-buses, trucks, golf carts, forklifts &amp; street cleaning vehicles</li> </ul>

The systemic importance of the LPG industry was demonstrated and reaffirmed during the COVID-19 lockdown when many governments globally declared the LPG industry as “essential”. This provided the many households and businesses relying on LPG with confidence that they would not run out of supply. As economies recover from the effect of the coronavirus, it is likely that many policymakers, especially in Europe and North America, will wish to balance the economic recovery with the environmental and development objectives as defined by the SDGs. As the most cost-effective option for decarbonisation of certain energy applications – such as reducing emissions from homes and mobile generators – the industry can support policymakers in achieving positive environmental outcomes during a challenging economic period through the supply of conventional LPG and bioLPG.

It is highly uncertain what impact COVID-19 will have on many businesses. Certain industries are likely to recover and return to growth far quicker (e.g. Autogas, manufacturing) compared to other industries (see Figure 6). The virus has affected nearly all parts of the hospitality supply chain - an industry reliant on LPG to power operations. The effect of cancelled events

***“The LPG industry can play an active role in supporting industries to reopen by powering operations with a lower-carbon and cost-effective fuel source.”***

and closed accommodation had an immediate knock-on effect further down the supply chain such as on catering and laundry services. In the US, it is estimated that up to 57 million jobs are now vulnerable with the accommodation and food services sector accounting for over 20% of all vulnerable jobs<sup>16</sup>. By way of context, some 59 million jobs are at risk in the European Union, the UK and Switzerland, which have a considerably larger population. The accommodation sector will have to ensure that they can make rooms safe and clean for guests. They will also have to demonstrate that there are processes in place to contain the virus spreading if an infected guest is to use the facilities.

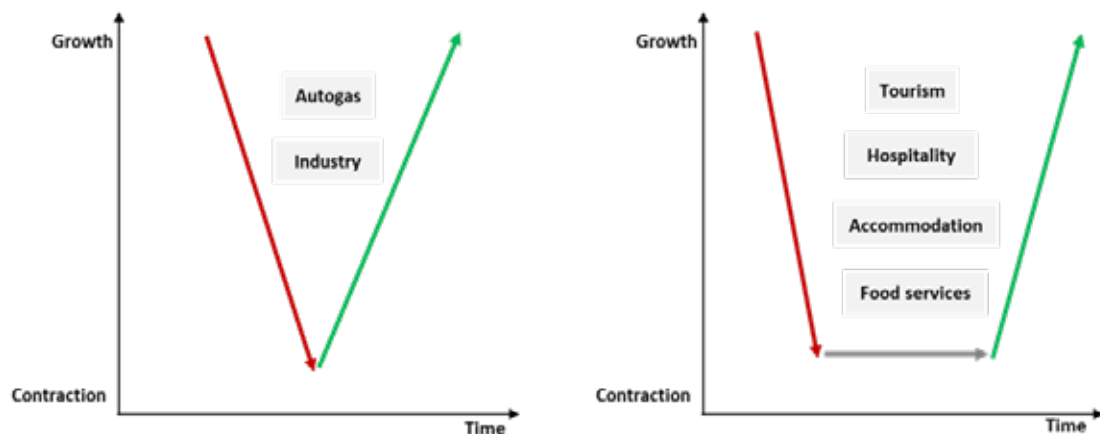


Figure 6 - Economic recovery trajectories of sectors that LPG supports (source: Ecuity Economics)

16. COVID-19 and jobs: Monitoring the US impact on people and places - [McKinsey & Company](#)



Governments worldwide have allocated around \$13 trillion to support economies and arrest the freefall in growth<sup>17</sup>. The return to growth is likely to be different for different sectors (see [Figure 6](#)). For some of the biggest commercial users of LPG (hospitality, accommodation, and food), the trajectory from contraction from growth is likely to be determined by government guidance and how quick these businesses can implement measures to make their operations as coronavirus-proof as possible. Demand from consumers and their confidence in these sectors to ensure government guidelines are met will also be important.

As these companies re-open, the LPG industry can support by offering a lower-carbon and low pollutant fuel their heating and industrial processes. Given most businesses are unlikely to operate at 100% capacity initially, the flexibility and versatility of LPG as a heating fuel can complement this staged approach to full capacity that businesses may adopt. For larger industrial users, LPG can be supplied to offer highly efficient decentralised generation through small self-containing generators and micro-combined heat and power. This is ideal for industries that may reopen initially at less than full capacity but can be sure of a clean-burning, flexible and versatile fuel type to power their operations.



