



# SUSTAINABLE DEVELOPMENT GOALS

Contributions of LPG

June 2019

## The Global LPG Partnership (GLPGP) and the World LPG Association (WLPGA)

The non-profit Global LPG Partnership (GLPGP) was launched in 2012 at the Rio+20 sustainable development conference as a public-private partnership (PPP) under the UN Sustainable Energy for All Initiative. Its mission is to help countries make the shift from biomass to LPG for clean cooking on a large scale, with the goal of one billion more people cooking cleanly with LPG energy by 2030. GLPGP holds UN Economic and Social Council (ECOSOC) Consultative Status and United Nations Framework Convention on Climate Change (UNFCCC) Observer Status.

The World LPG Association (WLPGA) was established in 1987 and unites the broad interests of the worldwide LPG industry in one organisation. It holds Consultative Status with the ECOSOC. WLPGA exists to provide representation of LPG use through leadership of the industry worldwide.

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Women in Cameroon collecting new LPG cooking equipment

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## Glossary and Abbreviations

Autogas	Automotive LPG
Bio-LPG	Renewably-sourced LPG
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
DALYs	Disability-Adjusted Life Years
GHG	Greenhouse Gas
GLPGP	Global LPG Partnership
HAP	Household Air Pollution
IEA	International Energy Agency
IPCC	Inter-Governmental Panel on Climate Change
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goal
NO <sub>x</sub>	Nitrous Oxides
PM <sub>2.5</sub>	Fine Particulate Matter
SDG	Sustainable Development Goal
WHO	World Health Organisation
WLPGA	World LPG Association
UN	United Nations

# EXECUTIVE SUMMARY



***“Three billion people need clean cooking solutions and their economic success is a hugely exciting investment opportunity.***

***LPG is an exceptional part of that opportunity... Imagine if we can create vibrant markets for clean fuels for the 20 countries where 84% of those three billion people live.***

***We would be advancing progress on the SDGs on health, poverty, women, children, environment, deforestation, energy and climate.”***

**Rachel Kyte**, Special Representative of the UN Secretary-General and CEO, Sustainable Energy for All<sup>1</sup>

The United Nations' 2030 Agenda for Sustainable Development provides a global “blueprint for action” on an urgent range of sustainable development imperatives. Within this Agenda are 17 Sustainable Development Goals (SDGs).

There are more than 1,000 applications of liquefied petroleum gas (LPG), a clean-burning fuel, which contribute to all the SDGs either directly or indirectly in a range of ways. The value of LPG is easily recognized in the context of SDG 7 focusing on affordable and clean energy, given its widespread use as a household cooking fuel. This is, however, only a small part of the story.

This short report provides an overview summary of the contributions of LPG towards several SDGs. It is not an exhaustive list, but is intended to showcase, via a range of case studies, some applications of LPG in both developed and developing countries,

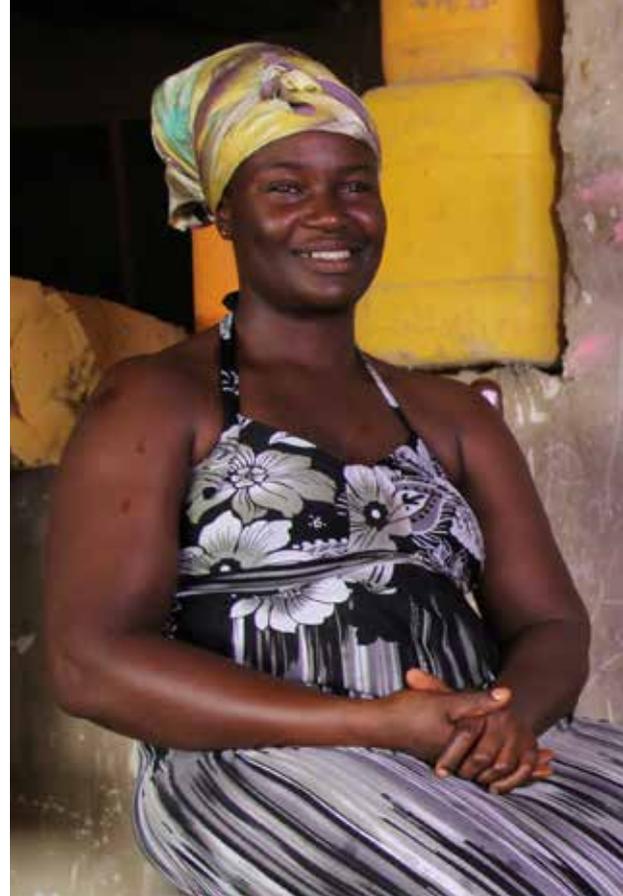
and how they contribute to expediting global achievement of the SDGs by 2030.

A global LPG surplus exists and is projected to continue for the next decade. In addition, the availability of renewable LPG produced from bio-based feedstock is increasing. Some of the surplus LPG is vented or flared at oil and gas production sites, sending carbon back into the atmosphere. Using it instead for applications that advance the SDGs in low and middle income countries is a much better use of this valuable fuel resource.

The LPG industry is constantly innovating in ways that help to provide safe, sustainable solutions for a range of tasks. LPG already contributes much to the achievement of the SDGs and can continue to do so, even increasing its role as part of a low carbon global energy pathway in the years to come.

# CHAPTER 1.

## INTRODUCTION TO THE SUSTAINABLE DEVELOPMENT GOALS



In 2015, United Nations (UN) Member States approved the 2030 Agenda for Sustainable Development providing a global “blueprint for action” on an urgent range of sustainable development imperatives. Within this Agenda are 17 SDGs which collectively constitute a global action agenda for all countries to work on together.

## SUSTAINABLE DEVELOPMENT GOALS





Each goal covers a set of issue areas, such as ending extreme poverty (SDG 1), or promoting gender equality (SDG 5). Within each goal are targets articulating specific areas for action in order to spur overall progress toward that goal. The goals are not meant to be seen as siloed approaches for development action, but rather as a unified set of goals with complex interactions among them, representing a common development agenda and framework for action by all stakeholders – including governments, civil society and private industry - to help them become a reality.

The SDGs build on the eight Millennium Development Goals (MDGs) to reduce extreme poverty by 2015, which were adopted unanimously by UN Member States in 2000. In 2013 the UN General Assembly set up an Open Working Group among Member States to develop a proposal on the SDGs, building on the MDGs. In 2015 (when the MDGs expired), the 2030 Agenda for Sustainable Development and its 17 SDGs were adopted at the UN Sustainable Development Summit. The annual UN High Level Political Forum now serves as the main UN platform for review of the SDGs.

One key difference between the MDGs and the SDGs - apart from there being more than twice the number of SDGs compared to the MDGs - is the attention given to energy issues for the first time as an explicit focus area. Notably this is enshrined in SDG7, focused on “ensuring access to affordable, reliable, sustainable and modern energy for all” by 2030. It includes specific targets relating to electrification, clean cooking (together comprising “energy access”) and the increase of both energy efficiency and clean energy in the global energy mix by that time.

The value of LPG is well known and easily recognised in the context of ensuring progress towards achieving some of the goals, such as SDG7, given its widespread use as a household cooking fuel across both developed and developing countries. This is, however, only a small part of the story.

There are more than 1,000 applications of LPG<sup>2</sup> which contribute to many of the SDGs either directly or indirectly in a range of ways, just a small number of which will be covered in the remainder of this report.

# CHAPTER 2.

## INTRODUCTION TO LPG



**LPG is a widely used, clean-burning, portable fuel. It is produced today primarily as an unavoidable by-product derived from crude oil and natural gas production and refining. Marketed as Propane and Butane, or as a combination of both, LPG is used globally for many different applications. LPG sources are extensive; a global LPG surplus exists and is projected to continue for the next decade. As of 2017, global LPG production exceeded consumption by around six million metric tonnes, demonstrating both its potential and that it is, at present, an underutilised resource. Some of the surplus is vented or flared at oil and gas production sites, sending carbon back into the atmosphere. Using it instead for applications such as clean cooking in low and middle income countries is a better use of this valuable fuel resource<sup>3</sup>.**

While most LPG is conventionally derived, the availability of LPG produced from bio-based feedstock is increasing, although at present it makes up a small amount of overall global production. Bio-LPG is produced from organic wastes and residues.

