Organization of the
Petroleum Exporting Countries

OPEC Contribution to Roadmap for Brazil's G20 Presidency on Clean Cooking Strategy

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Executive summary

Under Brazil's G20 Presidency in 2024, the Energy Transitions Working Group (ETWG) has initiated a series of meetings focused on different priorities, including the second priority, "*Social dimension of the energy transition*".

One of the ten voluntary principles under this priority is "*End energy poverty*", which states "*Tackle energy poverty in all its forms, with a priority focus on ensuring universal access to electricity and clean cooking technologies*." In support of Brazil's G20 presidency, this study seeks to contribute to the development of the "*Roadmap on Clean Cooking Strategy*". The objective of this report is to evaluate the potential of Liquefied Petroleum Gas (LPG) as a clean cooking solution. It also focuses on scaling up LPG production, distribution and utilization at the global level.

This report underscores the vital role of LPG as a clean cooking fuel in the medium and long term. It seeks to highlight the positive impact of LPG adoption as an effective solution for energy access, affordability, health, the environment, and economic development, while also exploring the possibility of expanding LPG use across various regions. The report explores the importance of utilizing advanced technologies to enhance LPG distribution and usage. Furthermore, it develops recommendations for adapting clean cooking strategies to fit varying regional contexts, particularly in areas that still lack access to clean cooking. Finally, the report sheds light on the experiences of some OPEC Member Countries in the promotion of clean cooking fuels, particularly the Kingdom of Saudi Arabia, along with other countries like India.

It is worth noting that LPG is a mixture of light hydrocarbon compounds primarily consisting of propane and butane. It transitions from a gas to a liquid when under moderate pressure or when cooled. At room temperature, it is a non-toxic, colourless, and odourless gas. Due to its flexibility, LPG is utilized across all major energy-consuming sectors and in numerous applications, such as cooking, heating water and spaces, and serving as an alternative fuel for transportation.

Various technologies are used across the LPG supply chain. These are critical in ensuring the efficient, safe, and reliable delivery of LPG from source to consumer worldwide. This report shows that all LPG-related technologies across its value chain are mature, reliable, accessible, and cost effective. This makes the widespread use of LPG not only feasible but also advantageous on a global scale.

Furthermore, the report demonstrates the critical role of LPG in providing a clean, reliable, and efficient energy solution that reduces greenhouse gas emissions and deforestation. Indeed, LPG also mitigates other possible negative

externalities by minimizing exposure to harmful pollutants, reducing health-related costs, saving time and effort in fuel collection, enhancing economic productivity and job creation, supporting the UN Sustainable Development Goals (UN SDGs) and ensuring energy accessibility even in the most remote and underserved areas.

Globally, LPG demand is projected to increase by 1.8 mb/d between 2023 and 2050, reaching over 11.2 mb/d by 2050. While non-OECD LPG demand will increase by more than 2.7 mb/d over the forecast period, some of this growth will be offset by declining OECD demand in the range of 1 mb/d. The largest demand growth in non-OECD countries is expected to materialize in India and the Middle East & Africa. This, in turn, will help to improve energy access by providing much needed energy for the residential sector.

Recognizing LPG's many comparative advantages, countries, international organizations, financial institutions and funds are focusing their efforts through various frameworks, policies and programmes to promote, finance and implement projects that expand the utilization of LPG across regions and countries. The OPEC Fund for International Development (OPEC Fund) and OPEC Member Countries, for example, have been playing a significant role in this area.

In particular, the Kingdom of Saudi Arabia is leading global efforts to promote LPG and other clean cooking solutions through several impactful initiatives, including the Clean Fuel Solutions for Cooking Initiative, the Empowering Africa Initiative, and the National Human Capacity Training Programme, all of which aim to enhance health, reduce carbon emissions, and support sustainable development in vulnerable and underserved regions worldwide.

1. Introduction

According to the 2024 edition of the Tracking SDG-7: The Energy Progress Report, around 2.1 billion people across the world are still using solid fuels – such as wood, crop waste, charcoal, coal and dung – to cook in open fires and inefficient stoves. Most are poor and live in low- and middle-income countries. Urban areas generally have greater access to clean cooking fuels and technologies compared to rural areas. In 2022, 88% of urban residents worldwide had access to clean cooking, compared to 54% of the world's rural population.

According to the World Health Organization (WHO), 3.2 million people die prematurely each year from illnesses attributed to household air pollution caused by the incomplete combustion of solid fuels used for cooking. Moreover, exposure to air pollution is more common among women and children who spend the most time in the cooking area. Particulate matter and other pollutants in household air pollution inflame the airways and lungs, impair immune responses, and reduce the oxygen-carrying capacity of the blood.

The UN has established access to "affordable and clean energy" as one of its SDGs, with ambitions to achieve universal access to clean cooking methods by 2030. Several solutions could be used for this purpose. However, LPG could play the most important role in achieving this objective given its many advantages that differentiate it from other solutions such as electric or clean biomass stoves.

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This report underscores the vital role of LPG as a clean cooking fuel in the medium and long term. It seeks to highlight the positive impact of LPG adoption as an effective solution for energy access, affordability, health, the environment, and economic development, while also exploring the feasibility of expanding LPG use across various regions. The report explores the importance of utilizing advanced technologies to enhance LPG distribution and usage. Furthermore, it develops recommendations for adapting clean cooking strategies to fit varying regional contexts, particularly in areas that still lack access to clean cooking. Finally, the report sheds light on the experiences of OPEC Member Countries in promoting clean cooking fuels, particularly the Kingdom of Saudi Arabia, along with other countries like India.

2. What is Liquified Petroleum Gas (LPG)?

Liquefied petroleum gas is a blend of light hydrocarbon compounds, predominantly propane and butane, which changes from a gaseous to liquid state when compressed at moderate pressure or chilled. It is a non-toxic, colourless, and odourless gas at room temperature.

When liquefied under pressure, the volume of butane and propane is reduced to around 1/260 of the gaseous aggregate state. The specific calorific value of LPG is around 46 MJ/kg or 12.78 kWh/kg depending on the composition of LPG. In comparison – according to Energypedia – wood has an energy content in the range of 14–18 MJ/kg or 3.89–5 kWh/kg (depending on the type and moisture content) and charcoal in the range of 27–33 MJ/kg or 7.5–8.34 kWh/kg (depending on the type).

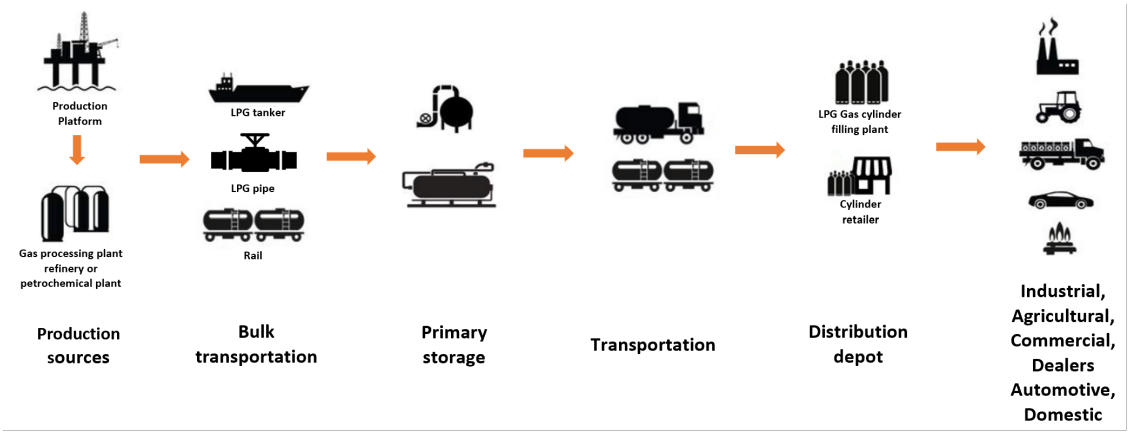
LPG in domestic cylinders used for cooking generally contains more butane than propane. This is because the fuel value per kilogramme of butane is higher than propane and it liquefies under much lower pressure than propane, making it safer to handle. National and international standards specify the minimum content of butane and a maximum LPG vapour pressure (Energypedia).