17. COVID-19 – Briefing note: [McKinsey and Company](#)

### **3. THE LPG INDUSTRY'S ROLE IN RESPONDING TO THE 'NEW NORMAL'**



**The COVID-19-crisis saw a dramatic change in the way that economies operated and consumed energy. Our survey suggested that the LPG industry experienced dramatic changes to demand patterns across countries. We have also seen changes in business practices across the sector in reaction to the pandemic.**

- There has been a slight increase in demand from the residential sector due to increased remote working requirements and business activity slow down. The potential opportunities in the residential sector are tempered by risks from a prolonged recession that could hit sectors that consume large quantities of LPG, such as the hospitality and tourism industries, particularly hard.
- As global economies begin to recover from the shock the pandemic has caused, it is likely that there will be knock-on effects of the crisis. In particular, it is expected that an increased interest in remote working and a preference for ecommerce has meant that some WLPGA members are preparing for continued online consumer interaction and an increase in digital sales.
- WLPGA members have introduced a range of measures to adhere to social distancing requirements and minimise risk of infection, many of these procedures will continue as we emerge from the crisis.
- There is likely to be increased preference for private transport over public and shared mobility due to infection concerns. Policymakers will be conscious of their air pollution objectives as we begin to emerge from the crisis. This presents an opportunity for the Autogas sector providing a lower carbon, clean-burning transport fuel.

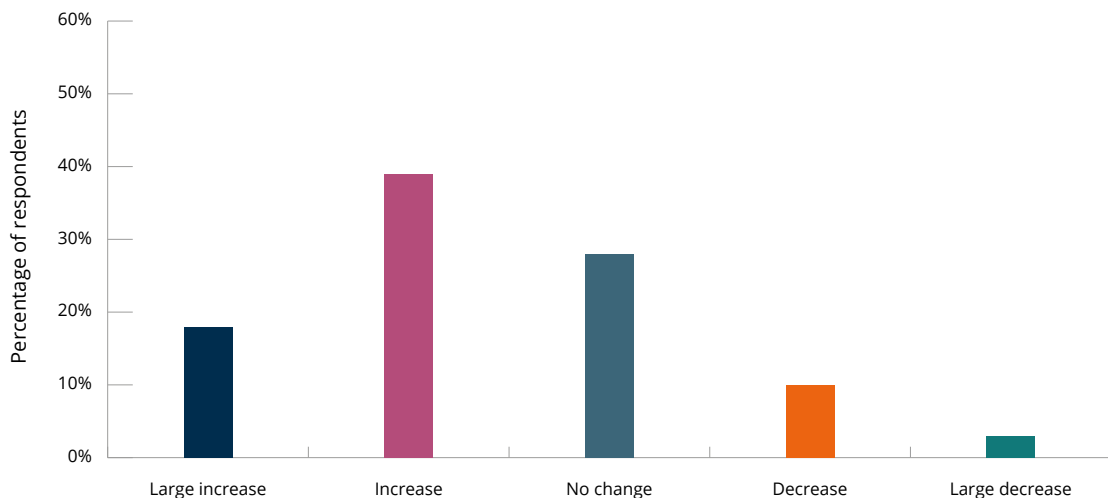


## DOMESTIC CONSUMERS: SHIFT TO REMOTE WORKING AND ECOMMERCE

With the majority of the global workforce encouraged to work from home and business closures leading to job losses, the demand for heating fuel shifted. Figure 7 illustrates how

domestic LPG demand changed as the COVID-19 crisis hit according to survey respondents. Approximately 55% of respondents reported an increase or large increase in LPG demand from residential consumers during the crisis, with respondents highlighting an increased prevalence of remote working and stockpiling as causes of the trend.