LPG is a gas with very high energy content, with a flame that burns very hot and therefore can be used more efficiently than other fuels. It has a higher calorific value per unit than other common fuels such as coal, diesel, petrol, fuel oil and biomass-derived alcohols. It can be transported very efficiently in small containers, called cylinders, for combustion by consumers

for cooking and for heating. LPG is often called “cooking gas” or “bottled gas” in developing countries, where cooking is its primary use.

LPG is also a common transportation fuel and is the third most used globally after gasoline and diesel<sup>4</sup> due to its clean-burning qualities, high energy density, availability and cost factors. When used in transportation it is known as Autogas. LPG is also increasingly being considered as a lower emissions marine shipping fuel, with at least a 20% reduction in greenhouse gas emissions as compared with the use of conventional maritime fuel oils, mostly heavy marine fuel oils.<sup>5</sup>

LPG is a clean-burning fuel that produces lower levels of carbon dioxide (CO<sub>2</sub>), nitrous oxide (NO<sub>x</sub>) and other pollutants compared to traditional fuels. In addition it emits virtually no black carbon (BC) and if spilled, will not pollute the ground or aquifers. Its use to replace traditional fuels reduces the emissions of several climate-active pollutants and protects forests by decreasing deforestation.

LPG CONTRIBUTES TO SEVERAL ENVIRONMENTAL AND CLIMATE GOALS

**THE CARBON FOOTPRINT OF LPG IS 20% LOWER THAN THAT OF HEATING OIL**

**AND 50% LOWER THAN COAL**

**LPG IS CLEAN BURNING FUEL**

AND ITS USE PRODUCED **VIRTUALLY NO PARTICULATE MATTER, OR SOOT**

**BLACK CARBON, OR SOOT, IS RESPONSIBLE FOR AN ESTIMATED 20% OF GLOBAL WARMING**

ADDRESSING **BLACK CARBON EMISSIONS** HAS AN IMMEDIATE **EFFECT ON CLIMATE CHANGE**

**LPG IS THE PERFECT PARTNER / BACK-UP FOR LOCALISED RENEWABLE POWER GENERATION**

**DRIVING ON AUTOGAS LEADS TO A REDUCTION OF 10-12% IN CO<sub>2</sub> EMISSIONS AS COMPARED TO PETROL**

**-96%** **AUTOGAS** vs **DIESEL** (NO<sub>x</sub>)

**-68%** **AUTOGAS** vs **PETROL** (NO<sub>x</sub>)

(Image: WLPGA)

This document shows how LPG in its many applications can and does contribute to the achievement of the SDGs. It provides a spotlight focus on several goals where LPG makes

a key contribution and provides associated case studies outlining how LPG currently contributes – and in many cases can contribute further – to the achievement of a specific goal.

**EXAMPLES OF LPG APPLICATIONS AND BENEFITS**

	<b>Application</b>	<b>Benefits</b>
<b>Home</b>	<b>Cooking, hot water, heating, BBQ.</b>	<b>Cleaner household air, better health, improved well-being, time savings.</b>
<b>Power Generation</b>	<b>Generators, Gas Turbines, Co-gen &amp; Tri-Gen.</b>	<b>Cost savings, reduced emissions, increased electricity reliability.</b>
<b>Hospitality industry and public institutions (schools, hospitals)</b>	<b>Food processing.</b>	<b>Safer food, cleaner air, time savings.</b>
<b>Industrial use</b>	<b>Metallurgical industry, boilers, forklifts, ovens, furnaces, pottery and ceramic tile manufacture, production of polymers, paint and varnish. Used in aerosols.</b>	<b>Technical ease, environmentally friendly, replacing ozone-depleting gases.</b>
<b>Transportation</b>	<b>Autogas, taxis, buses, commercial vehicles, boats, recreational vehicles, hot air balloons, shipping</b>	<b>Lower emissions, cleaner ambient air, lower costs.</b>
<b>Agriculture</b>	<b>Crop drying, greenhouses, flame weeding, heating livestock sheds and water, agricultural machinery.</b>	<b>Safer produce, healthier livestock, higher yields.</b>





**From warehouses in China to  
the skies above the Serengeti, LPG  
powers thousands of applications.**

# CHAPTER 3.

## THE MANY CONTRIBUTIONS OF LPG TO THE SDGS



LPG use contributes directly to many of the SDGs, and at least indirectly to all of them. This report focuses in particular on the key contributions of LPG to seven of the SDGs:



Using LPG for clean cooking, which is the largest use of LPG in developing countries, makes obvious contributions to SDG 7. In addition, LPG initiatives in developing countries are often prompted by the need for climate change mitigation. Recent modeling shows that LPG cooking will yield greater reductions in Disability Adjusted Life Years (DALYs, a measure of disease burden) and Global Warming Commitment

than improved biomass stoves in a range of developing countries, hence contributing to SDG 3 for good health and SDG 13 for climate action.<sup>6</sup> LPG also advances SDG 5 for gender equality through the employment of women in the sector, as well as by reducing the burdens of cooking with solid fuels which fall disproportionately on women. Finally, in both developed and developing countries, LPG applications in a range



of industries contribute towards job creation and economic growth (SDG 8), industrial innovation (SDG 9) and sustainable urban environments (SDG 11).

Through the remainder of the document, “snapshot” case studies are presented as examples showing the many contributions of LPG to these particular SDGs, drawn from both developed and developing economies to show how LPG is used around the world. While each case study focuses on a particular SDG, many of them have obvious contributions to multiple SDGs.

LPG also contributes to SDGs besides the seven featured in this report. Replacing biomass with LPG for cooking addresses SDG 15 by reducing forest loss. LPG advances SDG 1 for ending poverty and SDG 10 for reducing inequality, where clean cooking contributes to basic household requirements to lead a healthy, productive life. Where consumer financing innovations are used to make LPG more affordable to lower income consumers, they also contribute to SDGs 1 and 10 by promoting financial inclusion.

In addition, LPG clearly contributes to SDG 2 focused on zero hunger through making it easier and faster for families to cook their meals and reducing the burden of having to forage for fuelwood, saving time and money. LPG use in the agricultural sector also contributes to SDG 2 by increasing the productivity of farms, for example, through ensuring reliable heat for livestock farming, ensuring that sheds and brooder houses are heated to optimum temperatures which influence feeding, sleeping and weight gain in poultry. LPG-powered hot water pressure washers are used to sanitize pens, machinery and other farm equipment, which promotes healthy animals and prevents the spread of diseases.

# LPG AND SUSTAINABLE DEVELOPMENT GOALS

Besides its central contribution to Sustainable Development Goal 7, LPG in its many applications contributes directly to Goals 3, 5, 8, 9, 11 and 13. LPG also contributes indirectly to the remaining 10 Goals.



# 3 GOOD HEALTH AND WELL-BEING



LPG use helps to support good health and well-being through the prevention of non-communicable diseases in adults and pneumonia in children.

According to the World Health Organisation (WHO), air pollution kills seven million people prematurely each year. More than half of these die from Household Air Pollution (HAP), a result of the large disease burden related primarily to the use of polluting fuels for cooking, heating and lighting. This is the greatest environmental health risk in the world today.

Around three billion people still rely on solid fuels and kerosene for cooking. Reducing smoke emissions from household energy activities decreases the burden of disease associated with HAP and improves well-being, especially for women and children who bear the brunt of poor energy access.

For several important health outcomes such as child pneumonia, lung and cardiovascular disease, exposure to fine particulate matter (PM<sub>2.5</sub>) and carbon monoxide (CO) needs to be reduced to very low levels to achieve health benefits. The majority of solid-fuel cooking interventions promoted over the years have not come close enough to these levels.

One of the targets under SDG 3 is to “end preventable deaths of newborns and children under five years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-five mortality to at least as low as 25 per 1,000 live births” by 2030. Dr. Maria Neira, Director of the Department of Public Health, Environmental and Social Determinants of Health at WHO, has said that “the best vaccination against pneumonia is ensuring that kids don’t breathe dirty air at home.”

**WHO data compiled from across the globe show that around 90% of all people breathe air contaminated with pollutants. Air pollution kills over seven million people every year due to the related disease burden. Children are especially at risk of pneumonia from breathing in polluted air.**

The WHO's Indoor Air Quality Guidelines for household fuel combustion recommend the rapid scaling up of clean and modern cooking fuels such as LPG, gas and electricity in lower and middle income countries to reduce the burden of disease associated with HAP. LPG delivers significant direct health benefits from substantially reducing exposure to HAP from burning of solid fuels and kerosene, and can be scaled up at a rapid pace if the right policies, regulations and enabling conditions are in place.