3. LPG supply chain

The LPG supply chain is much simpler to understand than that of many other commodities. LPG is produced from oil refining and petrochemical processing plants and it is also extracted during crude oil and natural gas production process. LPG is obtained through separation during natural gas processing using an LPG gas refrigeration manufacturing process (NGL fractionation process). The share of LPG derived from gas processing has been growing for many years.

Subsequently, as described by Energypedia, it is delivered from supply points in a liquefied form to primary bulk storage facilities, where it is stored under refrigeration or pressurization. LPG for cooking is brought to cylinder filling plants. The cylinders are either owned by the bottling company, distributors or consumers. The filled cylinders are then distributed to a network of intermediaries, who operate depots and the necessary transportation facilities. Empty cylinders are either returned along the chain to the filling plant or directly brought to a filling station by the customer.

Figure 3.1: LPG supply chain



Source: adapted from (Multiconsult)

Due to its flexibility, LPG is utilized across all major energy-consuming sectors and in numerous applications, such as cooking, heating water and spaces, and serving as an alternative fuel for transportation.

In the **residential sector**, LPG is mainly used for cooking, heating, and hot water production. In some developing countries, it is also used for lighting where electricity is not available. In developed countries, it may be used for outdoor activities such as barbecuing and camping.

In the **commercial sector**, LPG is used for heating, hot water production, and cooking, but on a much larger scale than in the residential sector. For example, in restaurants and hotels, LPG powers larger and more powerful stoves, ovens,

and heating systems than those used in homes. Hospitals and commercial complexes use LPG for applications requiring a continuous and reliable power supply, such as large-capacity boilers for central heating or backup generators. LPG storage in the commercial sector is often in larger tanks, often installed underground or in dedicated storage areas.

In the **agricultural sector**, LPG is used in drying crops like grains and cereals, thereby helping to preserve agricultural products effectively. LPG is also used to heat greenhouses, thus maintaining crops at optimum temperatures for healthy growth. In livestock farming, heating livestock buildings with LPG helps to ensure animal welfare, especially in colder climates.

In the **transportation** sector, LPG is used as an alternative fuel for vehicles, including taxis, buses, and trucks. This fuel, often referred to as "LPG Autogas", is well regarded for its low environmental impact. Additionally, LPG is used to power various pieces of portable equipment, such as forklifts and other transportable industrial equipment, due to its enhanced safety and convenience.

In the **industrial** sector, LPG is used in various industrial processes and activities, notably those in which a high degree of precision and flexibility in process temperatures – as well as a strong flame – are required. For example, it is used in the manufacturing of glass, ceramics, concrete, textile and paper processing, as well as for drying various materials. LPG is also used in cogeneration plants to produce electricity and heat efficiently, making it a popular choice for industries looking for sustainable and cost-effective energy solutions. In addition, LPG is a fuel of choice for welding and torch cutting processes due to its clean combustion and ability to deliver high heat.

Moreover, LPG is used in the petrochemical industry as an alternative feedstock to ethane, naphtha and middle distillates in the production of basic petrochemicals. These basic petrochemicals are building blocks used in the manufacturing of a wide range of plastics and chemical derivatives.

4. LPG-related technologies

Various technologies are used across the LPG supply chain. These are critical in ensuring the efficient, safe, and reliable delivery of LPG from source to consumer worldwide.

Since the first attempt to transport LPG by sea using a purpose-built ship in 1931, advances in marine transportation like Very Large Gas Carriers (VLGCs) have revolutionized the global distribution of LPG, enabling large-scale international trade. Onshore storage solutions, including pressurized tanks, and land-based transportation methods like road tankers, have enhanced the accessibility and affordability of LPG. Additionally, innovations in LPG utilization technologies, such as modern cookstoves and generators, provide cleaner, more efficient alternatives to traditional biomass fuels, significantly reducing health risks and environmental impact.

4.1. LPG production

LPG production from oil refining and petrochemical processing plants, as well as from crude oil and natural gas production processes, has taken place since the early 20th century. The technology became more widespread with the expansion of the global oil industry. The process technology for LPG production is highly mature and very reliable due to established processes and infrastructure. It is also highly standardized, ensuring consistent quality and supply.

Furthermore, technological advancements have improved the LPG production processes, leading to enhanced efficiency, safety, reduced costs and lower environmental impact.

LPG is a product of crude oil refining, with most refining plants worldwide capable of producing LPG. Today, there are more than 700 refineries around the world, with the vast majority of them including LPG production as a fundamental process within their facilities. Advancements in refining technologies allow for crude oil to be turned into LPG, with improved quality and purity of the gas. In addition, advanced extraction techniques like hydraulic fracturing (fracking) have helped increase the available reserves of natural gas, which represent a vital source of LPG.

Moreover, advanced monitoring systems and sensors have been developed to ensure the safe handling and storage of LPG during production and transportation. These have helped to minimize emissions and reduce the risk of leaks and accidents, thereby promoting a safer and more sustainable LPG industry.

In addition, the technology is widely accessible in regions with established oil and gas industries, while another advantage of LPG is that it also presents relatively low production costs due to its by-product nature.

4.2. LPG storage tanks

Storage tanks for LPG have been in use since the mid-20th century, particularly following the increased use of LPG in residential and commercial applications. Aboveground and underground tanks are standard for storing LPG at various scales, ranging from small household tanks to large industrial installations.

Technology has been crucial in improving LPG distribution, enhancing its accessibility, efficiency, and reliability. The introduction of smart grid systems and automation has transformed the monitoring and management of LPG storage tanks, allowing for real-time tracking of inventory levels, leak detection, and remote maintenance. This also facilitates timely supply management, ensuring a steady and uninterrupted delivery of LPG to consumers.

Storage tanks are highly reliable when properly maintained. Safety standards and regulations ensure that storage tanks are built to withstand various environmental conditions and potential hazards. In addition, storage tanks are manufactured globally and are available in various sizes and specifications to meet diverse needs.

Costs vary depending on the tank size, material, and installation requirements. Household tanks are relatively inexpensive, while large industrial tanks involve significant investment.

4.3. LPG cylinders and bottles

LPG cylinders have been in widespread use since the 1930s, becoming a common means of distributing LPG for residential cooking and heating. Cylinders are used worldwide and come in various sizes for different applications, ranging from 20 lb – largely used for gas grills and small appliances – to 100 lb cylinders, typically used in commercial and industrial applications.

LPG cylinders store the gas in a liquid state under pressure. When the gas is released, it passes through a regulator that reduces the pressure to a usable level for appliances. This process ensures a consistent and safe supply of gas for various applications.

LPG cylinders or bottles are highly reliable and safe; however, they need proper maintenance and periodic safety checks. The introduction of composite cylinders

has significantly improved safety and reduced the risk of explosion. In addition, modern LPG cylinders are equipped with several safety features, including overfill prevention devices (OPD) that prevent the cylinder from being overfilled, and pressure relief valves that release excess pressure to prevent explosions.

Cylinders are distributed globally and are the most common form of LPG delivery for residential use. Conventional small cylinders have low initial costs, with prices varying from $20 to $100 depending on size and regional market conditions. Composite cylinders tend to be more expensive than traditional steel cylinders. LPG cylinders have a long lifespan, ranging between 15 to 30 years.

4.4. LPG transportation technologies

LPG can be transported by various means, including ship, pipeline, railway and truck. Logistics and transportation technologies have helped modernize the distribution network, utilising technologies such as GPS tracking, route optimization algorithms and digital inventory management systems. Improved distribution ensures faster, safer and more cost-effective delivery, reducing lead times and limiting the environmental impact.

Ship

Advancements in marine transportation, such as VLGCs, have revolutionized the global distribution of LPG, enabling large-scale international trade. These improvements enabled global LPG seaborne volumes to reach 140 mt in 2022.

LPG maritime transport can be carried out using three different types of vessels, depending on how the cargo is stored.

- **Fully-refrigerated**, typically at -50 °C and close to ambient pressure.
- **Semi-refrigerated**, typically at -10 °C and 4-8 bar pressure.
- **Pressurized**, typically at 17 bar, corresponding to the vapour pressure of propane at about 45 °C.

Table 4.1 LPG shipping fleet capacity by type in 2022

Type	Number of vessels	Capacity (thousand m3)
Semi-refrigerated	365	4,435
Fully-refrigerated	498	33,968
Pressurized	733	4,369

Source: (Argus & WLPGA)

LPG carriers can be also categorized by size. Maritime Optima provides the following breakdown of the most used sub-segments for LPG carriers.