### HAVE TOTAL LPG DEMAND VOLUMES INCREASED OR DECREASED DURING THE COVID-19 CRISIS ACROSS THE DOMESTIC SECTORS?



**Figure 7 - Reported change to LPG demand from domestic consumers (source: WLPGA)**  
 Large increase (>10% year-on-year), Increase (<10% year-on-year), No change, Decrease (<10% year-on-year), Large decrease (>10% year-on-year)

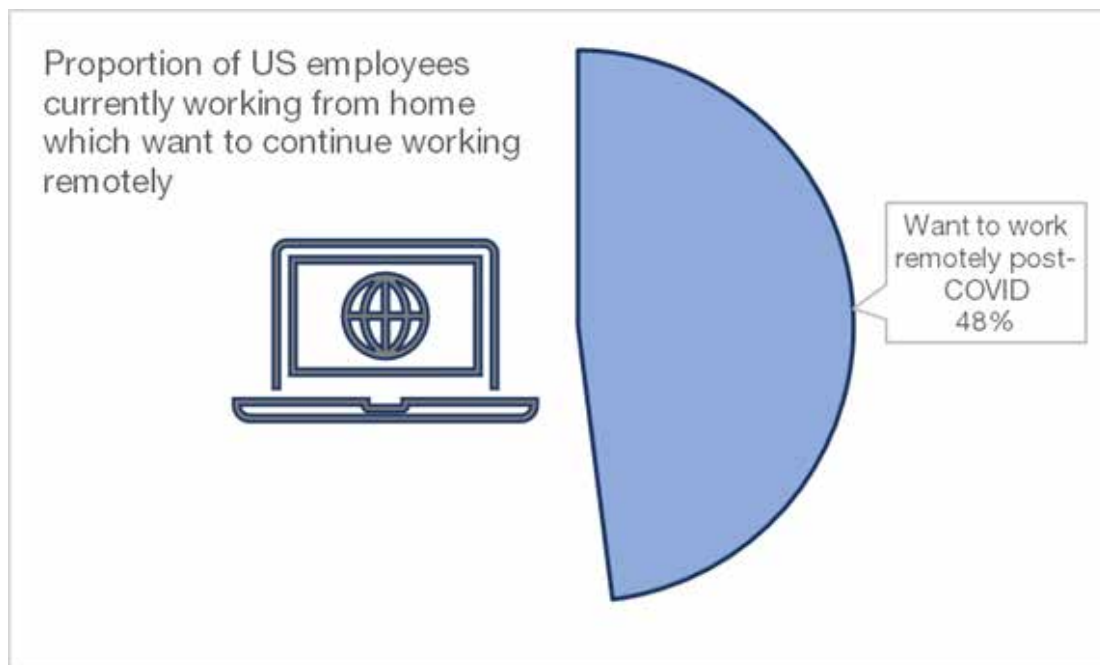
This changing domestic energy consumption pattern has been seen across energy vectors, with average residential use of electricity jumping by 20%-30% in some parts of the US at the weekend, and 15% in the UK<sup>18</sup>.

As economies exit lockdown, and society transitions to a 'new normal' characterised by a partial return to typical operations with additional safety precautions and regulations in place, many commentators expect an increased and persistent uptake of remote working practices. Indeed, consumer surveys suggest that an increasing number of workers will look to work remotely after lockdowns end. A survey of US employees currently working remotely suggests that nearly half wish to continue doing so in the future, suggesting that increases to residential energy consumption could be sustained into the future (see Figure 8).

***“Residential door-to-door delivery is the back-bone of our business - however COVID-19 is challenging this model.”***

WLPGA member

An Accenture survey of customers across 15 global markets conducted in March 2020 (Figure 14), also reflects a growing net interest in remote working, with 30% of respondents stating that they are planning to spend more time working at home (compared to 13% who plan to decrease time working at home).



**Figure 8 - Proportion of US employees currently working remotely who wish to continue doing so (source: Grossman Group)**

18. IEA (2020) Working from home can save energy and reduce emissions. But how much?

LPG is a versatile fuel that is easy and cost-effective to store, and well-placed to respond to variable energy needs from households that look to change their energy consumption patterns and increasingly work remotely in the future. Additionally, the LPG industry has demonstrated that the supply chain is robust and flexible to rapid changes in demand, with essential energy supply during the disruption caused by COVID-19 lockdowns.

Alongside a shift to remote working, we could also see a persistent change in consumer preferences for ecommerce and digital. Lockdowns have forced a move online for working, socialising, entertainment and shopping. Consumers are habitual and the sudden change to behaviours caused by the COVID-19 crisis will likely persist in the ways that households choose to buy goods and services in the future.