Reduced emissions from the use of Autogas as a transportation fuel also have a protective role for health, especially in many urban environments where ambient air pollution levels are high.

## **BOTTLED GAS FOR BETTER LIFE – COOKING WITH LPG FOR BETTER HEALTH**

Hundreds of lower income families in Cameroon and Kenya now breathe cleaner air and have better health, thanks to a microfinance programme launched in 2017 by GLPGP together with local microfinance and banking institutions, and LPG marketers.

The *Bottled Gas For Better Life* initiative addresses the challenge of upfront costs preventing many families from switching to LPG for cooking. Short-term microfinance loans of US\$80-\$100 are provided to families to purchase an LPG “start-up kit” including a double burner LPG stove, a filled LPG cylinder, and accessories.

Most programme participants had been using firewood as their main cooking fuel. Switching to LPG for everyday cooking eliminates smoke exposure in the kitchen, supporting better well-being and health, particularly for women and children.

The University of Liverpool, UK conducted an independent study of the programme's pilot phase in Cameroon, evaluating the extent to which overcoming the upfront cost barrier encourages households to adopt LPG, and how this affects their use of time, well-being and health.

***“The best vaccination against pneumonia is ensuring that kids don’t breathe dirty air at home.”***

**Dr. Maria Neira**, Director, Department of Public Health, Environmental and Social Determinants of Health, World Health Organisation

The study included HAP measurements in households before and after LPG adoption, measuring PM<sub>2.5</sub> in kitchens and inhaled by primary cooks. PM<sub>2.5</sub> is responsible for most of the disease related to HAP.

LPG consumption by participants measured over six months was nearly five times Cameroon's national average showing sustained LPG use after initial adoption. PM<sub>2.5</sub> exposure levels decreased significantly. Exposure in primary cooks reached

***“When you cook with firewood, smoke enters your eyes. My children cough because of the smoke. When you cook with gas, you feel nothing.”***

Woman who adopted LPG for cooking through *Bottled Gas for Better Life*, Cameroon



No more smoke and bending over: cooking with LPG compared to cooking with biomass

levels below the WHO's indoor air pollution Interim Target-1 ( $35\mu\text{g}/\text{m}^3$ ), confirming LPG's health protective role. Significant reductions in headaches (46% to 9%), eye problems (66% to 8%), cook burns (25% to 3%) and child burns (9%

to 0%) were also observed after families adopted LPG through the loan programme. Over time, scaling up LPG use for clean cooking is expected to lower the mortality and disease rates attributed to household air pollution.

**Switching from biomass to LPG for domestic cooking fuel use in line with Cameroon's National LPG Master Plan target for 2030 is projected to save 19,000 lives.**

# 5 GENDER EQUALITY



(Image: Practical Action/Carbon Clear)

SDG 5 includes measures to end all discrimination against women and girls, recognise and value unpaid care and domestic work, ensure women's effective participation and equal opportunities, and enhance the use of enabling technologies. Additionally, SDG 5 calls for adopting and strengthening sound policies and enforceable legislation for the promotion of gender equality, and the empowerment of all women and girls at all levels.

Gender equality is important for the energy sector to maximise its contribution to economic growth and broader development goals. Access to clean cooking energy is an especially gendered issue, because women are primarily responsible for cooking in most cultures<sup>8</sup> and need the benefits in terms of ease of use, time savings and improved health outcomes that using LPG as their cooking fuel can bring.

Delivering cooking energy access using LPG is a key contributor to meeting SDG 5 on gender equality. It provides women with opportunities through saving time spent on collecting fuelwood and cooking, allowing them more time to pursue other activities such as education, leisure and livelihood opportunities.

Women are active across the LPG supply chain as policy makers and as entrepreneurs. However, women remain underrepresented within the industry in some countries, and there are now a range of initiatives to address this.

The World LPG Association launched the Women in LPG (WINLPG) global network several years

ago as a way to support women's engagement across the industry, recognising that there is still room to enhance gender balance within the LPG sector. It is formulating and recommending actions through its national chapters in Africa, the Americas, Asia and Europe and at the global level. In 2018 it launched the LPG Woman of the Year Award as a way to champion the contribution of women leaders within the LPG industry.

***“Women across the world are significant contributors to the economic development of many nations. Today, women are making unparalleled achievements in traditionally male-dominated industries because we are naturally equipped with a depth of intuition, resilience and creativity that makes for ‘business unusual.’”***

**Audrey Joe-Ezigbo, Co-Founder & Executive Director, Falcon Corporation Limited, Nigeria**



## LPG, AN EMPOWERING FUEL FOR GENDER EQUALITY IN THE WORKFORCE

Because LPG is a modern energy source, its development has called for the employment of a modern, gender inclusive workforce.

Daw Kyaw Kyaw Win, Head of Business Unit at Parami Energy in Yangon, Myanmar, has had a lifelong career in the Oil and Gas sector starting with the Myanmar Petrochemical Enterprise (MPE). After her retirement from the MPE, she started her current role at Parami, the first company in Myanmar to obtain a license from MPE under the Ministry of Electricity and Energy for importing LPG by sea freight. She stated: "With my management contribution in Parami Energy, I want to motivate more women to participate and thereby boost the LPG Network, both here in Myanmar and in other countries." On the relationship between gender equality and energy, she strongly advocates improved gender diversity – particularly in Myanmar – and believes that all employment levels across the LPG supply chain and more generally in the energy sector will benefit from greater gender equality.

The LPG industry has provided many opportunities for women to participate in the workforce, across developed and developing countries. Promoting a more gender equal workforce not only allows the sector to benefit from a more diverse and resourceful pool of talent, but also empowers women economically and provides more opportunities for leadership.



**Daw Kyaw Kyaw Win, Parami Energy**

Growth of the LPG sector has also called for better investors and business developers. Enter Audrey Joe-Ezigbo, the Co-Founder and Executive Director of Commercial Operations of Falcon Corporations Limited, Nigeria. She is also the Vice President of the Nigerian Gas Association (NGA), the umbrella organisation for professionals and businesses involved in the Nigerian gas industry. She also serves as Chairperson for the NGA's Investment Promotion Committee.

LPG has been the centerpiece of Joe-Ezigbo's thriving career in the oil and gas industry. In a WINLPG interview, she spoke about her ambition to take LPG development in Nigeria to the next level: "I am working to quadruple my company's size and revenues within the oil & gas industry over the next three to five years through a strong play in LPG storage terminals; natural gas distribution; upstream gas development; and gas transportation infrastructure development." She also recognises the importance of keeping up with technological and regulatory developments in the LPG sector, and of industry networks in helping with learning and networking.

# 7 AFFORDABLE AND CLEAN ENERGY



Three billion people still cook, heat and light their homes using polluting fuels like wood and charcoal, dung and kerosene that produce unhealthy emissions and degrade forests. SDG 7 focuses on the need to provide modern energy access for all. In the cooking sector, this means moving to lower carbon, clean-burning fuels like LPG that are better for health and the environment, and that can be rapidly and widely scaled.

Countries such as India, Indonesia, Malaysia, Vietnam, Senegal, Cote d'Ivoire, Brazil, Colombia, and others have achieved national LPG use for cooking by 75% or more of their urban populations, and in some cases, 50% or more of their rural populations. LPG is already the main cooking fuel in many Latin American countries.

Over 2.5 billion people use LPG for some cooking tasks in resource-poor settings and millions more in developed countries<sup>9</sup>. The International Energy Agency (IEA) highlights LPG as a key fuel for substantially reducing energy-related pollution emissions. In its 2017 report, the IEA projects

that 1.4 billion people in the developing world will transition to LPG as a clean cooking solution if universal energy access is to be achieved by 2030. Countries like India, Indonesia and El Salvador have demonstrated how quickly and sustainably LPG can be scaled up over national territories for clean cooking.

In addition to its use for cooking, LPG is used in rural communities in many countries all around the world for heating purposes, as a lower emissions alternative to the use of heating oil or coal in residential settings. Because LPG is a very portable fuel, it can be transported and used in cylinders across urban, peri-urban and remote rural settings — wherever it can be transported safely.

In addition, LPG is used in the power sector, especially for remote applications and island economies where its flexibility is well suited to meet household energy needs, with little central infrastructure required. LPG is also suited to large-scale power infrastructure, where its use integrates well with renewable energy solutions.