Handy Gas Carriers are LPG vessels of about 15,000 to 25,000 cubic meters (cbm). This diverse segment includes semi-refrigerated, fully-refrigerated and some larger pressurized ships that carry a wide range of cargoes, such as ethylene, petrochemicals, LPG and ammonia on short to medium-haul routes.

Coasters are LPG vessels that are often below 15,000 cbm.

Mid-Sizes are LPG vessels of about 25,000 to 50,000 cbm. They are typically fully-refrigerated and carry ammonia or LPG on intra-regional routes (e.g. within the Americas or Asia) and medium-haul cross-trades (e.g. in the North Sea and Europe).

Large Gas Carriers (LGC) are LPG vessels of about 50,000 to 70,000 cbm. They mainly carry LPG and ammonia between ports that are too small for VLGC ships to enter.

VLGCs are LPG vessels of about 70,000 cbm or above. Many of these vessels are fully refrigerated and are mainly employed on long-haul trade routes.

Bulk transportation by ships to move large quantities of LPG from production sites to regional storage facilities and distribution centres is very mature and highly reliable. However, it is subject to the need for appropriate transportation infrastructure and it is also affected by regulatory standards in different regions.

Pipeline

LPG pipelines are less common but have been used in specific regions since the 1970s, primarily from production sites (oil/gas fields or refineries) to storage facilities and terminals. LPG pipelines are very reliable, providing a continuous supply of LPG. These pipelines are designed to handle high vapour pressure and can transport LPG in batches or as purity products.

However, the initial infrastructure investment is high, and maintenance requires adherence to stringent safety standards. LPG pipelines have low operational costs once established. They are economically viable in areas with consistent, high demand.

Rail

LPG is transported by rail using pressurized tank cars. This method is particularly useful for regions not served by pipelines. Rail transport facilitates the movement of large volumes of LPG to distribution centres, filling centres

and end-users. Specialized loading and unloading facilities are required at both ends of the rail route.

Trucks

LPG is transported from bulk storage and filling centres to professional and private customers. It is carried out with semi-trailers, or small carriers for private customers.

4.5. LPG filling (bottling) plants

LPG filling plants are essential components in the LPG distribution network, responsible for transferring LPG from bulk storage to smaller cylinders for consumer use. When considering investing in an LPG cylinder filling plant, there are various options available, ranging from simple manually operated filling plants to fully automated ones. Capacities can vary significantly, from a few cylinders per hour to several thousand cylinders, allowing for flexibility based on demand.

The investment cost for setting up an LPG cylinder filling plant can vary based on the size, capacity, and level of automation. Costs can range from a few tens of thousands of dollars to over one million dollars.

Establishing an LPG filling plant does not require a large area of land. For example, a small plant may need around 1,000 to 2,000 square metres. So too, operating such a plant does not require highly specialized personnel; proper training and adherence to safety protocols are sufficient.

In this context, containerized filling plants offer many advantages. They are especially useful in regions where demand is not yet strong enough to justify investment in a more permanent facility. Due to their modular and prefabricated design, these facilities can be rapidly deployed, relocated and reinstalled according to market needs. They are also compact and can be fitted on a 50m x 50m piece of land.

In addition to their low cost and ease of installation, these facilities offer a practical solution to expand LPG distribution coverage while minimizing the financial and operational risks associated with demand fluctuations in new or developing markets.

4.6. LPG cooking appliances

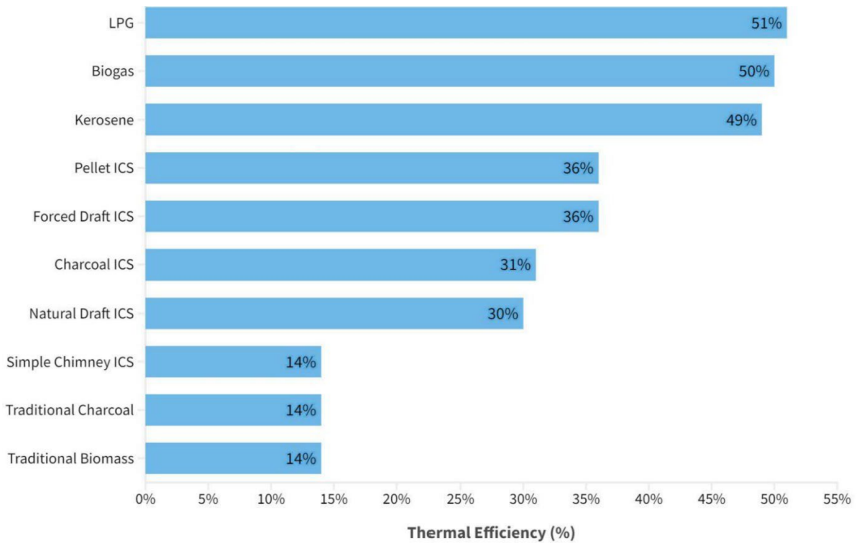
LPG cooking appliances have been commercially available since the 1920s, particularly for domestic cookers. Since then, a large number of indoor and

outdoor cooking appliances have become widely available that are efficient, clean and easy to maintain. These include cookers, stoves, ovens, cooktops, fryers, grills and rotisseries in all shapes and sizes. Their advantages ensure that they can easily provide cooking solutions for a wide consumer base, including families, community kitchens and industrial operators.

A LPG cooking stove will feature one or more burners, with an ignition system to produce a flame, while valves control the flow of gas from the LPG cylinder through a hose to the burners.

LPG cooking appliances have a very high cooking efficiency of around 55% to 60% higher than many other stoves. They are very convenient for users, as they heat up quickly and the temperature can be precisely controlled. They provide immediate heat on ignition (eliminating warming-up periods) and include user-friendly, effective thermostats. This is combined with low operational costs, ease of cleaning and straightforward fuel purchasing and storage options.

Figure 4.1: Thermal efficiency of LPG compared to other fuels



Source: (KAPSARC)

LPG cooking appliances are known for their high reliability, offering consistent performance and safety features. The portability of LPG appliances also makes them ideal for remote areas and outdoor activities. Additionally, LPG burns cleaner than many other fuels, producing fewer pollutants and greenhouse gases.

The cost of LPG cooking appliances varies, typically ranging from $50 to $200. A basic model of a gas burner does not exceed $20 in some regions.

5. Benefits and importance of LPG

LPG is used in every country and territory for a broad range of applications. According to the WLPGA, over four million people and thousands of companies, ranging from global actors to self-employed distributors, work around the clock to ensure that LPG reaches customers on time.

LPG is available even in the most remote areas, improving the lives of millions worldwide and boosting regional development. As relatively few rural or remote areas have access to natural gas and electricity networks, LPG is an ideal energy source for these regions.