**“We are already seeing consumers embrace digital LPG deliveries. This trend is likely to remain beyond COVID.”**

WLPGA member

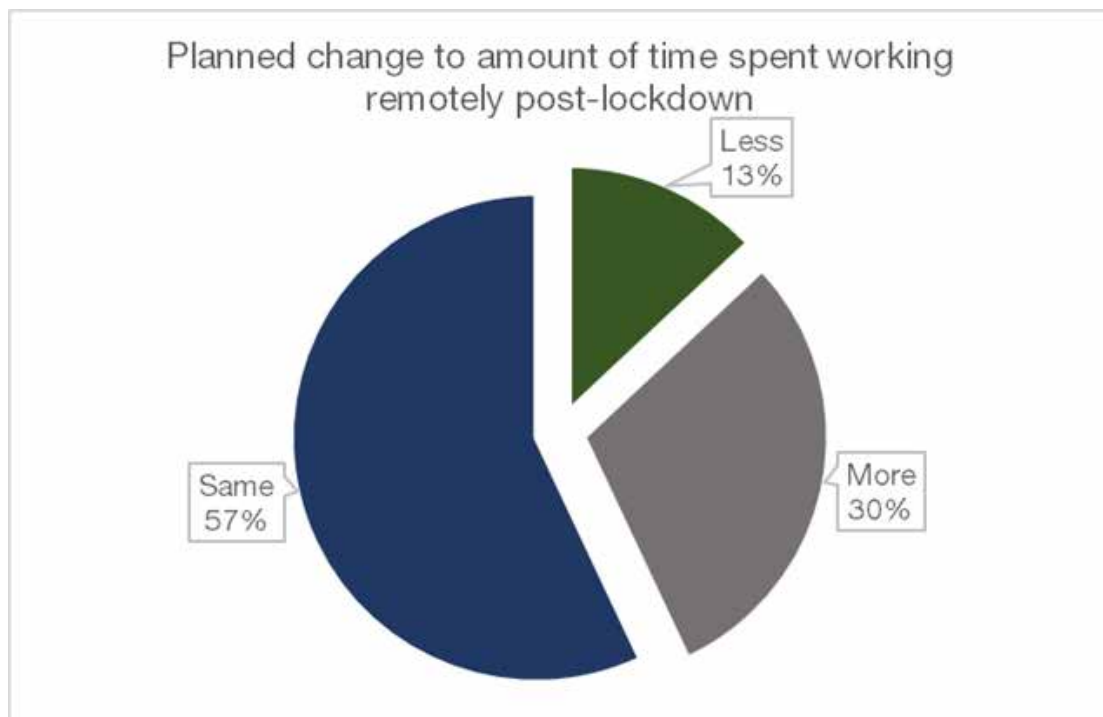


Figure 9 - Preferences for remote working in the future (source: [Accenture survey](#))

LPG is a versatile fuel that is easy and cost-effective to store, and well-placed to respond to variable energy needs from households that look to change their energy consumption patterns and increasingly work remotely in the future.

Additionally, with an increasing interest in the home, consumers could be looking to technology and energy providers that can provide extra value. In the medium term, there are opportunities for LPG companies to integrate with smart, digital and Internet of Things (IoT) appliances with their service offerings. Indeed, a number of IoT appliance providers have reported an increase in consumer interest in smart energy appliances and meters during the crisis<sup>19</sup>.

The LPG industry has a track record of supporting innovation in this space, for example telemetry services ensuring that households automatically receive delivery of fuel when supplies are low.

### **CHANGES WITHIN ORGANISATIONS SUPPLYING LPG**

Throughout the pandemic, WLPGA members have introduced a range of measures to adhere to social distancing requirements and minimise risk of infection. Some of these changes have led to increases in operational costs.

#### **Working arrangements:**

- Offices closed
- Working from home
- Virtual meetings
- Reduced travel
- Training/education services suspended
- Restrictions on international business engagement
- Redeployment of staff from sales
- Increased communications
- Reduction in discretionary spend
- Shifts/staggered work patterns

#### **Consumer interactions:**

- Contactless deliveries
- Pay as You Go introduced
- Sanitising cylinders and meters before delivery
- Closed walk-in centres
- Increased communications
- Changed yearly inspections to being virtual

#### **Personal safety and social distancing:**

- Utilising face masks and Personal Protection Equipment (PPE)
- Hand washing/sanitary procedures introduced
- Reduced site visits
- Temperature checks
- Extra cleaning and disinfecting

19. IoT Analytics (2020) The impact of COVID-19 on the Internet of Things – now and beyond the Great Lockdown: Part 1

The majority of WLPGA members predict that COVID-19 will have a long-term impact on the way the sector operates with changes to working practices, sales and the introduction of new procedures. As shown in Figure 15, very few members expect to see no long-term changes as a result of COVID-19. There is an expectation that customers will favour more digital engagement with reduced face to face engagement. Many members are preparing for continued online activity with an increase in digital sales.