**In a 2015 United Nations report, Ghana's commitments to achieve sustainable development goals included large scale adoption of LPG use for cooking, increasing from 5.5% in 2015 to 50% of peri-urban and rural households by 2030.**



## A CLEAN START – CLEAN COOKING IN KENYA WITH A PAY-AS-YOU-COOK SMART METER

Cecilia Wanjiku is a mother of four. She lives with her family in the so-called “slumburb” of Kawangware, Kenya. When Kawangware is in the news it is often for its difficult living conditions. Many families cannot afford to send their children to school. Clean water and electricity are in short supply. While many families have access to LPG, they often cook with charcoal.

It is at the start of the day when Wanjiku’s first decision regarding household energy must be made. Charcoal takes nearly 20 minutes to heat up. However, charcoal is reliably available and she can purchase what is needed for the day close to her home at a cost she can afford.

LPG, on the other hand, burns cleaner and can cook meals faster. However, gas must be bought by the cylinder, which is inconvenient and expensive for many poorer households.

Envirofit’s SmartGas technology overcomes this barrier by offering users the ability to pay-as-you-cook – or make daily LPG purchases using mobile money. These payments can be as little as \$0.50 a day at a cost equal to or cheaper than charcoal. This flexibility is necessary because income can vary throughout the month. “I like that I can buy gas in smaller amounts; a factor that ensures that I always have gas. I don’t have to save for a full cylinder refill, which was sometimes a challenge especially during those difficult curves of the month,” said Wanjiku.

Envirofit’s SmartGas cylinders use an Internet of things (IoT) smart meter technology, which allows consumers to pay for gas in daily increments, and communicate through mobile systems which schedule cylinder refills automatically before customers run out of gas. This ensures a consistent, affordable supply of fuel, and removes the burden of refilling from Wanjiku’s schedule by having a full cylinder of LPG delivered safely to her door just as her current cylinder is running out of LPG.

Much of the cooking with LPG that takes place in Kawangware happens on cylinder-top burners. For larger families, a single burner isn’t enough to make a meal consisting of multiple dishes. Often, a charcoal stove is used as well, diminishing the positive health impact of LPG use. Envirofit also helps users upgrade their kitchen by financing a two-burner LPG stove. As LPG usage increases, households like the Wanjiku family benefit from more reliable, affordable and convenient access to modern fuels, and lowered exposure to smoke and soot.



Cecilia Wanjiku, SmartGas customer in Kenya

## **POWERING SUSTAINABLE ENERGY TRANSITIONS IN THE CARIBBEAN: ROATAN, HONDURAS**

LPG powers environmentally-friendly energy transitions by fueling electricity generation in developing nations in the Caribbean.

Wärtsilä, an energy company, has closely cooperated with Roatan Electric Company to deliver a modern, low-emissions LPG-fueled power plant to the island of Roatan, Honduras. This plant has prepared the Roatan hybrid power system for the future large-scale integration of renewably sourced energy generation<sup>10</sup>.

For this project, Roatan Electric Company evaluated LPG and Liquefied Natural Gas (LNG) and decided to use LPG due to its easy portability: LPG (in contrast to LNG) can be stored in industry standard pressurised bullet tanks, avoiding the complex and costly cryogenic storage infrastructure required for LNG. Furthermore, the worldwide fleet of small-sized pressurised LPG tankers is large, and existing vessels can be used for the Roatan trade while at the same time supplying LPG to other consumers in the region.

Andrej Borgmästars, Senior Manager LPG to Power at Wärtsilä Energy Solutions, says the following regarding the benefits of LPG for the Caribbean region: "At Wärtsilä, we believe that LPG is an excellent fuel, not only for the Caribbean and Central America where we already have LPG plants in operation, but for any site that needs clean energy and does not have access to pipeline natural gas. Furthermore, thanks to the flexibility of our LPG power plants, they represent the optimal solution allowing for the integration of renewable energy generation into any power system."

LPG also increases energy security and reliability for the Caribbean island. This improvement to the energy infrastructure will help to generate faster local economic development.

### **LPG POWER PLANTS FOR LARGE-SCALE ENERGY ACCESS**

Bridge Power project<sup>11</sup>, an LPG-fueled power plant under development in Tema, Ghana, will use high efficiency turbine generators. The US\$953 million power plant being built in two phases, one of 194 MW and the second of



LPG-powered electricity generation

206 MW, is the largest of its kind. Because of the scale of this LPG energy project, the power plant will not only fuel sustainable energy transition, but also local employment and economic development.

LPG greatly suits the Ghanaian market for power generation, due to Ghana's high wholesale electricity prices. LPG's versatility makes it efficient and easy to use, and it delivers lower carbon emissions with great results. The project will use imported LPG as the primary fuel, and diesel as the secondary fuel during the first five years of operation. Natural gas is expected to become available to serve as the primary fuel, and LPG will become the secondary fuel later.

LPG's versatility is demonstrated in ways beyond its efficiency and sustainability aspects. LPG is easier and less expensive to compress, ship, and store than LNG, and LPG power plants can be developed close to where energy is needed, thus avoiding significant losses from power transmission lines. It is adaptable to other fuel sources such as wind, solar, hydro or other renewable sources, as well as natural gas and, because of this quality, LPG is considered as a valuable "bridge" energy source for such power plants. Fueling power plants with LPG therefore also contributes over time to a greater renewable energy share in overall electricity generation.



# 8 DECENT WORK AND ECONOMIC GROWTH



The LPG industry is a significant employer globally, with around two million people working both directly and indirectly across the supply chain. Many good jobs are created related to the use of LPG for men and women alike, as outlined earlier in this report.

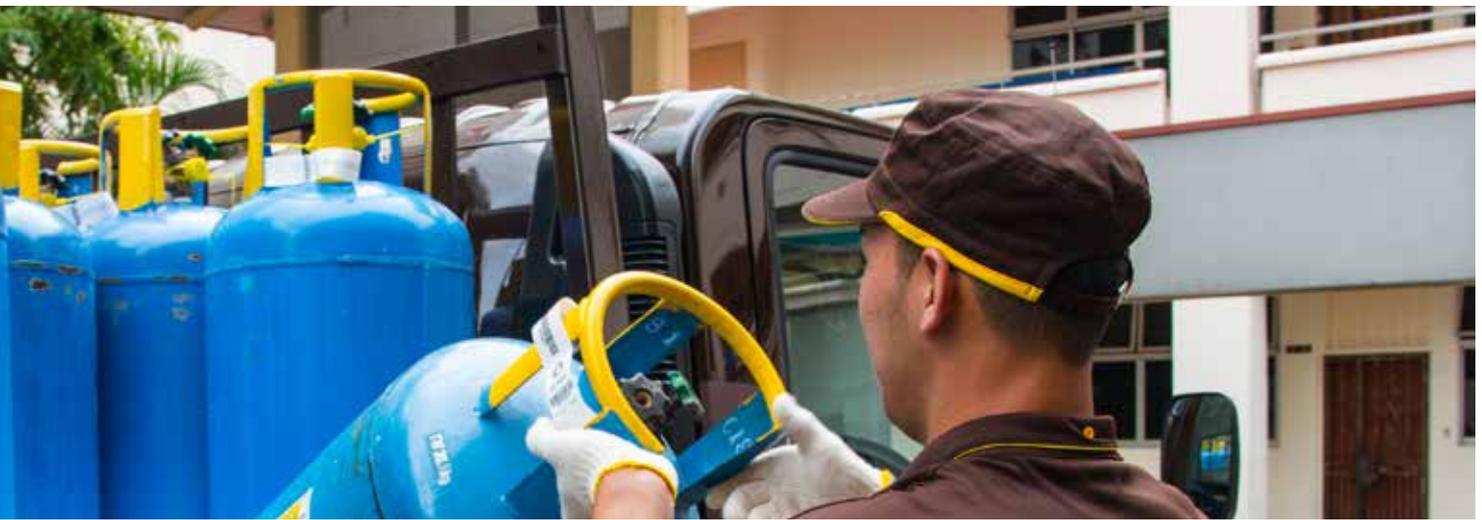
LPG use supports and enables inclusive economic growth at both national and local levels, empowering a range of industries and economic sectors, both large and small. In Indonesia, a national LPG transition programme led to a rapid increase in households using LPG for cooking— from three million in 2007 to 43.3 million by 2012. The government created eight new LPG terminals, 53 LPG cylinder factories, 31 stove manufacturers, 14 regulator producers

and 22 filling stations, according to the Asian Development Bank. This generated \$1.7 billion of investment and created 28,000 new jobs.<sup>12</sup>

LPG enables entrepreneurship in industry as a portable, flexible fuel with applications in both small craft industries and large industrial settings, creating and supporting many jobs. Since LPG can be transported long distances and doesn't require pipelines, it can be utilized effectively even in very rural and remote areas. In the agricultural sector, LPG is used by 80% of farmers worldwide, according to the WLPGA, for a range of applications. LPG helps to support employment opportunities that may otherwise be limited in very rural settings.