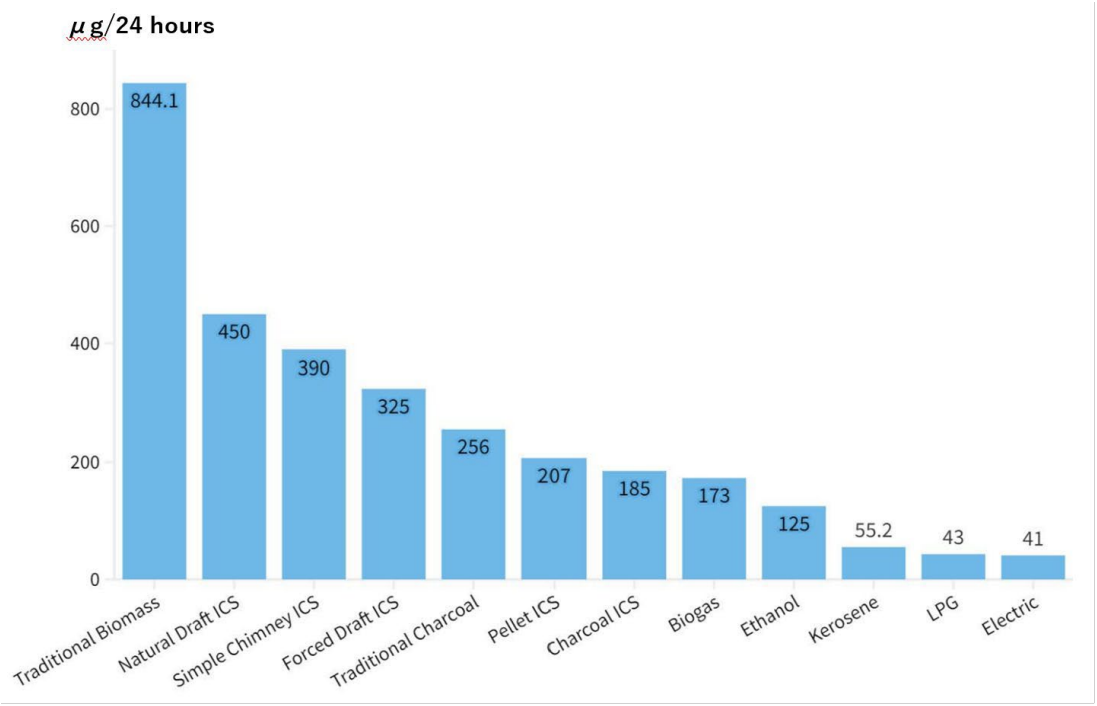
The LPG industry provides reliable energy, everywhere. It has already helped hundreds of millions of families switch from polluting solid fuels to cleaner gas alternatives and has enabled millions of farms and businesses to reduce their emissions. LPG offers a multitude of benefits that can transform the lives of its users, contributing positively to both health and the environment.

LPG is also abundantly available, making it a viable option to provide clean cooking solutions worldwide. Furthermore, the appliances required for LPG use, such as stoves, are low-tech and cost-effective. "Pay as you go" models can also further lower the barriers to adoption, making LPG accessible to more people.

Additionally, LPG generates the lowest greenhouse gas emissions among traditional fuels, potentially reducing emissions by up to 70% compared to other cooking methods. This positions the LPG industry as a key player in the transition to a lower-carbon economy. With minor adjustments, the existing distribution and logistics networks can efficiently deliver LPG to consumers globally.

Using LPG for cooking is both efficient and cost-effective due to its high calorific value, which enables faster cooking times and reduces fuel consumption, in turn leading to long-term cost savings. LPG also undergoes complete combustion, producing no residue or particulate matter, thereby minimizing maintenance costs and contributing to a lower carbon footprint.

Figure 5.1: Particulate matter (PM 2.5) origination from various fuel stoves



Source: (KAPSARC)

Unlike wood, an LPG fire can easily be turned on and off, and the size of the flame can be adjusted, controlling the cooking. These stoves also emit less heat than other cooking equipment, limiting the ambient temperature rise in the kitchen. LPG stoves and burners have an additional benefit of requiring less maintenance than other cooking forms.

The use of LPG offers significant health benefits and can lead to substantial reductions in health-related costs. One of the primary health advantages of LPG is its ability to provide a clean-burning alternative to traditional biomass fuels for cooking in many developing regions. Unlike LPG, which causes no emissions issues in indoor use, traditional fuels release harmful pollutants, including particulate matter, carbon monoxide, and other toxic compounds, which contribute to respiratory diseases, heart conditions, and even premature death. The WHO estimates that indoor air pollution from cooking with solid fuels is responsible for millions of deaths each year, particularly affecting women and children who spend more time near cooking fires.

Transitioning to LPG does not only improve the health and quality of life for individuals, it also leads to significant savings. With fewer cases of illness, families experience lower medical expenses, reduced absenteeism from work or school, and overall improved economic productivity. Consequently, the adoption of LPG for cooking and heating contributes to healthier communities and lowers

public health expenditure, highlighting its value as a cleaner and safer energy source.

Today, handling LPG is both convenient and safe due to advancements in technology. Innovations such as improved bottle/cylinder storage solutions, efficient stoves, the addition of strongly scented odorants and the use of advanced leak sensors to detect leaks have significantly enhanced safety measures. These developments ensure that LPG can be used reliably and securely across various applications, thereby minimizing risks and making it a practical energy choice for households and businesses alike.

The versatility of LPG utilization significantly enhances the profitability of its supply chain development. LPG finds extensive applications across various sectors beyond domestic cooking, including industrial, agricultural, commercial and automotive uses. This range of uses amplifies demand, making investments in LPG infrastructure and supply chains highly lucrative. Indeed, developing the LPG supply chain not only promotes economic growth by creating jobs and enhancing local incomes, it also boosts local economies by stimulating market activities and fostering entrepreneurship, particularly in rural areas.

In terms of storage, LPG can be stored locally for a long time, which means the cooking fuel is always available, even in the most remote areas.

Moreover, LPG significantly reduces the need for collecting firewood and biomass fuels, saving time and effort. This benefit is particularly important for women and children, who are often the ones gathering these traditional fuels.

In addition, by using LPG for cooking instead of biomass fuels, reliance on wood and charcoal is diminished, helping to reduce deforestation and environmental degradation. According to the WLPGA, a typical 13 kg cylinder of LPG can prevent the deforestation of a 6 m^2 area of forest.

Ultimately, it is clear that LPG aligns with the goals of several UN SDGs, including ensuring universal access to affordable, reliable and modern energy services, making improvements in health and gender equality, increasing the adoption of clean energy, and supporting environmental sustainability.

6. LPG demand, current situation and perspectives

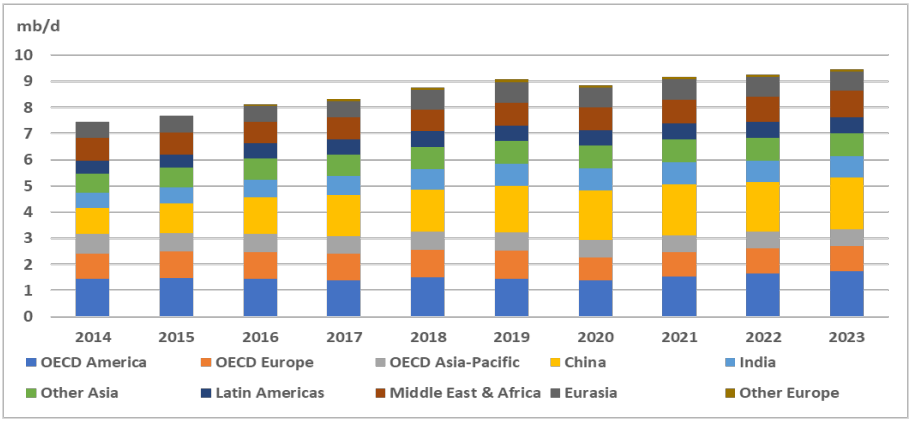
6.1. Current situation

From 2014 to 2019, LPG demand grew continuously at an average rate of 4% per annum. However, the COVID-19 pandemic that hit the global economy in 2020 brought this growth to an abrupt halt. Demand for petroleum products declined by 5% in 2020 compared to 2019. The impact on LPG demand was less severe, but it still fell by 2.5%. LPG again proved exceptionally resilient in 2021, with global demand reaching 9.2 mb/d, up 3.7% from 2020 and 1% from pre-pandemic levels in 2019.

This strength highlights the versatility of LPG across both energy and non-energy sectors. Indeed, LPG demand rose by 0.3 mb/d to 9.5 mb/d in 2023, even as inflation spiked and global gross domestic product (GDP) growth weakened. The largest increase in demand was in the residential sector, where usage jumped by 0.15 mb/d from the 2021 level.

Today, China dominates the global LPG market, with demand at 2 mb/d. In 2023, this accounted for 21% of global consumption, followed by OECD Americas and the Middle East & Africa. Notably, the Middle East & Africa reported an 11% increase in consumption from 2021, reaching over 1 mb/d in 2023. LPG is primarily used as a cooking fuel in many countries in Africa, including Nigeria and Kenya. Ambitions to replace the use of firewood, charcoal and other dirty traditional fuels with LPG could significantly boost demand in this region.

