

# Accelerating the LPG Transition

Global Lessons from Innovative  
Business and Distribution Models

September 2015



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# Management Overview

This report examines how ten countries have transitioned (switched), or are planning to switch, from traditional fuels such as wood, coal, charcoal, animal waste and kerosene, to liquefied petroleum gas (LPG) as a cooking fuel. It identifies some findings that might be applicable to other countries. The ten countries include three in South America – Brazil, Ecuador and Peru; three in Africa – Ghana, Kenya and Senegal; three in Asia – India, Indonesia and Sri Lanka; and Turkey.

## Key Findings:

1. LPG is a clean, powerful, versatile and exceptional energy that is well suited for cooking applications
2. The total population represented by the ten countries is two billion, or almost 30% of the world's population
3. Some of the key barriers to switching remain those discovered in the Rural Energy Challenge project conducted by the WLPGA and the UNDP:
  - Low density of LPG target population
  - Low purchasing power and even sometimes barter communities
  - Need for local credit facilities
  - Inadequate cylinder size
  - Lack of safety culture and poor enforcement of regulations
  - Strong competition of cheaper alternative energy sources (sometimes subsidised)
  - Inadequate energy State policy to stimulate downstream LPG development (sometimes driving major players away)
  - Weakness of LPG distribution networks in remote rural area
4. There is strong correlation between GDP/capita and LPG consumption per capita
5. A successful switching programme needs a Champion. That can be government, private industry or another key stakeholder in the process
6. The value proposition to the consumer must be simple, easy to understand, convincing and affordable
7. Several of the ten countries used subsidies to make LPG more affordable – unless subsidies are carefully applied they can be a waste of resource, and often remain a burden on state finances
8. A strong brand is needed to market LPG. Multi-branded distribution channels should be avoided
9. LPG requires effective and enforceable regulations to allow the industry to grow in a safe and sustainable manner. The application of good safety and good business practices is important

# COOKING FOR LIFE

## ROADMAP TO A BILLION



# 1.0 Background and Purpose

In December 2013, the WLPGA published the Cooking For Life Roadmap to a Billion which outlined the problems, opportunities and plans for achieving the Cooking For Life Goal to facilitate the transition of one billion people from traditional fuels (e.g. solid biomass, coal, charcoal, wood), and other dirty and dangerous fuels such as kerosene, to cleaner burning LPG by 2030.

The Roadmap outlined some examples of tactical steps that the WLPGA could undertake to advance the Cooking For Life goals.

These included:

1. Responding to requests to intervene in a country or market as part of a regulatory educational process, in coordination with interested local WLPGA member companies and relevant national associations.
2. Identifying information gaps that exist and conducting studies to fill them, partnering with appropriate academic and research organisations as appropriate.
3. Capturing success stories and lessons learned of conversions happening around the world, with an emphasis on scalability and sustainability.

The objective of this report is to address one of these tactical steps of the Roadmap (3) by capturing some stories and lessons learned of conversions happening around the world, with an emphasis on scalability and sustainability.

The decision to produce this report followed an approach from Professor Kirk R. Smith – Professor of Global Environmental Health at the University of California, Berkeley.

The WLPGA agreed to consider sponsoring this project to review a number of current and past innovative initiatives from around the world in selected countries where there has been an attempt to accelerate access to LPG among populations using solid biomass (wood, crop residue and animal waste), coal, charcoal and kerosene.

The proposal received support to proceed from the WLPGA Industry Council at its meetings in Miami (October 2014) and Seoul (January 2015).

This project has been partly funded by the WLPGA together with additional contributions pledged from The Global LPG Partnership and The Global Alliance for Clean Cookstoves.

A steering committee, under the Cooking For Life programme, was established to agree the terms of reference.

This included the selection of ten countries where there has been an attempt to transition from solid biomass (wood, crop residue and animal waste), coal, charcoal and kerosene to LPG.

The criteria for selection was agreed as follows:

- There is evidence of a LPG transition programme that would make a significant contribution towards the objectives of the project.
- Detailed information about the programme is likely to be available from stakeholders in that country including government.
- WLPGA members are present in the country or have interests there.
- The final list would have good geographic diversity.



The ten countries selected by the steering committee were Brazil, Ecuador, Ghana, India, Indonesia, Kenya, Peru, Senegal, Sri Lanka and Turkey.

The total population represented by these ten countries is two billion, or almost 30% of the world's population.

In each one of these countries there have been efforts to transition from traditional fuels to LPG.

Some of these efforts have taken place some years ago (Brazil), while others are undergoing plans now (Turkey).

Some of these countries have received strong government backing (Indonesia) while others rely on the private sector (Sri Lanka).

For each of the ten examples this report contains some country background, a review of the LPG market over the past 20 years with a more recent assessment based on the latest WLPGA Global Statistical Review.