The LPG sector provides ample employment opportunities



## **SUPERB STREET FOOD IN SINGAPORE SUPPORTS DECENT LIVELIHOODS**

Many street food vendors in Singapore use LPG to cook food for their customers.

Street food markets, called “hawker centers” in Singapore, are popular destinations for locals and tourists alike. These markets feature rows of stalls selling a wide variety of local delicacies at affordable prices. As the stalls are tight spaces and packed close to one another, LPG is an ideal cooking fuel due to its portability and low emissions.

Unlike charcoal, LPG produces no odour and is better for the environment. Because LPG cooks food quickly and efficiently, vendors are also able to serve customers with greater speed, save costs and increase their earnings, supporting a decent livelihood.

The food stalls are often small family-owned businesses passed from one generation to another. Some began as itinerant food vendors decades ago, and have over time shifted from cooking with traditional, inefficient and expensive fuels to LPG.

Foo Kui Lan, the proprietor of Tian Tian Hainanese Chicken Rice at the popular Maxwell Food Centre, started her business in 1978 and now has two other locations. In addition to her regular local customers, she sees a growing

number of tourists and expatriates eager to sample Singapore’s unique culinary culture.

“LPG is much better than charcoal because it is better for the environment and it also saves costs. The suppliers monitor my LPG use and if I am running low they will come and replace the cylinders,” said Foo.

Using LPG supports the vendors’ livelihoods. They have a reliable supply of fuel to cook their food with, in cleaner and more efficient kitchens. And patrons from all over the world can enjoy Singapore’s best street food in a clean, smoke-free environment.



**Cooking with LPG**

## **LPG, A VERSATILE FUEL SUPPORTING LOCAL INDUSTRIES**

LPG has the ability to support multiple innovative applications across different industries.

Furniture craftsmen in the bustling marketplaces of Marrakesh, Morocco use LPG flames to create metal furniture pieces. The craftsmen aspire to use LPG mainly because LPG flames can be precisely controlled to burn at different temperatures, which in turn helps soften metals that bend at different temperatures. Because of this versatility, they can build furniture faster and with more beautiful craftsmanship for their customers. In addition, the LPG used is odourless, in contrast to fuels used in the past that produced harmful and polluting smoke.

The LPG used by the Moroccan craftsmen has not only boosted their incomes and livelihoods, but also made their environment cleaner by not emitting harmful fumes. Because of the benefits generated, using LPG as a fuel source supports local enterprise development in Morocco's craft industry.

***“LPG gives me the capability to complete a lot more work and makes many things possible.”***

Furniture craftsman,  
Marrakech, Morocco



LPG's many applications support local industries and decent livelihoods

**Around two million people are employed,  
both directly and indirectly, in the LPG  
industry globally.**



# 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



There is an urgent need to decarbonize industry globally. Without a shift in the types of fuels used, it is unlikely that greenhouse gas reduction targets will be met. In countries like the U.S. where nearly 50% of the industrial sector uses coal, a significant opportunity exists to switch to LPG for a lower carbon footprint.

LPG is used in both large industries as well as for smaller applications, in both developed and developing countries alike, as a key clean-burning fuel. It is used in the metallurgical industry and to fuel boilers, forklifts, ovens, and furnaces. It is used in pottery and ceramic tile manufacture, for the production of polymers, paint and varnish. It is also used in aerosols to replace ozone depleting propellants.

LPG's significance, versatility and flexibility as a fuel with many applications is important for consideration when developing sustainable industrialisation plans. In addition, the availability of bio-sourced LPG, or renewable LPG produced from organic wastes and residues, is growing year on year. Bio-LPG provides a promising



pathway towards decarbonisation of the LPG sector, of the many industries that LPG fuel supports, and of many industrial and transport processes that presently use other, higher-carbon-footprint fuels.

Adoption of LPG at scale in a national setting requires investment in infrastructure related to importation (if LPG is not domestically produced), bulk storage, transportation, and filling facilities and LPG cylinders. It also requires well-expanded distribution and retailing networks to ensure reliable and affordable supply and safe delivery to end-users.



LPG-fueled hot air balloons floating over Turkey



## **A POLISH ROAD CONSTRUCTION COMPANY SWITCHES FROM OIL TO LPG**

Poland's extensive road infrastructure network is a clear sign of the country's economic development. During the last decade, the number of local and national roads – including motorways and expressways – has increased rapidly. Unfortunately, the manner in which the country produces bituminous masses and asphalt has not changed at all during this same period. Bituminous masses are used for road construction, and many facilities still use heavy burning oil, coal or coal dust in their production. This in turn emits large amounts of CO<sub>2</sub> and other harmful gases into the atmosphere.

In 2018, the Road Construction Company in Raciborz (in southwestern Poland) commenced the construction of an LPG installation and gas supply. The new approach was driven by complaints to the company and protests by

local inhabitants concerning environmental pollution, resulting in the company's decision to switch from oil to LPG.

The Road Construction Company will use 220 tons of LPG each year to produce 40,000 tons of bituminous masses in a much more environmentally-friendly way. The switch will translate into a significant reduction of CO<sub>2</sub> emissions compared to the old production method. The company itself will receive an additional benefit: the use of this convenient, maintenance-free energy source will provide significant savings of up to EUR 75,000.

Switching to LPG has a dual benefit for the environment and the company's bottom line. LPG enables the retrofitting of a longstanding integral industry for economic growth, facilitating the development of environmentally sustainable, resource efficient and resilient infrastructure for the future.



## LPG FUELING A NEW SERIES OF VERY LARGE GAS CARRIERS (VLGC)

As an innovative solution to address increasingly stringent emissions restrictions, LPG as a main engine fuel will be installed on two VLGC New buildings – 86,000 m<sup>3</sup> gas carriers. EXMAR has contracted these VLGCs to serve long-term commitments with Equinor ASA for worldwide LPG transportation. Both vessels are to be delivered by 2021.

This development is the result of Equinor ASA's commitment to improve the sustainability

performance in its activities. It also reflects the longstanding cooperation of EXMAR with Lloyds Register as Classification Society and MAN Energy Solutions as engine maker to develop an efficient LPG fuel system, which allows part of the cargo to be used for the vessels' propulsion. EXMAR has also signed a contract with Jiangnan Shipyard to deliver two newbuilt LPG-fueled vessels. This will be a pioneering project in the gas shipping industry. LPG as a marine fuel has superior environmental benefits; it does not contain sulfur, substantially reduces CO<sub>2</sub> and NO<sub>x</sub> emissions, and almost halves the emissions of particulate matter compared to conventional marine fuel engines.



LPG-fueled gas carriers improve fuel efficiency and environmental sustainability

## BIO-SOURCED LPG, A FULLY RENEWABLE FUEL FOR THE FUTURE

SHV Energy customers in seven European countries are now able to use a brand new, low carbon fuel: bio-LPG. Bio-LPG is a by-product from the Neste Renewable Diesel production facility in Rotterdam and represents the first large-scale distribution of bio-LPG in the world. Primagaz and Calor market and distribute this fuel, the newest innovation in the LPG sector.