Figure 6.1: LPG consumption by region. 2014–2023

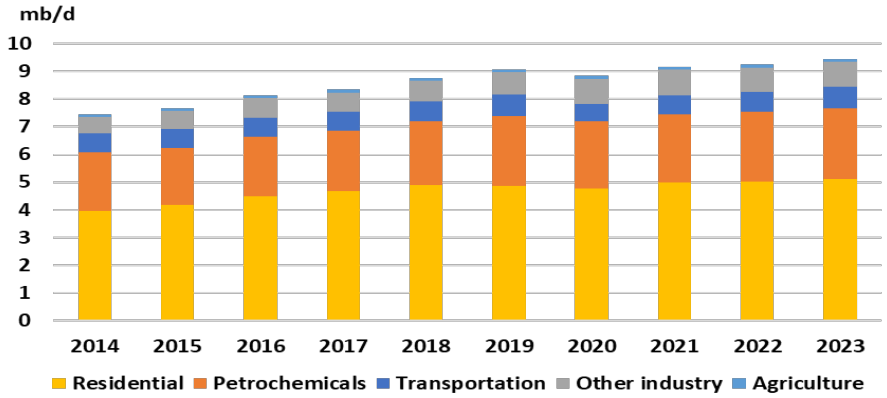


Source: (OPEC)

From a sectoral perspective, LPG demand from all sectors increased last year. Global demand from the residential (domestic) sector increased to 5.1 mb/d in 2023. This figure was only slightly higher than the previous year, as many

populations around the world continued to lack access to LPG. At the same time, demand for LPG as a petrochemical feedstock continued its expansion, reaching almost 2.6 mb/d.

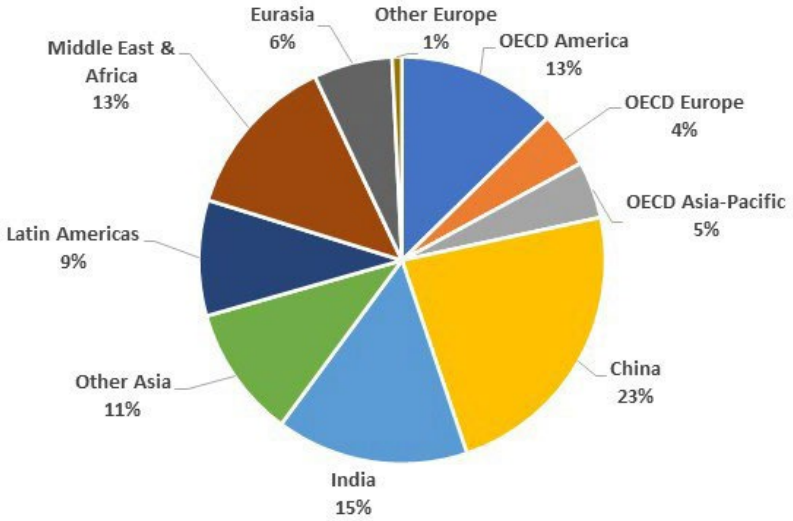
Figure 6.2: LPG consumption by sector, 2014–2023



Source: (OPEC)

Despite the strong increase in LPG use as a petrochemical feedstock, consumption of LPG for residential purposes continues to dominate global demand, with a share of 54%. The Asia-Pacific region has by far the largest share in this sector, accounting for almost 54%, followed by Middle East & Africa and OECD Americas at 13% each.

Figure 6.3: LPG residential consumption by region, 2023



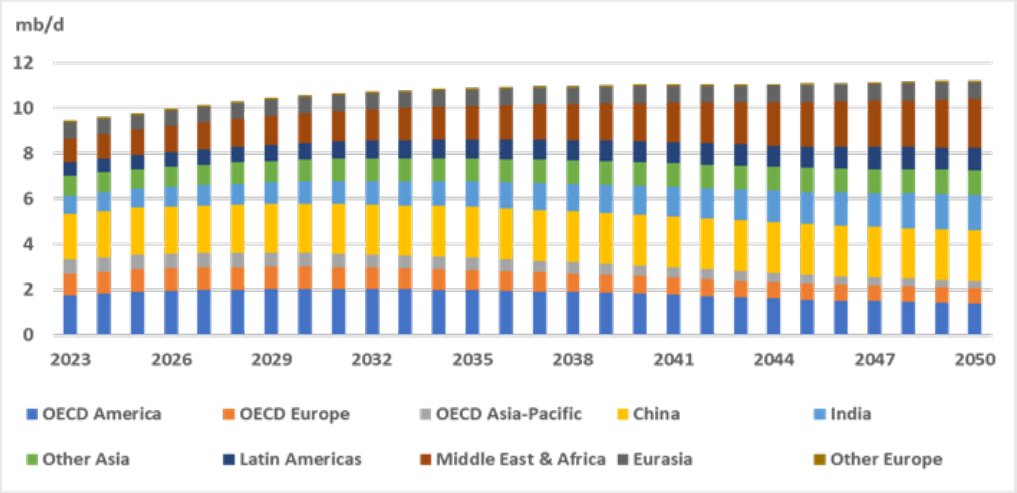
Source: (OPEC)

6.2. Perspectives

As already outlined, LPG has the potential to improve the living standards of billions of people worldwide. It is already doing so, and will continue to be used in a wide range of industrial applications, as well as in the transport system. These expectations are supported by recent projections for future LPG demand presented in Figure 6.4 (by region) and Figure 6.5 (by sector).

Globally, LPG demand is projected to increase by 1.8 mb/d between 2023 and 2050, reaching over 11.2 mb/d by 2050. However, this overall growth pattern masks diverging demand trends between OECD regions and developing countries. Indeed, while non-OECD LPG demand will increase by more than 2.7 mb/d over the forecast period, some of this growth will be offset by declining OECD demand in the range of 1 mb/d.

Figure 6.4: LPG demand outlook by region, 2023–2050

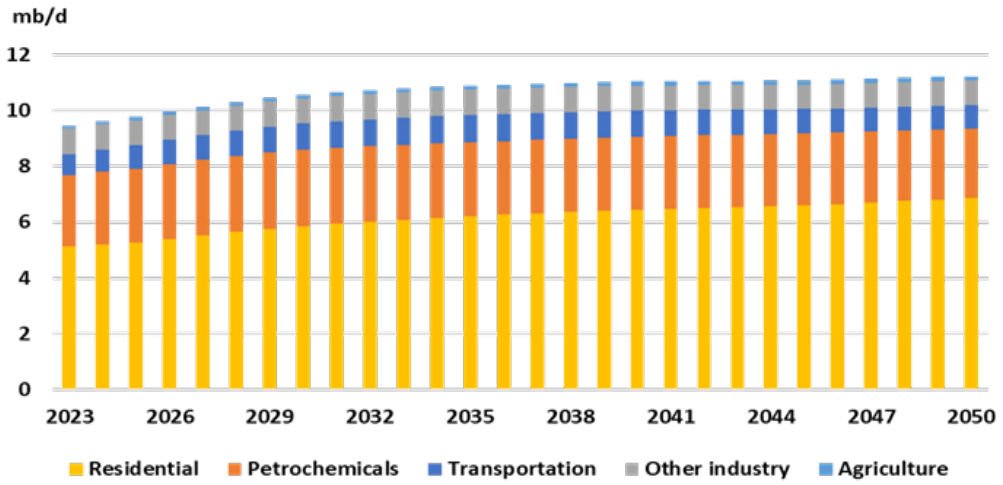


Source: (OPEC)

The largest demand growth in non-OECD countries is expected to materialize in India and the Middle East & Africa. This, in turn, will help to improve energy access by providing much needed energy for the residential sector. These two regions combined account for 70% (1.9 mb/d) of the overall non-OECD growth. Significant demand additions are also projected for Latin America (+0.4 mb/d) and China (+0.2 mb/d).

Projections indicate that almost all incremental LPG demand over the forecast period will be driven by the residential sector, especially in developing countries. Moreover, this sector will not only be the key driver of future demand, it will also be the only sector in which LPG demand will continually grow at the global level. In other sectors, LPG demand is projected to fluctuate around current levels, with broadly offsetting effects between OECD and non-OECD regions.