Reference has been made throughout this report to the findings taken from the study 'Rural Energy Challenge' because those findings still apply.

There is a description of each of the ten countries, together with the transition initiative taken by that country, in Section Eight.

For those reading this who are new to the LPG industry it is recommended to turn to Section Five which provides some information about LPG and how it compares to traditional fuels and kerosene.

## 2.0 Summary

The objectives of this report is to suggest, through the examples from the ten countries selected, tactical steps for the industry to achieve the goals of the Cooking For Life Roadmap to a Billion.

This report includes a summary and brief analysis, from each of the ten countries, of initiatives by national governments, the LPG industry, non-governmental organisations, development institutions and other organisations around the world to accelerate the use of LPG for cooking, particularly in those areas where the percentage of households using solid biomass (wood, crop residue and animal waste), coal, charcoal and kerosene is high.

There are some examples of successful projects and distribution models – and some not so

successful. It is a desktop study, supported by focal points in each country. In a number of cases it was possible to meet some of these focal points, to discuss the initiatives, and conduct peer reviews of the findings.

Several of the important keys to a successful transition from traditional fuel and kerosene to LPG were highlighted in previous work by the WLPGA and the UNDP in their Rural Energy Challenge study and these are referred to again in this report because they are still relevant.

If there were to be some overriding key success factors to give from this report, having studied the initiatives in each of the ten countries that have been highlighted here, it would be that three issues have to be in place for a successful transition.

### Three Key Success Factors when switching from Traditional Fuels & Kerosene to LPG

1. *'...there has to be motivation for change...'*
2. *'...the value proposition to the consumer must be simple, easy to understand, convincing and affordable...'*
3. *'...the application of safety and good industry practices is vital to allow the LPG industry to grow in a safe and sustainable manner...'*

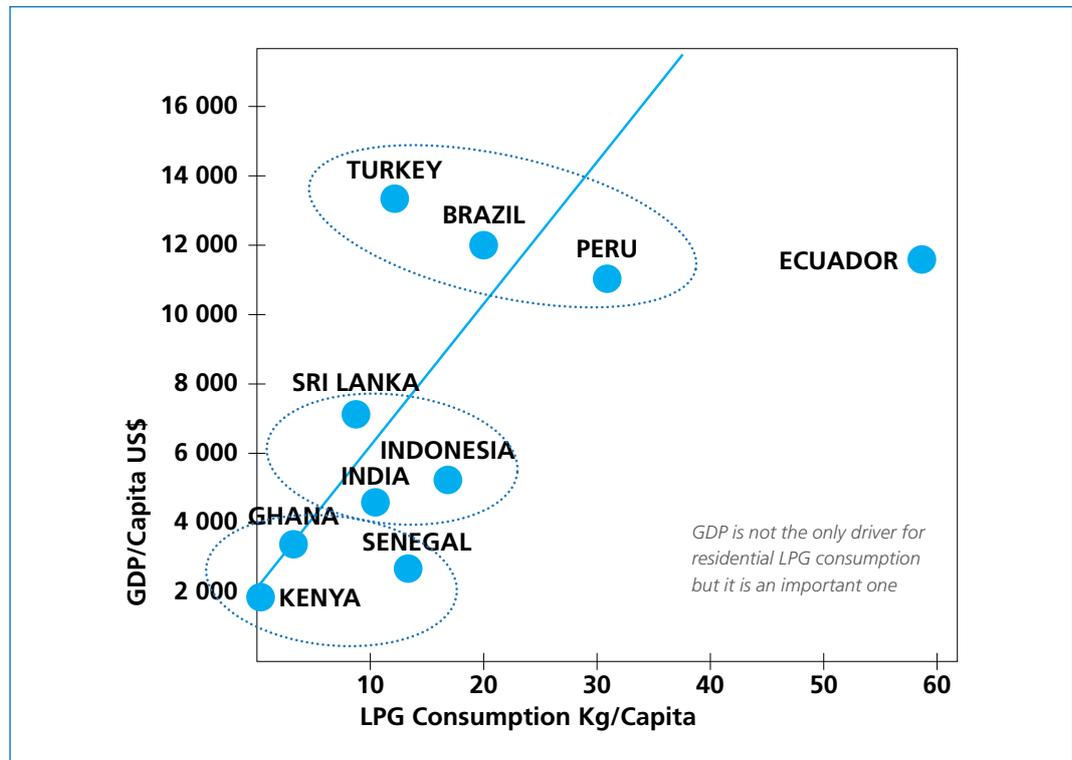
**DRIVERS** – for a country that is considering a programme to switch its population from traditional fuels and kerosene to LPG there has to be a driving force behind it. That might be the government backing the programme (e.g. Indonesia, Peru), the private sector (Sri Lanka, Kenya), or a combination of drivers (e.g. Brazil, India, Turkey)

**PROPOSITION** – the value proposition to the consumer must be simple, easy to understand, convincing and affordable. Simplicity is important with the design of the hardware – stoves, pots, pans, etc. LPG is very different to traditional fuels and education, demonstrations and peer support have a key role to play in convincing users to switch. The affordability of LPG is frequently seen as a barrier to change. There should be innovative ways to keep that barrier as low as possible. Subsidies, grants, microfinance may

all have a role to play but there is caution here with subsidies. There are many examples where subsidies have become a burden (Ecuador, Senegal, Indonesia...).