The increase in delivery services is anticipated to continue creating an opportunity for distributors to differentiate themselves. This may however lead to an increase in distribution costs and is likely to encourage cost-efficiencies through digitalisation and route optimisation. The introduction of automated process is also expected to continue.

Some of WLPGA members have highlighted the negative impact of reduced travel and the current economic situation on investment. The inability to travel to meet potential investors inhibits acquisition work and capital formation. Members have raised concerns about the retraction of investments and the need to scale up and expand.

## **PROLONGED CHALLENGES FOR THE HOSPITALITY AND TOURISM SECTOR**

These potential opportunities in the residential sector are tempered by risks from a prolonged recession that could hit sectors that consume large quantities of LPG, such as the hospitality and tourism industries, particularly hard. For instance, in the short term the United Nations



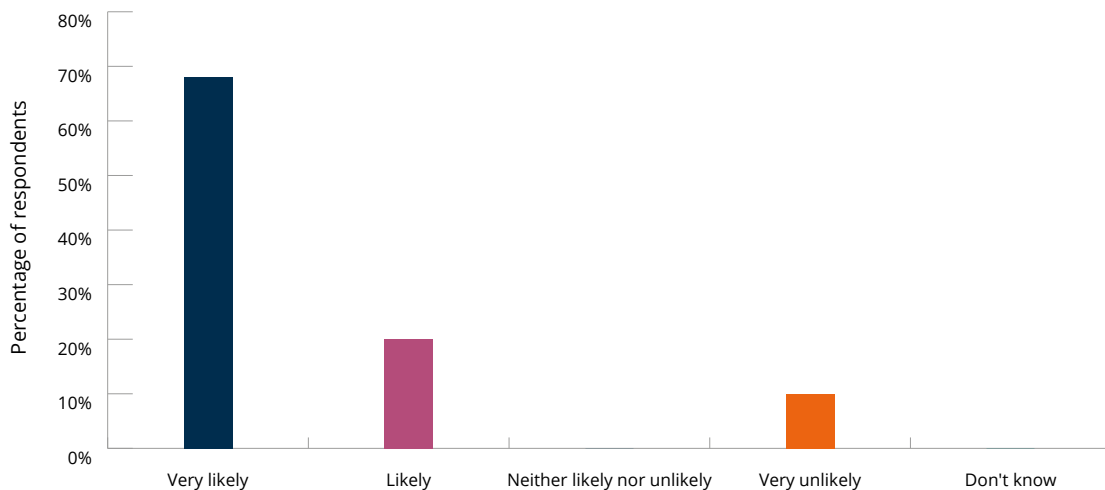
World Tourism Organization (UNWTO) notes that the COVID-19 crisis has caused a 22% fall in international tourism in the first quarter of 2020, and an expected 60%-80% decline in the calendar year (see Figure 16). This translates to a loss of 850 million to 1.1 billion international tourists and up to \$1.2 trillion of exports lost.

Other sectoral opportunities exist though, especially with Autogas markets as cars return to roads at a time of increased interest in low-emission transport. In the 'new normal' policymakers have to balance an increased preference for private transport over public and shared mobility, with clear objectives and public pressure to keep air pollution levels low. In times of constrained public funds, the temptation for policymakers certainly in Europe will be to increase congestion charges on the most polluting vehicles to simultaneously tackle congestion, pollution, whilst increasing government revenues.

As demonstrated in Chapter 2, switching from oil-powered to Autogas vehicles is a cost-effective way for policymakers to meet their emission targets. This has already been recognised in France where policymakers have supported the replacement of petrol cars with Autogas models with an upfront grant of €100 - €5,000 typically available.

On the operations side, the 'new normal' is in many parts of the world characterised by increasing cost of labour (for example driven by necessary and costly health and safety measures) and a period of economic instability. This is at a time when demand patterns for LPG are changing at rates that haven't been experienced before. Automation, and the use of IoT can support LPG businesses in securing supply and responding to uncertain economic times flexibly and with resilience.