The first consumer of bio-LPG in France is the L'Oréal site of La Roche-Posay, an industrial site in the French countryside which is not connected to the gas grid. La Roche-Posay consumes approximately 130 tonnes of standard LPG per year for its industrial processes. As of May 2018, it now uses 100% bio-sourced LPG, delivered by Primagaz France. Jean-Yves Larrauffie, the president of a L'Oréal subsidiary, explains:

"L'Oréal is committed to a carbon neutral approach for its manufactured products and



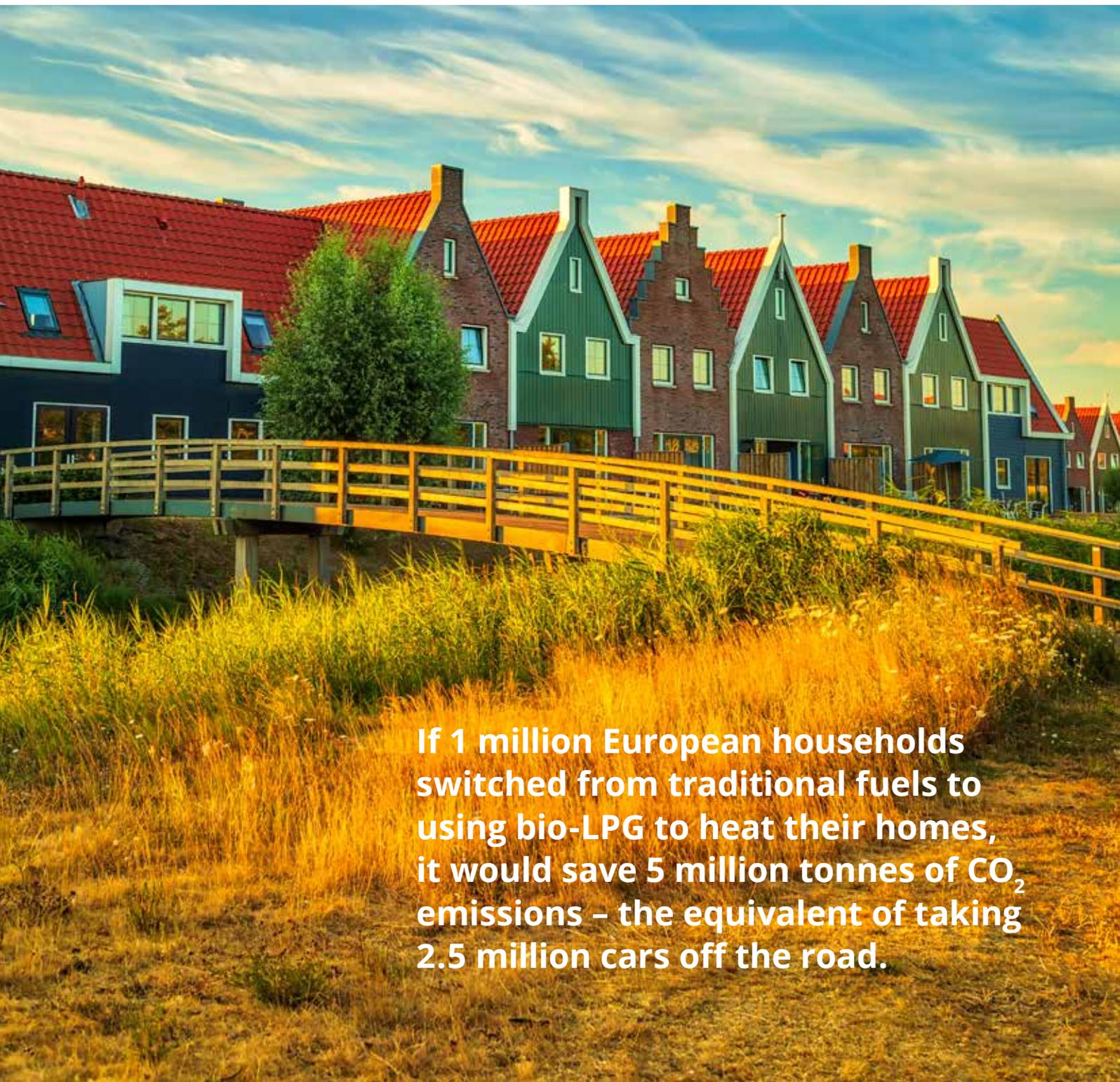
Bio-sourced LPG is now available in many European countries and the United States

plants and has set a target of reducing its CO<sub>2</sub> emissions by 60% between 2005 and 2020". Primagaz will deliver 150 tons per year over five years, saving 1,915 tonnes of CO<sub>2</sub> on an annual basis. As requested by L'Oréal, the delivered bio-LPG is produced exclusively from used cooking oil, improving resource-use efficiency.

Bio-LPG is a drop-in replacement for conventional LPG. Consumers can use exactly the same LPG appliances and vehicles while

dramatically improving their carbon footprint. For instance, if one million European households switched from traditional fuels to using bio-LPG to heat their homes, it would save five million tonnes of CO<sub>2</sub> emissions – the equivalent of taking 2.5 million cars off the road.

By 2040, SHV Energy aims to have 100% of its energy products be from renewable sources. Bio-LPG will have an integral role in achieving this goal.



**If 1 million European households switched from traditional fuels to using bio-LPG to heat their homes, it would save 5 million tonnes of CO<sub>2</sub> emissions – the equivalent of taking 2.5 million cars off the road.**

# 11 SUSTAINABLE CITIES AND COMMUNITIES



LPG is used for a variety of applications in both large cities and in small communities.

In urban centres, LPG is used as Autogas, the third most common automotive fuel globally. Because of its efficiency and emissions profile, use of LPG helps to address environmental air quality issues in cities. Worldwide, around 25 million vehicles are refueled with Autogas at over 70,000 refueling sites.<sup>13</sup> By 2016, according to the WLPGA, there were around 155,000 LPG vehicles in the USA. Some 13,045 new LPG vehicles and fuel systems were sold in 2017 alone, 40% of which were medium or heavy-duty trucks, helping to replace higher emitting diesel trucks.



**Autogas - Refueling with LPG**

The environmental benefits are clear - LPG is a lower NO<sub>x</sub> and greenhouse gas (GHG) alternative to diesel. LPG is also used in vehicles such as street sweepers which are used to help clean the urban environment.

LPG use for cooking is widespread in urban areas in many developing countries, which contributes not only to cleaner household air, but also reduces ambient air pollution, contributing to healthier cities. Many developing countries where LPG is not yet used nationwide are embarking on national programmes to enable and encourage its expanded use for cooking and other purposes in both urban and rural areas.



**An LPG-fueled street sweeper to help keep cities clean**

LPG is also widely used for heating in both developed and developing countries. Indeed, some of the recent penetration of bio-LPG in the UK by the SHV subsidiary company, Calor Gas, is from its use for home heating purposes. Bio-LPG can be used as a substitute for conventional LPG in existing heating systems, consistent with the UK's emissions reductions goals<sup>14</sup>.



### **LPG-ELECTRIC HYBRID TAXIS – CONVENIENT TRANSPORT FOR CLEANER CITIES**

Autogas is a common alternative fuel in the transport sector. Vehicles running on LPG produce far fewer harmful emissions such as NO<sub>x</sub> and particulates that contribute to environmental and health problems. The hybridisation of Autogas vehicles combines the benefits of electricity together with a longer range provided by a cleaner fuel. This technology is particularly suitable for taxis in urban areas, contributing to cleaner, more sustainable public transportation in cities.

13CABS in Melbourne, Australia, has equipped its Toyota Camry Hybrid taxis with state-of-the-art sequential vapor injection LPG systems. Both passenger and driver friendly, the Toyota Camry Hybrid integrates the high torque of a battery-powered electric motor with the power of a combustion engine. Results have included

**LPG vehicles produce three times fewer NO<sub>x</sub> emissions than cars run on gasoline, and 93 times fewer than diesel cars. The South Korean government expects nearly US\$317 million to be saved in environmental costs by 2030 through the reduction in emissions, given the expected increase in LPG vehicles<sup>15</sup>.**

payback on conversion of six months, fuel cost savings of up to 45% compared to the gasoline-powered Camry Hybrid, and CO<sub>2</sub> emission reductions by approximately 3.45 tonnes per vehicle. Said Greg Hardeman, Fleet Operations Manager for 13CABS, “While the Toyota Camry Hybrid with its petro-electric drive is already one of the most economical cars in the market, with a tri-fuel system using LPG, the vehicle delivers even more environmental and cost benefits.”

In Tokyo, Japan, the JPN taxi was launched in October 2017. This LPG-electric hybrid taxi was designed to provide usability and comfort to a people across all age groups, as well as wheelchair users. In terms of environmental and power performance, the Toyota JPN taxi offers an LPG hybrid system with 19.4 km/liter fuel economy and sharply reduced CO<sub>2</sub> emissions. The city of Tokyo plans to use the JPN Taxi to greet visitors from around the world in 2020, when Tokyo hosts the Olympic and Paralympic Games.