#### **SAFETY AND GOOD BUSINESS PRACTICES**

– the consumer perception that LPG is unsafe is sometimes difficult to shift. It is vital that good safety and good business practices are enforced. The LPG equipment must kept in good order and fit for purpose. It is equally important that not only the consumer, but all the people involved in the supply and distribution channel, are aware of their roles and responsibilities to keep the LPG industry safe and allow it to grow in a sustainable manner. LPG will be new to many people in these new markets and they need all to be educated about the product, and the storage, handling, distribution and use of LPG.



Residential LPG demand has a broad correlation with GDP and a look at the ten countries selected, using data from the 2014 WLPGA Global Statistical Review, shows this to be the general case with the ten countries selected (opposite).

The three African countries follow the general trend in most parts of East, Central and West Africa, of having low LPG consumption per capita.

The three Asian countries lie slightly higher up the chart and together these six countries probably present the best opportunities for growth.

The outlier country is Ecuador which has a per capita consumption almost twice that expected for a country with a per capita GDP of around US\$12,000.

LPG in Ecuador is heavily subsidised making it an attractive proposition for neighbouring countries - Peru and Colombia - to receive illegal cross border product. It is also understood that an illicit diversion of LPG cylinders gets channelled into other sectors, such as transport, driven again by artificially low prices. Actual per capita consumption in Ecuador would likely be closer to 30kg/person/year.

The plan is to remove these subsidies, perhaps as early as this year, which will have a big impact on Ecuador's position on the chart.

Safety in the LPG business is paramount. So too is the application of good business practices which will strongly influence investor confidence. In some countries, for example Kenya, there is much work to be done to manage the LPG industry in a safe and sustainable manner.

The Rural Energy Challenge was an important project undertaken by the WLPGA and the UNDP several years ago to examine the rural usage of LPG in seven countries (see Appendix A).

Two of those countries, Ghana and Turkey, are re-visited in this study.

The barriers to LPG penetration, which were highlighted in the Rural Energy Challenge, are still very much in evidence from the feedback found from the ten countries examined here.

In addition, there are some new observations that were discovered. These also need to be considered by countries seeking to transition from traditional fuels to LPG.

# The Rural Energy Challenge

Over ten years ago the WLPGA and UNDP jointly undertook a project called The Rural Energy Challenge (see also Appendix A).

This was a public/private partnership aimed at addressing the lack of access to clean energy and improving living standards through the use of LPG.

The target group was populations living in rural, peri-urban and suburban areas of developing countries and the aims were to identify and address barriers to rural market development.

One of the key conclusions from the Rural Energy Challenge was that despite the cultural diversity that existed in the countries selected there were many similarities in terms of barriers to LPG penetration.

These were:

- 1. LOW DENSITY OF LPG TARGET POPULATION**
- 2. LOW PURCHASING POWER AND EVEN SOMETIMES BARTER COMMUNITIES**
- 3. NEED FOR LOCAL CREDIT FACILITIES**
- 4. INADEQUATE CYLINDER SIZE**
- 5. LACK OF SAFETY CULTURE AND POOR ENFORCEMENT OF REGULATIONS**
- 6. STRONG COMPETITION OF CHEAPER ALTERNATIVE ENERGY SOURCES**  
(sometimes subsidised)
- 7. INADEQUATE ENERGY STATE POLICY TO STIMULATE LPG USE**  
(driving major players away)
- 8. WEAKNESS OF LPG DISTRIBUTION NETWORKS IN REMOTE RURAL AREAS**

Some additional observations were found in this report in respect of the eight points:

#### **1. LOW DENSITY OF LPG TARGET POPULATION**

This is not only a deterrent to investment in the distribution channel because of the lack of critical mass, it is also likely to encourage bad business practices. Unauthorised and poorly trained dealers see opportunities to service a low volume market through short cuts, impacting on good LPG cylinder management practices (Ghana).

#### **2. LOW PURCHASING POWER AND EVEN SOMETIMES BARTER COMMUNITIES**

LPG does not appear to be a relatively cheap fuel when compared to traditional fuels, especially for the first time user who has to acquire the necessary equipment (LPG cylinder, stove, regulator and hose). One of the biggest challenges is how to lower that entry barrier for new users. Assistance here can certainly help (Indonesia) but misdirected fuel subsidy programmes are unlikely to reach the consumer and are vulnerable to be channelled off into completely different markets such as supporting an illegal Autogas industry (Ecuador).