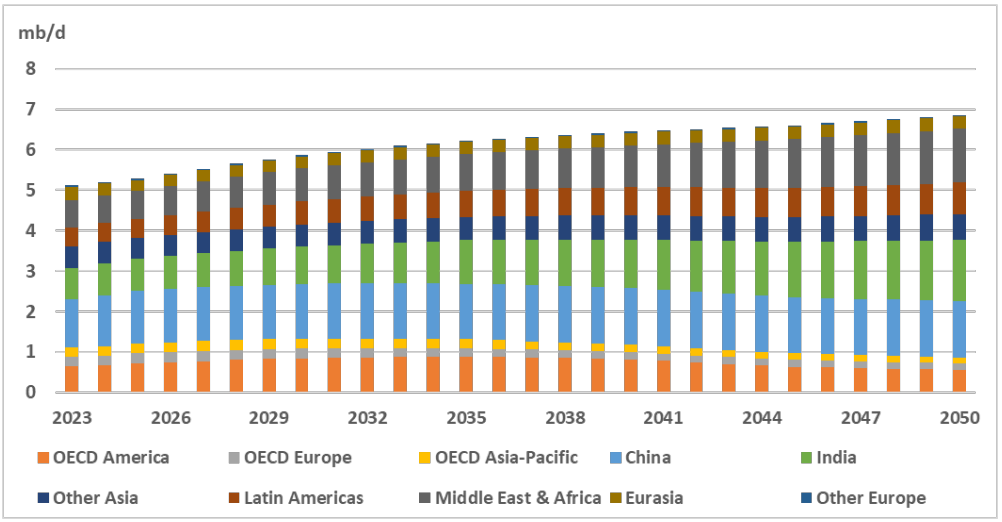
Figure 6.5: LPG demand outlook by sector, 2023–2050



Source: (OPEC)

Focusing on the LPG demand perspective for the residential sector, Figure 6.6 shows LPG residential demand outlook by region to 2050. It is expected that global LPG demand in this sector will grow by more than 1.7 mb/d between 2023 and 2050. It is clear that demand will be driven by non-OECD countries, which together will add almost 2 mb/d, more than offsetting demand decline in OCED countries. India, followed by the Middle East & Africa, are set to be the largest contributors to this growth, adding 0.73 mb/d and 0.66 mb/d, respectively.

Figure 6.6: LPG residential demand outlook by region, 2023–2050



Source: (OPEC)

Non-OECD countries are expected to continue expanding the use of LPG as a viable solution for clean cooking to address energy poverty, improve public health and reduce dependence on traditional biomass fuels. By fostering

partnerships with international organizations and private sector actors, these countries aim to improve access to affordable LPG, especially in rural and underserved areas. These efforts will aid these countries in achieving national clean energy targets and also contribute to global commitments to reduce carbon emissions and advance sustainable development.

7. Initiatives and experiences of OPEC Member Countries

Access to clean energy is essential for a good quality of life, yet all too many people around the world still struggle to obtain it for basic needs such as lighting, heating and cooking. While progress has been made toward achieving UN SDG 7, which aims to ensure universal access to affordable and clean energy, significant disparities remain. Indeed, the reality today is that modern cooking fuels that are essential in improving health and protecting the environment remain out of reach for millions, particularly in developing countries.

Recognizing the important role of LPG in remedying this situation, many countries, international organizations, financial institutions and funds are increasingly focusing their efforts through different frameworks, policies and programmes to promote, finance and implement projects aimed at expanding LPG utilization across regions and countries. OPEC Member Countries serve as a prime example in this regard, continuing to play a significant role in this area.

7.1. Kingdom of Saudi Arabia

The Kingdom of Saudi Arabia has taken significant steps in promoting clean energy for cooking as part of its broader sustainability and environmental initiatives. Included below are a selection of some of these efforts.

Oil Sustainability Program (OSP)

The Oil Sustainability Program was established in 2020 under the umbrella of the Supreme Committee for Hydrocarbon Materials. His Royal Highness, the Minister of Energy, chairs the Supervisory Committee, which includes 17 entities from both the public and private sectors in the Kingdom.

The OSP's ambition is to create opportunities and applications for hydrocarbons globally as a competitive energy source, ensuring that hydrocarbons remain part of the global energy mix in the most efficient and sustainable manner possible. Furthermore, the Program seek to remove barriers to energy access in developing markets, accelerate technological advancements and increase sustainability.

Clean Fuel Solutions for Cooking Initiative

According to a study conducted by King Abdullah Petroleum Studies and Research Center (KAPSARC), the Clean Fuel Solutions for Cooking Initiative aims to provide cleaner cooking fuels, including LPG, solar power, and biodigesters, to 750 million people worldwide. The Kingdom's commitment to the initiative was made during the Middle East Green Initiative (MGI) summit held in October of 2021.

The Initiative offers solutions to vulnerable populations worldwide, many of whom continue to suffer the severe consequences of using traditional, hazardous cooking practices, including the use of coal and wood.

The OSP has been the leading entity in executing the Initiative and has been actively working on implementing multiple global projects alongside key local and international stakeholders.

The Initiative is based on a set of strategic pillars that include:

- Raising awareness and increasing access to clean cooking solutions for end users.
- Supporting sustainable market growth for clean cooking solutions.
- Removing barriers to clean energy in emerging markets.

The Initiative will ultimately:

- Improve the quality of life for disadvantaged people and support gender equality.
- Reduce CO2 emissions from traditional cooking methods by providing access to clean cooking solutions.
- Support economic growth, job creation, and infrastructure development in targeted countries.
- Scale up international cooperation to prevent and mitigate climate change impacts and support a sustainable future.
- Provide off-grid solar power systems to empower households to use electric stoves as clean cooking solutions.

As part of the Initiative, the countries selected for LPG intervention are Ethiopia, Ivory Coast, South Africa, South Sudan, Sudan, and Tanzania. The countries selected for both LPG and renewable interventions are Cameroon, Ghana, Kenya, Madagascar, Nigeria, and Senegal. The countries identified as potential locations for renewable projects are Chad, Mali, Mozambique, Namibia, Niger, Zambia, and Zimbabwe.

In 2022, the initiative kicked off efforts to provide LPG for clean cooking in Ghana, Madagascar, and Nigeria.

Expanding initiatives like this would help accelerate progress in addressing the access gap for clean cooking fuels in the most vulnerable countries and ensure that no one is left behind in transitioning to a just and inclusive energy system.

National Human Capacity Training Programme

Within the Clean Fuel Solutions for Cooking Initiative, and in a move to provide cleaner cooking solutions and create jobs, the OSP, in collaboration with the Nigerian Ministry of Petroleum Resources, launched in early 2024 the National Human Capacity Training Programme for the adoption of LPG for clean cooking in Edo State, Nigeria.

The Programme's launch marks a significant step toward Nigeria's sustainability goals and contributes to global efforts to address challenges associated with traditional energy practices.

The Initiative aims to bridge the gaps in availability and accessibility of LPG for cooking through a strategic plan that includes establishing micro-distribution points of retail outlets across the country. The Programme will be facilitated by mobilizing, sensitizing, and training local communities.

This collaborative effort represents a major commitment by the Kingdom of Saudi Arabia to provide clean fuel solutions for cooking and underlines the commitment of the Nigerian government to its environmental and social development goals. It also aligns with the Kingdom's Clean Fuel Solutions for Cooking Initiative, which aims to provide clean cooking solutions to 750 million people worldwide.

Led by the OSP, the Programme specifically targets populations facing health risks and environmental damage due to harmful traditional cooking practices like using coal and wood.

Empowering Africa

In October 2023, the OSP, Ministry of Communications and Information Technology (MCIT), and Ministry of Health (MOH) in the Kingdom unveiled the "Empowering Africa" initiative to bring cleaner energy, connectivity, e-health and e-education solutions.

"Empowering Africa" builds on the Clean Fuel Solutions for Cooking Initiative, a vital MGI component, and represents a milestone in advancing sustainable development and improving the lives of millions of people across Africa.

Spearheaded by the OSP, MCIT, and MOH, "Empowering Africa" funds electric cooking stoves and introduces essential connectivity solutions, e-education platforms, and e-health services to rural areas in Africa. This collaborative effort among Saudi institutions underscores the Kingdom's commitment to one of its most ambitious initiatives, which will forge a brighter future for African communities. It also signifies the Kingdom's steadfast commitment to addressing worldwide challenges. Furthermore, it encourages public involvement and

promotes international regulatory collaboration to pursue a brighter, more sustainable future for all.

7.2. Algeria

In Algeria, more than 99.7% of the population can access clean cooking technologies. Nevertheless, the country aims to further improve the distribution of LPG. National companies, including Sonatrach, have partnered to build a 424 km LPG pipeline on the western coast, at an estimated cost of $364 million. This project is part of Algeria's broader strategy to diversify its energy portfolio and will significantly reduce costs associated with transporting LPG via sea or road.