LPG taxis are widespread in South Korea

## CONVERTING SCHOOL BUSES TO LPG IN THE USA



**LPG school buses reduce children's exposure to harmful air pollution**

Given the health risks conventional diesel school buses pose, using LPG buses to transport children to school reduces their exposure to harmful air pollution, offering environmental benefits to their communities. Improving health outcomes for children and young people in turn improves their ability to succeed in education and in life. Some studies have reported links between long-term exposure to ambient levels of particulate matter and  $\text{NO}_x$  and illness-related school absenteeism. LPG school buses are also quieter, reducing noise pollution.

LPG school buses also save money. There are currently 15,600 LPG school buses in operation across the United States. There are numerous reasons why LPG can be a lower overall cost option than diesel on a total cost of ownership basis - including federal and state incentives which make the fuel cost very competitive, lower maintenance costs, and a lower likelihood of downtime for repairs given the absence of complex after-treatment systems required with diesel engines.

In the state of Nevada, USA, the 48 LPG buses in operation transport 18,400 students daily, saving the state around US\$80,000 a year, compared to diesel counterparts. In the Alvin ISD school district, a large suburban area located just outside Houston, Texas which operates more than 100 Autogas school buses, drivers reported a strong preference for using LPG buses, stating improved performance and reduced maintenance times as key factors. In this district, where LPG buses comprise half of the school bus fleet and cover nearly a million miles each year, 50% is saved on fuel costs annually, refueling time has been halved and extended motor oil changes only occur every 10,000 miles, in contrast to every 6,000 miles with diesel-fueled buses.

**According to the WLPGA, if the USA's 459,000 school buses currently fueled by diesel are converted to LPG, not only would the children breathe healthier air, but also – based on savings achieved in Nevada through switching school buses to operate on LPG – over a billion dollars per year could be saved.**

The city of Tokyo plans to use the JPN Taxi to greet visitors from around the world in 2020, when Tokyo hosts the Olympic and Paralympic Games.



# 13 CLIMATE ACTION



The use of LPG helps to move the world towards lower carbon pathways. Replacing high emissions fuels like diesel with LPG in automobiles and solid fuels burned in traditional stoves for cooking and heating helps to lower emissions of climate active pollutants, and provide for a healthier living environment.

Reducing CO<sub>2</sub> emissions alone is not enough to address climate change. The Inter-Governmental Panel on Climate Change (IPCC) has noted that although CO<sub>2</sub> is the main component responsible for long-term warming, the reduction of Short-Lived Climate Forcers such as methane (CH<sub>4</sub>) and black carbon (BC), that operate in the short term, can contribute significantly to limiting warming to 1.5°C.<sup>16</sup>

BC is the second top global warming agent after CO<sub>2</sub>.<sup>17</sup> The IPCC recognises the role of gas, and specifically includes LPG as a climate mitigation measure to tackle BC emissions from residential cooking. Household air pollution contributes significantly to ambient (outdoor) air pollution; globally, up to 25% of BC emissions and 15% of fine particulate (PM<sub>2.5</sub>) emissions come from burning solid fuels for household energy needs.<sup>18</sup>

In India, researchers found that eliminating emissions from household fuel sources — without changes to industrial or vehicle emissions — would lower ambient air pollution levels to meet the country's air quality standard.<sup>19</sup>

LPG has an overall climate protective role when used at scale for cooking. It burns more efficiently with a lower emissions profile than firewood, charcoal and kerosene burnt in open fires or rudimentary technologies in low and middle-income settings.

In Ghana, GLPGP has projected that between 2020 and 2030, increased LPG access for cooking could result in up to 221 million trees saved, up to 9.30 million MT CO<sub>2</sub>eq emissions and 16.6 million MT of BC equivalent emissions averted. The economic value of averted CO<sub>2</sub>eq emissions, in terms of carbon financing, was projected to be € 29.6 – € 40.6 million cumulatively, using the 2018 prevailing price of carbon.<sup>20</sup>

**In Europe, LPG offers 15% lower greenhouse gas emissions than heating with fuel oil.**



### **SCALING UP LPG USE FOR EVERYDAY COOKING PROTECTS THE CLIMATE**

A study by the University of Liverpool, UK and the Centre for International Climate and Environmental Research (CICERO), Norway, sponsored by the African Development Bank was conducted in 2017. The study modeled the health and climate impacts of scaling LPG adoption for clean cooking to 58% of Cameroon's population by 2030 from less than 20% through the country's national LPG Master Plan, developed in 2016 with GLPGP. A key driver of the Cameroon government's desire to expand LPG access was concern about the severe forest loss, and related climate consequences, from the widespread use of fuelwood for cooking.

Study results show that implementation of the Master Plan is expected to reduce the emissions



**LPG for cooking reduces charcoal use and fuelwood gathering, protecting forests which help capture CO<sub>2</sub>**

of short-lived climate pollutants like BC by more than a third, and ultimately avert 4.5-7.6 million tons of CO<sub>2</sub>-equivalent over a 100-year time horizon. This will have a net cooling effect of -0.10 millidegree centigrade (milli °C) in 2030. By 2100, assuming LPG continues to be the fuel used by at least 70% of the population, a global cooling effect of -0.70 milli °C to -0.93 milli °C is forecast.

**The IPCC's *Special Report: Global Warming Of 1.5 °C* states that "reductions of black carbon (BC) and methane (CH<sub>4</sub>) would have substantial co-benefits, including improved health due to reduced air pollution."**

## CARBON CREDITS FROM LOW SMOKE STOVES PROJECT IN SUDAN

Over 90% of households in North Darfur, Sudan, depend on firewood and charcoal for cooking. The country is experiencing many negative effects of climate change, including drought and desertification, exacerbated by forest degradation from woodfuel gathering.

In the Low Smoke Stoves project in North Darfur, LPG fuel and stoves are used as a substitute for wood and charcoal in household cooking.

Practical Action and Carbon Clear launched the project in 2008. The objective was to promote widespread use of LPG for cooking in El Fashir. Poor households gained access to LPG for cooking through a microfinance credit revolving fund. Participants were trained on the efficient use and safety of LPG, and educated on the negative environmental impacts of excessive fuelwood use. As of 2017, more than 11,000 LPG “start-up” equipment sets have been distributed by the project, and a 95% reduction in key pollutants has been observed when the households switch from solid fuels to LPG, according to Practical Action. Almost 100% of households acknowledge that air quality has drastically improved with LPG use.



The project also reduced regional deforestation by saving approximately 80 kilograms of wood, or 30 kilograms of charcoal, per household each month. LPG has reduced overall fuel consumption by up to 70%. The LPG cookstoves cut more than 48,000 tonnes of CO<sub>2</sub> emissions between 2013 and 2017, and the estimated greenhouse gas emissions reduction over ten years is approximately 300,000 tonnes. This is the first Gold Standard certified project to use LPG, as well as Sudan's first carbon credit project.

By delivering access to LPG for cooking, the Low Smoke Stoves project continues to improve the air quality, and reduce pressure on dwindling forest resources in Darfur.

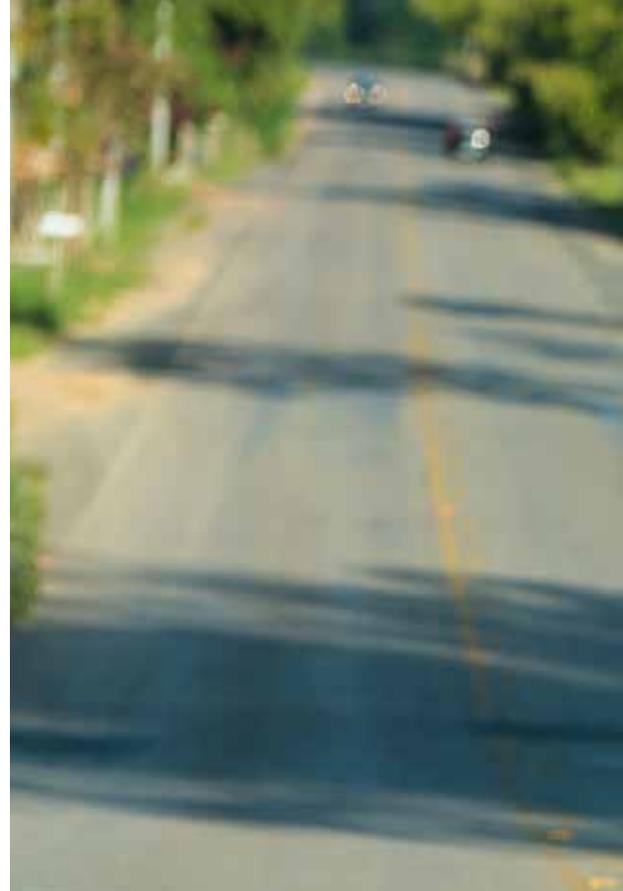
**“I spent 3-4 hours cooking before. Now, in one hour I can do everything. I recommend LPG to my friends. I tell them it has been a benefit and they should go and get it. With LPG, my husband is now willing to help me.”**