#### **3. NEED FOR LOCAL CREDIT FACILITIES**

The use of microfinance has been shown to be a powerful tool, especially when channelled through a trusted local focal point. New initiatives like this are best introduced by a local community leader who has the trust of the local population (Sri Lanka).

#### **4. CYLINDER SIZE – SELECTING THE RIGHT SIZE**

If the cylinder is too large the entry barrier is raised not only because of the higher initial cost of the cylinder but also the higher refilling cost. In addition the larger the cylinder the higher the tare weight and eventually the package becomes too heavy for the consumer (who is often a female) to carry (Peru). If the cylinder is too small the consumer loses

confidence and becomes frustrated when it frequently becomes empty. The contents of a steel LPG cylinder is not easy to see. From an operations perspective the need for frequent refilling, and the associated increased number of cycles through the filling plant, causes greater wear and tear on the cylinder and increases operational costs (Indonesia). In addition to having an adequately sized cylinder, thought must also be given to facilitating change from traditional fuels to LPG in the kitchen. It will be an advantage to create a working environment with LPG that is not so dissimilar in terms of utensil compatibility, cookstove height etc. A consumer who is used to cooking with particular utensils does not appreciate using a new gas stove that cannot accommodate them.

#### **5. LACK OF SAFETY CULTURE AND POOR ENFORCEMENT OF REGULATIONS**

The withdrawal of some of the larger multinational companies from the global LPG business over recent years has perhaps made the need for safety and regulations enforcement even more acute. The need for training, coupled with a strong consolidated government lobbying body, has become a bigger issue since the days of the Rural Energy Challenge. This is particularly the case in developing countries where the LPG industry is still growing and where a country LPG association is either non-existent or in its infancy. This is an important development that bears more discussion, perhaps in a separate report. It will likely have an impact on the price, availability, and other parameters that impact the subject of this report.

#### **6. STRONG COMPETITION OF CHEAPER ALTERNATIVE ENERGY SOURCES**

(sometimes subsidised)

For many people, in most of the countries under review, the relative cost of LPG versus traditional fuels is higher and creates a barrier to entry. Kerosene subsidies to encourage the transition away from biomass are not uncommon but, as Indonesia discovered, they are a financial

drain on the national budget, particularly when subsidised kerosene illicitly enters other fuel markets such as diesel.

## 7. INADEQUATE ENERGY STATE POLICY TO STIMULATE LPG DEVELOPMENT

(sometimes driving major players away)

The LPG industry requires high levels of investment - in storage tanks, vehicles, filling plants, cylinders etc., - and if governments are to encourage LPG markets to be developed they need to provide investors with a high degree of confidence that these assets are being protected from illegal practices by enforcing a level playing field. Sound policies supported by good enforcement will encourage investment. If bad practices are prevalent, investors will be put off (Kenya).

## 8. WEAKNESS OF LPG DISTRIBUTION NETWORKS IN REMOTE RURAL AREAS

One of the advantages of LPG is its portability and having the ability to be able to reach populations in the most remote rural areas (Turkey). Once cylinders leave the filling plant the control over safety and business practices diminishes. Peri-urban and rural development of LPG markets requires strong controls through the distribution channel. The 'last mile' challenges of reaching the households, often located in remote areas, with accessibility and communication issues, is something that distributors need to address. This might be through harnessing modern technology to assimilate urban solutions.

Full reviews of the LPG transition initiatives in each of the ten countries are set out in Section 8.0 of this report.

The approach taken in each of the case studies highlighted in this report differs from country to country and some have been more successful than others. The important message is there is no one simple solution to transition a population away from traditional fuels.

In each of the reviews there is a brief description of the country, along with a chart showing the historic LPG consumption and production over the last ten years.

The most recent assessment of the LPG demand by sector has also been included for each country, taking the latest data from the 2014 WLPGA Global Statistical Review.

Each country demonstrates a particular initiative that has been used, or highlights a particular challenge faced, to illustrate the different ways to promote the transition from traditional fuels to LPG.

LPG is one of those products where the packaging – the cylinder – is more expensive than the contents.

This presents a particular challenge when trying to compete with something that appears inexpensive, and often free. Especially so when the target market has limited disposable income for energy.

In addition to this, the use of LPG for the first time requires other equipment. A regulator to connect onto the cylinder valve, a flexible hose to carry the LPG to the appliance, and the appliance – or stove – itself.

Despite all this upfront expense using LPG can be an attractive option to even those groups with limited disposable incomes because of the efficiency of using an energy with good heat transfer properties and excellent flame control.