The pipeline is expected to have the capacity to transport 1.2 million tonnes of LPG annually. Scheduled for completion in 2026, it will link the port city of Arzew with the capital, Algiers, traversing several districts. To facilitate distribution, additional filling centres are planned at strategic locations along the pipeline's route. Sonatrach has also announced substantial investments across various energy sectors for the 2022–2026 period, with $8 billion allocated for 2022 alone, a significant portion of which is designated for projects in the LPG sector to meet national fuel demands.

Algeria's expansion of its LPG infrastructure for both residential and vehicular use, supported by energy subsidies and incentives, serves as a model of how substantial investments and strategic planning focused on people can yield tangible benefits. This approach not only promotes energy diversification but also ensures a fair and inclusive strategy to bridge the LPG access gap.

7.3. Nigeria

The Federal Government of Nigeria's vision and strategy for the clean cooking sector are articulated in its National Climate Change Policy, Energy Transition Plan (ETP), revised Nationally Determined Contributions (NDC), and other related energy policies. A recent draft of the National Clean Cooking Policy aims to consolidate these efforts by aligning various relevant policies. These policies not only define qualitative targets, they also include specific quantitative targets for cooking energy.

In the revised NDC, in the conditional scenario, Nigeria has committed to ensuring that 65% of the population will use clean fuels for cooking by 2030, up from 17% in 2019. Specifically, the NDC goals target a significant increase in the share of LPG users, with almost half (48%) of households expected to use it by 2030.

In the ETP, the Nigerian government expects that over 80% of the population will achieve access to clean cooking by 2060. The strategy includes a medium-term plan to shift from traditional fuels to LPG and electric stoves. Specifically, around 75% of traditional biomass woodstoves are expected to be replaced – mainly by LPG stoves – by 2030.

Key government goals in the oil and gas sector are also relevant to Nigeria's clean cooking sector. The immediate target in the first phase of the expansion programme is to convert 10 million households to LPG as a cooking fuel. For this, the programme focuses its efforts on 12 pilot states. The medium-term plan aims to switch over 60 million households to LPG by 2030, increasing average usage from 750,000 metric tonnes per year (MTPA) to 2 million MTPA.

In order to achieve these objectives within the defined timelines, Government projects equating to approximately $6 billion will be required for necessary infrastructure investment over the next ten years. This includes $2 billion for LPG production facilities from natural gas and natural gas streams, $2 billion for distribution and marketing, $750 million for storage, $750 million for bottling plants, and $500 million for consumer infrastructure. This plan will include a strategy for massive cylinder reinjection into the system, including a cylinder ownership and recycling model that transfers ownership from individuals to LPG marketers for onward issuance to consumers.

This system will ensure that new cylinders equipped with safety and tracking systems are issued to consumers. The first phase of the rollout will involve the procurement of 150 propane trucks, forecourt equipment for Autogas, and over $10 million worth of cylinder injection across 12 pilot states of the federation, each with two LPG filling plants and 24 LPG filling stations.

8. LPG financing

According to the World Bank (2021), achieving universal access to modern energy cooking services by 2030 will require an investment of about $150 billion a year. This includes $39 billion from the public sector to ensure that modern cooking solutions can be afforded by the poorest households and $11 billion from the private sector to install downstream infrastructure necessary for the functioning of modern energy cooking markets. Over $100 billion of the above-mentioned amount will need to come directly from household purchases of stoves and fuels.

8.1. The OPEC Fund

The OPEC Fund is one of the leading international organizations actively involved in supporting, financing and promoting the use of LPG as a cleaner and more efficient energy source for cooking and other residential uses. It has launched several operations across various regions, designed to enhance access to modern energy, reduce reliance on traditional biomass fuels, and improve health and environmental outcomes. Some notable operations include the following.

LPG Project in Thailand (1983): This was one of the OPEC Fund's first operations in financing such projects since its establishment in 1976. The main objective was to establish integrated projects to build a gas separation plant to recover ethane, propane, LPG and natural gasoline, including bulk storage and distribution installations to distribute propane and LPG in the domestic market. It also aimed to support studies and technical assistance relating to LPG marketing. The total cost of the project was estimated at $455 million, to which the OPEC Fund contributed $15 million.

Commodity Imports Programme in Senegal (1994): This import programme helped supply petroleum products (gas, oil, kerosene and LPG) to meet rising demand for energy and decrease fuel-wood use in order to reduce depletion of the country's forests. The total project cost was $37.7 million, with the OPEC Fund contributing $4.6 million.

Commodity Imports Programme in Grenada (1994): This programme helped provide the country's petroleum products requirement for 1994. Products imported included leaded and unleaded gasoline, diesel, kerosene, LPG and aviation fuels. The total project cost was $9.6 million, with the OPEC Fund contributing $2 million.

LPG Country Market Assessments in Ghana, Kenya, and Uganda (2012): The project, financed with $0.1 million in grant funding, involved comprehensive market assessments to evaluate the potential for increased LPG adoption in Ghana, Kenya, and Uganda. The assessments aimed to identify market barriers and proposed strategies to foster LPG use as a clean cooking solution, including supporting policy development and investment decisions.

Enhancing Access to Modern Energy Services through Expanding Manufacturing Capacities in Burkina Faso and Haiti (2014): This project, supported by $0.6 million in grant funding from the OPEC Fund, aimed to expand the manufacturing of energy efficient products (improved stoves and solar lanterns) and make them available to the poorest households in rural and peri-urban areas in Burkina Faso and Haiti.

Access to Modern Energy Services through Efficient LPG Cook Stoves in Sudan (2014): The general objectives of the project were to reduce cooking fuel costs for poor households in El-Fasher, North Darfur State, and to reduce instances of indoor air pollution and related illnesses and hazards. This was done through a micro-finance scheme that enabled poor households to obtain LPG sets, comprising an LPG stove and canister. The project was supported by $0.4 million in grant funding from the OPEC Fund.

Clean Cooking for Africa Project, in Nigeria, Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Liberia, Mali, Niger, Gambia, Ghana, Guinea, Guinea Bissau, Senegal, Sierra Leone, Togo, Cameroon (2017): This project, supported by $0.2 million in grant funding from the OPEC Fund, promoted the adoption and utilization of LPG for clean cooking across the 15 ECOWAS countries and Cameroon, with specific plans for each country. More specifically, the project consisted of two sub-projects, a “Bottled Gas for Better Life” Pilot Project in Cameroon and the development of a strategy on clean cooking with LPG for the 15 ECOWAS States.

Promotion of LPG Cooking Solutions and PayGo Solar Systems in Burkina Faso, the Philippines, and Togo (2018): The Project aimed to enhance access to modern, clean and affordable energy for rural populations in Burkina Faso, the Philippines and Togo, with a view to improving their living conditions and preserving the natural environment, while bolstering the local economy. Its specific objectives were to expand the range of energy access solutions available in these countries and improve performance levels and quality of services, with a focus on LPG cooking solutions and PAYGO solar-home-systems. This project was supported by $0.7 million in grant funding from the OPEC Fund.

Increasing LPG Adoption Across India (2018): The total cost of the project was estimated at $1 million, to which the OPEC Fund contributed $0.1 million in the

form of a grant. The project aimed to support the Government of India's efforts to increase LPG adoption. Its specific objective was to demonstrate that Envirofit's SmartGas System was a viable solution and assess how it could be scaled-up across the country.

National Clean Cooking Transition Programme in Madagascar (2023): The programme aims to improve energy access and reduce reliance on traditional biomass fuels like firewood and charcoal, which are major contributors to deforestation and health issues in the country. The project is expected to benefit about 500,000 households by introducing clean cooking systems. The OPEC Fund has contributed significantly, with a total of $36.5 million in funding to support the Programme, including $35 million as a public sector loan and an additional $1.5 million grant for technical assistance and pilot projects.

8.2. African Refiners and Distributors Association

Most recently, in May 2024, the African Refiners and Distributors Association (ARDA) and the Global LPG Partnership (GLPGP) announced their intention to raise a $1 billion fund to enable clean cooking with LPG for millions of people. This venture aims to stimulate and support rapid LPG sector development in Africa at scale, building on ARDA members' distribution and human capacity and GLPGP's expertise in LPG policy and investment planning capability. The goal is to catalyze large-scale, private sector investment in traditional LPG sector growth and to unlock the huge potential of renewable LPG.