**DO YOU THINK THE COVID-19 CRISIS CREATE LONG TERM CHANGES TO THE WAY THAT EMPLOYEES WORK ACROSS THE COUNTRIES YOU OPERATE IN?**



**Figure 10 - Market research survey – Long term impact of COVID-19 on employees in LPG sector (source: WLPGA, 2020)**  
Prolonged challenges for the hospitality and tourism sector

“We will see consumers become accustomed to having goods such as LPG delivered. This will provide an opportunity for distributors to differentiate themselves in the delivery service they provide. It will also mean that distribution costs increase, meaning distributors will need to be more savvy in how they use digital to enhance the customer experience, while optimising distribution to bring down costs.”

WLPGA member

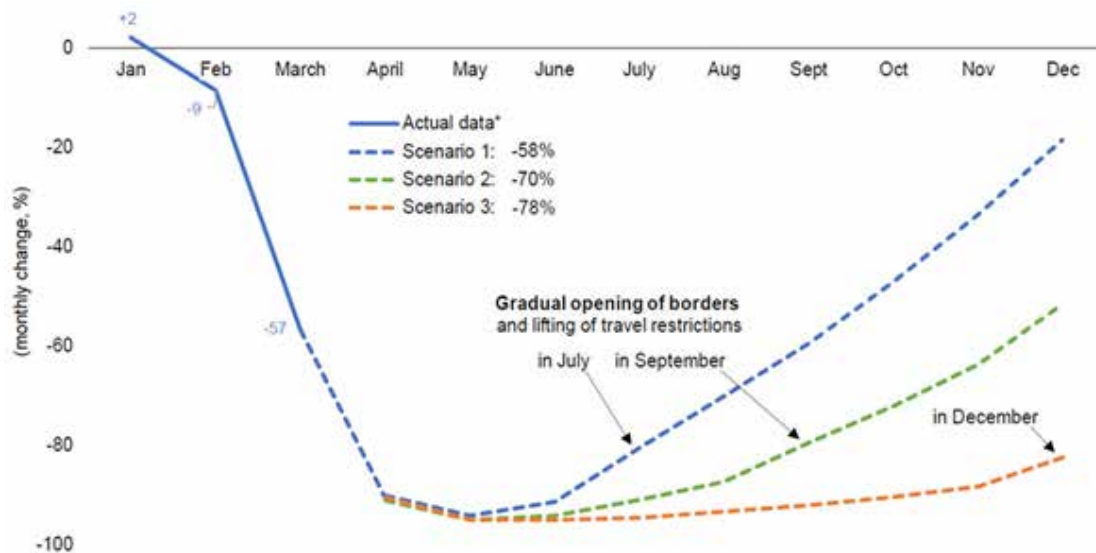


Figure 11 -International tourist arrivals in 2020: three scenarios (source: UNWTO, 2020)

# A FINAL WORD



**The LPG industry across the world has played a crucial role in responding to unprecedented challenges during the COVID-19 crisis. Our survey results show an industry that has had to rapidly change the way it operates to ensure the same security of supply and quality of service for households and businesses in a time of need. A drastic shift from B2B to B2C demand, as well as supply chain challenges were cited by respondents. Through case studies, this report has provided a few notable ways in which the LPG sector has responded and delivered during the COVID-19 crisis.**

Moving forward, policymakers will be looking to build back better. The LPG industry can position itself as a facilitator of the recovery, providing cost-effective, reliable and clean energy to households and businesses. This report has demonstrated that in several applications – such as large Autogas vehicles and off-grid heating – LPG is a cost-effective and cleaner alternative to incumbent oil-fuelled technologies. Indeed, this report estimated that the school-system in the USA could save \$1.38 billion a year if old diesel buses were replaced by new Autogas models, and 27,000 tonnes of particulate matter emissions which

have a significant impact on children's health. The industry can help governments build back better and cleaner at an affordable cost.

In this sense, the 'new normal' presents opportunities, to grow Autogas markets as a response to air quality concerns for example, and to service new, remote working demands from domestic consumers with innovative service packages and digital solutions. Risks are also evident, with a challenging period expected for the hospitality and tourism industries.



But crucially, the LPG industry has shown its resilience and flexibility during the initial phase of the COVID-19 crisis. The crisis has laid bare the importance of resilient supply chains in essential industries such as the LPG sector. These lessons will be important for future crises and allow the industry to respond resiliently and robustly to hard-to-predict events.

In the coming months, as economies exit lockdown and look to the rebuilding phase, industry leaders have the opportunity to come together, share experiences and build back better. In this context, industry forums such as the WLPGA are more important than ever. As a global organisation, the WLPGA is well placed to support its members with best practice and learnings from regional developments, and to communicate the industry's important role as a partner for recovery and regeneration.



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