## 3.0 Scope and Methodology

This is a desktop study. Information has been gathered from published material and selective interviews with government bodies, non-government organisations and other stakeholders including WLPGA members.

In some cases this has been possible through country visits when attending other events.

WLPGA Director David Tyler has been the lead author of the work but the Cooking For Life

Steering Committee along with representatives of the University of California at Berkeley (UCB), the Global Alliance for Clean Cookstoves (GACC) and the Global LPG Partnership (GLPGP) have been responsible for reviewing and approving of the final report.

A key requirement of the study is to make an assessment of the particular initiatives in relation to the safety and conformity to WLPGA Good Industry Practices.

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Where possible, the country reviews include analysis of:

- The country itself, some key facts, especially relating to the population and the economy.
- Pilot projects, if implemented prior to launch of the programme.
- Policy objectives and rationale/justification of the programme.
- Design and implementation of the programme, in particular the stakeholders and partnerships involved, and choice of instruments (direct and cross-subsidies or other incentives and grants; demonstrations of the use of LPG, social marketing, etc.) to promote the use and dissemination of LPG, especially to poor and remote populations.
- Financial aspects of the programme (costs, pricing policies, relative fuel costs, level of support, source of funding, timetables, impact etc.).
- Technological aspects of the programme (choice of equipment, technology, technological development, etc.).
- Logistical impact (storage facilities, cylinder filling plants, road vehicles, distribution channel etc.).
- Barriers – technical, logistical, social, economic, public perception, lack of primary infrastructure, and political – that were encountered and how these were overcome.
- Success rates, measured for example in numbers and percentages of household switching away from traditional fuels (e.g. solid biomass, coal, charcoal, wood etc.) and kerosene (for existing programmes).
- Monitoring and evaluation processes.
- Lessons learned and future plans.



## 4.0 Target Countries

The list of target countries includes those that have mainly focused on a traditional fuel to LPG transition programme. Some are in the planning stage (Turkey) but have been included because of they have a particularly interesting initiative.

Some have focused on a kerosene to LPG transition but most focus on moving away from traditional fuels (coal, charcoal, wood, rice husks, animal waste and others).

In selecting the list of countries the steering committee considered the following criteria:

- There is evidence of a LPG transition programme that would make a significant contribution towards the objectives of the project
- Detailed information about the programme is likely to be available from stakeholders in that country including government
- WLPGA members are present in the country or have interests there
- The final list would have good geographic diversity.

The following countries were selected: Brazil, Ecuador, Ghana, India, Indonesia, Kenya, Peru, Senegal, Sri Lanka and Turkey.



In selecting these countries the steering committee have identified examples where reproducibility, scalability and sustainability are most likely to be applied.

The kerosene to LPG conversion programme conducted in Indonesia over the last seven years – which involved 58 million users – remains as one of the largest ever projects to encourage the transition from kerosene to LPG in a country.

While it is important to note that conversion from traditional fuels to LPG presents different challenges, a review of the Indonesian programme, which focused on moving away from kerosene, is important as many of the common lessons on issues such as affordability, distribution, safety, and infrastructure have applied.

India and Sri Lanka are two other countries in Asia that have been included. India has long used subsidies to encourage the use of LPG but this is creating a huge financial burden for the Indian State and the subsidies are not reaching their target. A Direct Subsidy Transfer (DST) scheme is being introduced in 2015 to address this issues. The Sri Lankan example targets a particular rural group through a private initiative.

Africa is represented by Ghana, Senegal and Kenya. The low per capita consumption of these three countries presents a great opportunity for the LPG industry but the challenges are many, not least affordability and business practices.

The three South American countries included are Brazil, Peru and Ecuador. Brazil used subsidies to switch the majority of its population to LPG in the 1980's and 1990's. Peru and Ecuador have more recent examples of switching.

Turkey, as a relatively developed country, has been included as it is encouraging the use of LPG in remote rural schools where wood fired stoves are used to heat the class rooms. Because it doesn't focus on cooking perhaps it is not an obvious example for this study. However it is aimed at improving the health of children and reducing infant mortality and the concept of moving away from traditional fuels in a heating application can readily be extended into cooking with LPG.



## 5.0 LPG – An Exceptional Energy

*LPG is one of the cleanest forms of energy available, both in terms of handling and combustion.*

The properties of LPG, especially its portability, hot flame, low emissions, low carbon footprint and high energy value, makes it an outstanding choice for cooking. As a result nearly half the world's demand for LPG is in the residential sector for cooking, hot water and space heating.

### 5.1 What is LPG and where does it come from?

LPG is a by-product of natural gas and crude oil refining which makes it a fossil fuel. This, unfortunately, frequently puts LPG into the same category as other traditional fossil fuels such as diesel, kerosene and fuel oil.