**Fatima Suliman Ahmed,  
23 from Darfur, Sudan**



# CHAPTER 4.

## TOWARDS 2030



**Just 11 years remain until 2030, the deadline for achievement of the SDGs. While some SDGs are on track, others need far more concerted action to be achieved.**

Addressing climate change (SDG 13) in particular requires increased commitment from all stakeholders. Although counterintuitive to some, conventionally-derived LPG, being a low emission and environmentally friendly fuel, is very well placed to play a large role in this ongoing global energy transition, both as a transition fuel and under long-term clean energy pathways. LPG should be a key part of climate mitigation action as recommended by the IPCC. Bio-LPG produced from non-fossil, bio-based feedstock is also likely to grow in production in the coming years and is already used for heating homes in countries like the UK. As its production grows, it will be important for policy makers to develop appropriate policies to support its blending with conventional LPG fuel, further enhancing the low climate footprint of LPG.

One area that still requires special attention is the clean cooking target under SDG 7 for energy access, which remains, sadly, well behind target. The number of people lacking access to clean cooking solutions is not keeping pace with population growth, especially in Africa. Given the suitability of LPG as a cooking fuel in developing

countries, as well as the recognition of the primacy of the role of LPG as a healthy cooking fuel by leading global entities such as the IEA and WHO, there is an opportunity and need to work with governments and investors on finalizing plans that include significantly increased national capacity for, and use of, LPG in many countries.

The government of India, in its Pradhan Mantri Ujjwala Yojana programme launched in 2016, has shown that rapid national rollout can be achieved through strong state support. Indonesia has also shown how strong government leadership could enable a large proportion of the population to gain access to LPG in a relatively short time. Similarly, across Africa, governments are embracing LPG as a preferred cooking fuel at least for urban areas, recognizing that consumers want it but access to capital is needed to make it a reality. These governments also recognise LPG's protective value for forests, given the decimation of forests in many countries derived in part from the cutting down of trees for fuel and for making charcoal, a common cooking fuel in those



**India's massive national LPG for cooking (Ujjwala) programme has already supported the penetration of LPG cylinders into rural areas across the country, providing 71 million new connections across 714 districts of India.**

countries. LPG, in many countries, is also actually less expensive than charcoal or kerosene to use, on a per-meal-cooked basis.

But in order to help meet SDG 7 faster, more concerted, catalytic action is still required. To develop the LPG industry further for residential cooking purposes, particularly in developing countries, requires the support of investors to help underwrite the build-out of required assets all along the supply chain. Only then can LPG reach far beyond its existing customer base and penetrate into poorer and more remote communities. It also requires governments to develop sensible national and local energy plans to support robust, sustainable and safe supply chains, as well as donors to help those chains reach poorer and vulnerable communities sustainably.

Almost all the SDGs highlighted in this report are interconnected, and several case studies presented contribute to multiple SDGs. A concerted effort to scale up these applications of LPG will have positive impacts across a range of SDG issue areas, advancing a common global development agenda.

LPG must also be used and scaled up in ways that do not hold back the achievement of certain SDGs. For example, LPG for cooking will remain inaccessible to the very poor – impeding achievement of SDG 1 for No Poverty and SDG 10 for Reduced Inequality – unless the proper enabling environment, distribution infrastructure, and consumer financing tools are created. In relation to SDGs 7 and 13, the continued development of bio-LPG will over time decrease the share of non-renewable fuel use. Finally, as LPG is an unavoidable by-product of the crude oil and natural gas production and refining process, it should be used more for clean cooking and other applications that advance multiple SDGs, than applications such as plastics production that may contribute negatively to environmental goals.

The LPG industry is constantly innovating in ways that help to provide safe, sustainable solutions well-suited to a range of tasks. LPG already contributes much to the achievement of the SDGs and can continue to do so, even increasing its role as part of a low carbon global pathway in the years to come.

# REFERENCES



1. Excerpt from keynote remarks at LPG for Development Summit, Marrakech, Morocco, 2017.
2. To learn more about LPG applications go to: <https://lpg-apps.org/>
3. Van Leeuwen, R., Evans, A., Hyseni, B., (2017). Increasing the Use of Liquefied Petroleum Gas in Cooking in Developing Countries. Live Wire, Washington DC. Retrieved from <http://glpgp.org/s/World-Bank-LiveWire-Increasing-the-Use-of-LPG-in-Cooking-in-Developing-Countries.pdf>
4. U.S. Department of Energy. Propane Fuel Basics. Retrieved from [https://afdc.energy.gov/fuels/propane\\_basics.html](https://afdc.energy.gov/fuels/propane_basics.html)
5. World LPG Association. (2017). LPG for Marine Engines The Marine Alternative Fuel. Retrieved from <https://www.wlpga.org/wp-content/uploads/2018/02/LPG-for-Marine-Engines-2017-.pdf>
6. Rosenthal, J. et al. (2018). Clean cooking and the SDGs: Integrated analytical approaches to guide energy interventions for health and environment goals. Energy for Sustainable Development, Volume 42, Pages 152-159.
7. Burki, T. K. (2011). Burning issues: tackling indoor air pollution. The Lancet, Volume 377, Issue 9777, Pages 1559-1560. Retrieved from [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(11\)60626-0/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(11)60626-0/fulltext)
8. ENERGIA, WLPGA and Global Alliance for Clean Cookstoves. (2014). Cooking with Gas: Why women in developing countries want LPG and how they can get it. Retrieved from <https://www.wlpga.org/wp-content/uploads/2015/09/2014-cooking-with-lp-gas-women-report.pdf>
9. According to the WLPGA
10. World LPG Association. (2019). Roatan 28 MW LPG Power Plant. Retrieved from <https://www.wlpga.org/wp-content/uploads/2019/02/WLPGA-RECO-Roatan-Case-Study-Draft-FINAL.pdf>
11. World LPG Association. (2018). Bridge Power Project In Tema, Ghana. Retrieved from <https://www.wlpga.org/wp-content/uploads/2018/10/2018-Bridge-Power-Plant-Tema.pdf>
12. Van Leeuwen, R., Evans, A., Hyseni, B., (2017). Increasing the Use of Liquefied



(Image: Practical Action/Carbon Clean)

- Petroleum Gas in Cooking in Developing Countries. Live Wire, Washington DC. Retrieved from <http://glpgp.org/s/World-Bank-LiveWire-Increasing-the-Use-of-LPG-in-Cooking-in-Developing-Countries.pdf>
13. Autogas.net. Retrieved from <http://www.auto-gas.net>
  14. World LPG Association. (2018). The role of LPG in shaping the energy transition. Retrieved from <https://www.wlpga.org/wp-content/uploads/2018/10/The-role-of-LPG-in-shaping-the-energy-transition-2018.pdf>
  15. Excerpted from: Korea JoongAng Daily. (2019). LPG: Fuel of the future or flash in the oil pan?. Retrieved from <http://koreajoongangdaily.joins.com/news/article/article.aspx?aid=3061817>
  16. Intergovernmental Panel on Climate Change. (2018). Special Report: Global Warming of 1.5°C. Retrieved from <https://www.ipcc.ch/sr15/>
  17. Bond, T. C., et al. (2013). Bounding the role of black carbon in the climate system: A scientific assessment, J. Geophys. Res. Atmos., 118, 5380–5552.
  18. Clean Cooking Alliance. Delivering on the Sustainable Development Goals Through Clean Cooking. Retrieved from <https://www.cleancookingalliance.org/feature/delivering-on-the-sustainable-development-goals-through-clean-cooking.html>
  19. Manke, K. (2019). India could meet air quality standards by cutting household fuel use. Retrieved from <https://news.berkeley.edu/2019/04/18/india-could-meet-air-quality-standards-by-cutting-household-fuel-use/>
  20. Global LPG Partnership. (2019). National Feasibility Assessment: LPG for Clean Cooking in Ghana. Retrieved from <http://glpgp.org/s/GLPGP-Clean-Cooking-for-Africa-Ghana-National-LPG-Assessment-First-Edition-December-2018.pdf>
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