8.3. Funding of $2.2 billion pledged to clean cooking in Africa

Public and private-sector pledges amounting to $2.2 billion in cash, infrastructure investment and finance to provide access to clean cooking fuels, including LPG, in sub-Saharan Africa by 2030 were announced in May 2024.

From the public sector, the EU has allocated $432 million for clean cooking under an existing EU-Africa investment package. Norway has added $50 million to this commitment, while France, Denmark and the UK have pledged $108 million, $72 million, and $10.7 million, respectively, as part of various clean cooking initiatives across the continent by 2030. The US will contribute at least $40 million in the next two years alone.

From the private sector, the companies Vitol, Eni, and TotalEnergies have announced significant investments in LPG infrastructure and distribution across Africa.

Vitol committed $550 million towards "infrastructure, LPG cylinders, distribution and cookstoves" across its African operations. Italy's Eni pledged $300 million to increase the number of beneficiaries of its clean cooking

programme in Africa from 500,000 to 10 million by 2027 and 20 million by 2030. TotalEnergies will invest $100 million in additional LPG production in Uganda and associated local distribution, and $400 million across Africa and India in developing LPG cooking markets.

Moreover, Africa50, a financial institution founded by African governments and the African Development Bank (AFDB) to mobilize investment in infrastructure on the continent, pledged $500 million of finance for LPG infrastructure projects. This is on top of a previous commitment from the AFDB, announced at the UN's COP 28 climate summit in November 2023, to allocate 20% of its energy lending budget to clean cooking, amounting to around $2 billion over the next 10 years.

8.4. Experience of India

India has undertaken several initiatives to promote and scale up households' access to LPG as a clean cooking solution to address health, environmental, and socio-economic challenges associated with traditional cooking methods. One of the most notable programmes in this regard was the Pradhan Mantri Ujjwala Yojana (PMUY), launched in 2016, which aims to provide LPG to the 100 million rural and deprived households still using traditional cooking fuels like firewood, coal, and cow-dung cakes.

The scheme aimed to provide 50 million deposit-free LPG connections to women devoid of LPG access and belonging to Below Poverty Line (BPL) households. The target of the scheme was later revised to 80 million LPG connections and the identification criteria were expanded under the scheme Extended-PMUY (E-PMUY). The scheme also provided an optional loan facility to cover the cost of the stove and the first refill, with repayment to be made from the subsidy accruing to the consumer on LPG refills under the Direct Benefit Transfer for LPG (DBTL) scheme. The government allocated a total budget of Rs. 80 billion for the implementation of the scheme over three years starting from the fiscal year 2016–17.

To cover the remaining households under PMUY, Ujjwala 2.0 was launched on 10 August 2021, on a pan-India basis, to provide an additional 10 million LPG connections. Due to a large number of applications, the government further extended the scheme with 6 million more connections under Ujjwala 2.0.

Additionally, to make LPG more affordable, the Indian government offers direct cash transfers to eligible consumers through the DBTL scheme, also known as the PAHAL scheme. Under this scheme, consumers receive subsidies directly into their bank accounts when they purchase LPG at market prices, reducing the effective cost of LPG for end-users. This initiative has helped increase the

affordability of LPG and encouraged its widespread adoption as a cleaner alternative to traditional biomass fuels. As of 01 April 2023, more than 290 million LPG consumers had joined the scheme.

9. Conclusion

Around 2.1 billion people in the world are still using solid fuels (such as wood, crop waste, charcoal, coal and dung) for cooking, in open fires and inefficient stoves, according to the 2024 Tracking SDG-7 Report. Most of these people are poor and live in low- and middle-income countries. Urban areas generally have greater access to clean cooking fuels and technologies compared to rural areas. In 2022, 88% of global urban residents had access to clean cooking, compared to only 54% of the global rural population.

According to the WHO, each year, 3.2 million people die prematurely from illnesses attributed to household air pollution caused by the incomplete combustion of solid fuels used for cooking. Moreover, exposure to air pollution is more common among women and children who spend the most time in the cooking area. Particulate matter and other pollutants in household air pollution inflame the airways and lungs, impair the immune response, and reduce the oxygen-carrying capacity of the blood.

The UN has established access to “affordable and clean energy” as one of its SDGs, with ambitions to achieve universal access to clean cooking methods by 2030. Several solutions could be used for this purpose; however, LPG, could play a pivotal role in achieving this objective, given its many advantages over other solutions such as electric or clean biomass stoves.

LPG is a blend of light hydrocarbon compounds, predominantly propane and butane, that change from a gaseous to liquid state when compressed at moderate pressure or chilled. LPG is a non-toxic, colourless and odourless gas at room temperature. It is highly versatile and can be used in a wide range of applications, including cooking, water and space heating and as an alternative transport fuel. Given its versatility, LPG is used in all major energy end-use sectors.

Various technologies are used across the LPG supply chain, ranging from production to end-use applications, including cooking. These technologies are critical in ensuring the efficient, safe, and reliable delivery of LPG from its sources to consumers worldwide. This report shows that all LPG-related technologies across its value chain are mature, reliable, accessible, and cost effective. This makes the widespread use of LPG not only feasible but also advantageous on a global scale.

In addition, the report highlights the critical role of LPG in providing a clean, reliable, and efficient energy solution that reduces greenhouse gas emissions and deforestation. It also demonstrates that LPG improves health by minimizing exposure to harmful pollutants, decreases health-related costs, saves time and effort in fuel collection, enhances economic productivity and job creation,

supports sustainable development goals, and ensures energy accessibility even in the most remote and underserved areas.

Globally, LPG demand is projected to increase by 1.8 mb/d between 2023 and 2050, reaching over 11.2 mb/d by 2050. While non-OECD LPG demand will increase by more than 2.7 mb/d over the forecast period, some of this growth will be offset by declining OECD demand in the range of 1 mb/d. The largest demand growth in non-OECD countries is expected to materialize in India and the Middle East & Africa. This, in turn, will help to improve energy access by providing much needed energy for the residential sector.

Recognizing the important role of LPG in addressing these issues, countries, international organizations, financial institutions and funds are focusing efforts through various frameworks, policies and programmes to promote, finance and implement projects that expand the utilization of LPG across regions and countries. The OPEC Fund and OPEC Member Countries, for example, have been playing a significant role in this area.

In particular, the Kingdom of Saudi Arabia is leading global efforts to promote LPG and other clean cooking solutions through several impactful initiatives, including the Clean Fuel Solutions for Cooking Initiative, the Empowering Africa initiative, and the National Human Capacity Training Programme, all of which aim to enhance health, reduce carbon emissions, and support sustainable development in vulnerable and underserved regions worldwide.

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List of abbreviations

AFDB	African Development Bank
ARDA	African Refiners and Distributors Association
BPL	Below Poverty Line
cbm	Cubic Meter
CFT	Clean Fuel Technologies
CO_2	Carbon Dioxide
DBTL	Direct Benefit Transfer for LPG
ETP	Energy Transition Plan
ETWG	Energy Transitions Working Group
EU	European Union
FY	Financial Year
GDP	Gross Domestic Product
GLPGP	Global LPG Partnership
GPS	Global Positioning System
KAPSARC	King Abdullah Petroleum Studies and Research Center
LGC	Large Gas Carriers
LPG	Liquefied Petroleum Gas
mb/d	Million Barrels per Day
MCIT	Ministry of Communications and Information Technology
MGI	Middle East Green Initiative
MJ	Megajoule
MOH	Ministry of Health
MTPA	Metric Tonnes per Year
NDC	Nationally Determined Contributions
NGL	Natural Gas Liquids
OECD	Organization for Economic Co-operation and Development
OPD	Overfill Prevention Device
OSP	Oil Sustainability Program
PAHAL	Pratyaksh Hanstantrit Labh
PM	Particulate matter
PMUY	Pradhan Mantri Ujjwala Yojana
SDG	Sustainable Development Goal
UN	United Nations
VLGC	Very Large Gas Carriers
WHO	World Health Organization
WLPGA	World LPG Association

Organization of the Petroleum Exporting Countries

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