This association is unfair because the clean burning attributes of LPG, associated with its carbon footprint, together with its clean handling properties (LPG will never create the same pollution hazards that an oil spillage does) makes it a 'five star' fossil fuel.

And if it is a by-product, it could also be described as a waste stream. But then this waste stream is being put to some very productive use around the world. Where limitations of traditional fuels have been reached, an example is in desert areas where the growing of trees is a challenge, LPG can be an effective alternative.

So although the non-renewability of LPG is acknowledged the long term goal is for LPG to serve as part of a transition to renewable energy sources in the future.

With the increasing number of natural gas fields being developed around the world, continued refining of crude oil and the discoveries of shale gas, the outlook for LPG has never been better.

This increasing supply is also starting to have an impact on international prices of LPG. LPG in 2015 is now half the price it was in 2014 creating an exciting opportunity for penetrating low income households with this modern energy. Whether this is a lasting phenomenon is unknown but it does lower the entry barrier.

## 5.2 How is LPG transported from the natural gas fields and refineries?

Although LPG is used as a gas it can be easily turned into a liquid by applying moderate pressure.

LPG is transported in a liquid state like other liquid fuels such as diesel and gasoline.

**THE LPG INDUSTRY EXISTS BECAUSE BY THE EXERTION OF PRESSURE IN A CLOSED CONTAINER LPG CAN BE COMPRESSED TO LIQUID FORM**

**Gas**

**Liquid**

AND the liquid occupies only about 1/250<sup>th</sup> as much space as the gas would

Cylinder holding LPG as a liquid

**THIS MUCH VOLUME OF GAS CAN BE HELD AS A LIQUID IN THE CONTAINER AT LEFT**

*The ability for LPG vapour to be converted to liquid under pressure allows it to be transported efficiently by ship, rail and road and also be carried to consumers in small cylinders in the most remote rural regions.*

The only real difference is that the LPG storage vessels are pressurised. One unit of liquid LPG can produce around 250 units of vapour. So LPG in a liquid state provides the opportunity for large amounts of energy to be transported to the point of application where it is then turned into a gas by releasing the pressure.

Pressurising the LPG to create a liquid state allows the product to be easily moved through the distribution channel from the point of production right through to the consumer. It is only at the point of consumption that LPG is turned into a vapour, by releasing the pressure, to create the gas. This 'releasing the pressure' is done by opening the valve on a cook stove for example.



Traditionally LPG has been stored in spherical tanks; these spheres would each contain around 1,000MT of LPG.

LPG is produced in large quantities requiring large storage facilities and large ships to start moving it closer to the market.

Apart from the familiar steel spherical tanks often associated with LPG storage there are other types of storage such as cylindrical tanks (or bullets), mounded storage and even large underground caverns if the ground conditions allow.



One of the most popular methods of storing LPG in depots and customer premises is in above ground cylindrical tanks.

The storage facilities can be as large as 100,000MT. The size and type of storage will depend on a number of factors including on site and off site risks, available space, demand offtake, economics and topography.



Mounded LPG storage tanks provide increased security from external effects such as flame impingement in the case of a large fire nearby.

## Vapour Pressure

The pressure of the vapour of LPG in a storage container, whether it is in a very large gas carrier (VLGC) or a small 3kg cylinder, will increase as the temperature of the LPG increases. This provides the opportunity to reduce or increase the vapour pressure during the distribution channel by reducing or increasing the temperature of the product. This is useful during storage because by chilling the LPG, it reduces the vapour pressure, and this reduces the requirement of the pressurised container. This is why refrigerated storage is used. Similarly by increasing the temperature of LPG the vapour pressure increases. This is useful if we want more vapour for a particular application but it is also something to be aware of if the LPG storage vessel is subjected to heat. If the LPG tank or cylinder is in a fire for

example we need to cool the surface by applying water to reduce the vapour pressure and lower the risk of loss of containment. Propane has a higher vapour pressure than butane and also boils at a lower temperature. The boiling point (the temperature when the liquid turns into a vapour) is about zero degrees for butane which means butane would not be suitable for use in cold climates because it would not produce any vapour to burn.

The effect of temperature on vapour pressure is apparent with aerosols when LPG is used as the propellant. Shaving foam or deodorants for example always seem to more 'energised' when they are warm. This is because the vapour pressure inside the container is higher.

LPG in large coastal storage facilities will typically move product to the markets using very large gas carriers (VLGC's).

These can contain 60,000MT or more of LPG. Smaller coastal tankers can contain typically 5 – 10,000MT and barges even less.



*LPG ships range in size from a few hundred metric tonnes to tens of thousands of metric tonnes.*

Apart from ships, LPG is also transported by rail tank car, pipeline and road tankers. The latter can contain as little as one or two metric tonnes (MT). As the product moves through the distribution

channel it can be packaged in small bulk tanks and cylinders. These cylinders can typically range from 50kg down to 1kg. A typical LPG distribution channel is shown in Appendix Two.



*Road tankers are a common method of transporting LPG from terminals to depots, or consumers, even in very cold weather as shown here.*



*LPG cylinders come in a range of different sizes. The smallest one shown here would provide for a household using it for cooking for many days. The tall one enough for a small restaurant.*

Once the LPG has been transferred into cylinders it can be moved to the most remote locations allowing even rural villages, well off the distribution grid, to receive this modern clean energy.

The connection of the LPG cylinder to a cook stove can be done directly, by placing a simple stove on top of the cylinder, or by using the more traditional connection to a separate appliance via a regulator and hose.



*LPG cylinders should always be transported upright to reduce the risk of a liquid leak.*

In either case the consumer has a neat packaged solution to provide for their cooking needs in a highly efficient manner compared to charcoal and other traditional fuel stoves.

Imaginative forms of transport emerge across the world to bring LPG to the final consumer including bicycles, tricycles, boats and canoes; even in rucksacks. This illustrates the importance of further addressing the 'last mile'.

In all cases LPG remains in a liquid state throughout the distribution channel by being contained in pressure vessels.



*A simple cook stove fitted directly onto a 4.5kg cylinder*

## 5.3 Why does the WLPGA Call LPG an Exceptional Energy?

Apart from the ease of transporting LPG, making it extremely easy to reach the most remote rural areas, LPG has unique properties allowing it to be used effectively and efficiently in many applications.

The ability to easily liquefy LPG at very moderate pressure (not much higher than the pressure in a bicycle tyre) enables large quantities of energy to be stored safely in small containers.

The temperature of a LPG flame exceeds 1,800 degrees Centigrade, hot enough to cut through steel. The hot flame makes it a very popular fuel for cooking, especially when using a wok, which requires high flame temperatures.

Being a gas, a LPG flame can be controlled very easily allowing a cook stove to switch from full flame to simmering in less than a second.

LPG is a very clean fuel, both in storage, if LPG is spilt there is no mess and when burning. It has a low carbon footprint and produces little emissions, and virtually zero particle matter (PM). However the power of LPG is the reason why so much attention is placed on safety throughout the distribution channel.

LPG can be used to generate light using simple LPG fuelled lanterns. Apart from being an exceptional fuel in a burner, LPG also has excellent engine fuel properties. It has an octane number exceeding gasoline.

This allows it to be used in engine applications as well as burners and lanterns. This versatility gives LPG the ability to provide not only heat and light, but also electricity, through the application of a gas engine driven generator.

Introducing electricity into a remote rural community through a LPG fuelled generator will transform people's lives. Apart from providing lighting to the community, electricity allows the introduction of other modern facilities which are taken for granted such as refrigerators, televisions and the internet.

It is all these attributes that led the WLPGA to apply the 'Exceptional Energy' brand.



*Simple LPG lanterns enable rural communities to extend their days into the evenings.*

## 5.4 Will there be sufficient supplies of LPG to meet future demand?

Because LPG is a by-product, the supplies rely on the availability of natural gas and crude oil refining.

Today there is already a gap between supplies and demand and LPG is flared off in some countries because the cost of moving it to demand centres exceeds the value.

Recent production of shale gas deposits in North America and elsewhere, and the associated LPG, together with planned natural gas fields, all indicate that this surplus will continue ensuring sufficient LPG supplies for the foreseeable future.

## 5.5 How is LPG priced?

Historically the international pricing of LPG has been driven by the Middle East producers who have been the dominant global players.

There are signs that this is changing with the USA becoming the world's largest exporter of LPG in 2015 following the development of shale deposits.

In 2016 the expansion of the Panama Canal is expected to be completed, cutting weeks off the journey time of VLGC's heading towards the fast growing regions of Asia, and increasing the utilisation of LPG ships.

This US production has applied pressure on traditional LPG suppliers and as a result prices have fallen during the past 12 months.

The international price of LPG in 2015 is half the level it was a year ago. This is good news for the

three billion people who are still without access to modern energy making it more affordable.

The LPG industry is often accused of having a product which is unaffordable to low income groups. The reality is that the traditional fuel alternatives to LPG – such as charcoal, coal, wood and animal waste – may be initially cheaper but their inefficiency distorts their lower price.

A rural family lighting a wood fire at the middle of the day to cook lunch may have to sustain that fire throughout the rest of the day to cook the evening meal. This is not only wasteful it is generating sustained emissions for long periods impacting on the health of the family members.

A LPG stove can be switched on and off whenever a meal is to be cooked. Limiting the amount of energy used, keeping the cost down and contributing to the overall efficiency of the process.



## 5.6 What is the Outlook for LPG?

The LPG industry has a product that is well suited to be used as a cooking fuel. Potentially it can be used to provide lighting, heat and electricity to those three billion people who have no access to modern energy.

LPG can be easily transported from the major production centres around the world, with an existing infrastructure that is in place and proven, to remote consumers but there are still challenges in some rural areas.

LPG is one of the cleanest forms of energy available, giving the opportunity to displace the dirty and dangerous traditional fuels such as charcoal, coal, wood, animal waste and kerosene.

In doing so it can release women in society from the chore and dangers of collecting wood, thus reducing the impact this has on deforestation; give them the opportunity of doing more meaningful work; improve the air quality in the kitchen, living conditions and health; provide the opportunity for introducing electricity into people's lives and creating opportunities for extending their day through lighting at night; increase the opportunities for education

through modern communications; and so much more.

The challenge is to make this happen. The examples showcased here in this report are taken from ten countries where efforts have been made to transition consumers from traditional fuels to LPG.

They are not all success stories but they provide ideas and initiatives that could be considered by others who have yet to take that step.

The challenge of the WLPGA Cooking For Life programme is to encourage the transition of one billion people from traditional fuels to LPG by 2030. It is hoped these ten examples provide some ideas for that to be achieved so that the population can access modern energy for the first time.

But what of the current traditional fuel alternatives? Understanding the risks of continuing to use traditional fuels such as charcoal, coal, wood, animal waste and kerosene are equally important to drive the transition.





## 6.0 Traditional Fuels

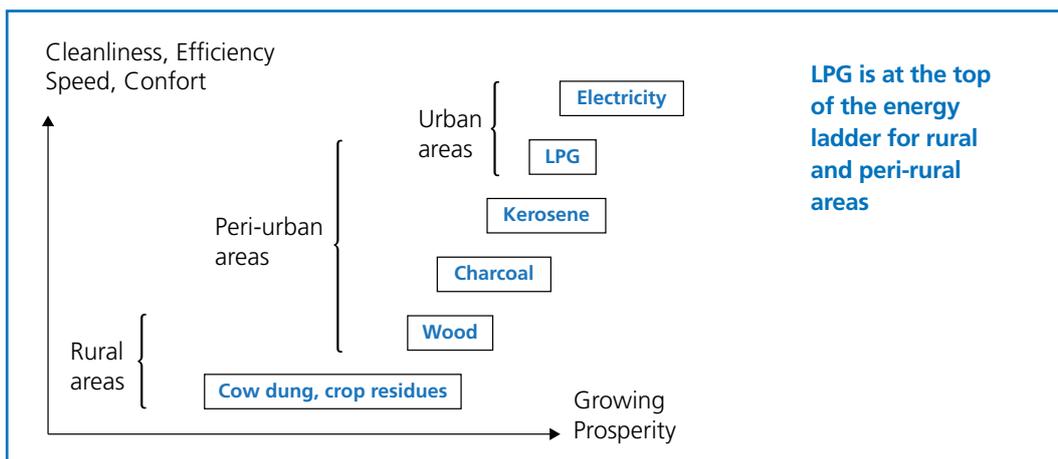
*Traditional fuels such as charcoal, coal, wood, animal waste, rice husks and kerosene are the only fuel option available for billions of people.*

These traditional fuels are challenging to collect and they need a dry area to store them. There is no focus on safety regarding kerosene which makes it dangerous to have around the home. All these fuels produce unhealthy air pollution emissions in households.

There are other transition processed fuels available now such as pellets and briquettes (carbonised

and non-carbonised) made from sawdust, agricultural residues and other raw materials.

While not as clean as LPG, they form part of the non-fuel, non-liquid cooking fuel mix and are alternatives that offer more benefits than burning raw solid unprocessed biomass.



### 6.1 Crop residues, animal waste etc.

For a substantial part of the world's population the only energy available to them as their primary fuel is waste material from crops and animals. These products are at the very bottom of the energy ladder.

The energy value of these products are not easy to measure because they vary so much in content but one thing they have in common is they are very difficult to light and burn when wet.

In countries where rainfall can be intense during certain times of the year this is a major inconvenience.

This also applies to wood, charcoal and coal.



*The use of animal waste is often the only form of energy available.*

## 6.2 Wood

The most common traditional fuel is wood. Even in the developed world wood is a popular form of heating. However the use of wood in the developed world is frequently a secondary form of heat and used as much for aesthetic reasons as primary heating. It would rarely be used to cook unless it was a recreational barbecue.

For many people wood is the only realistic form of energy available for both cooking and heating with alternatives being other traditional, equally dirty, fuels.

The task of collecting wood is often the task for the women in the household. It is a time consuming and often dangerous occupation as the source of the wood is commonly in remote locations where personal attack is a risk.

The wood is often collected from small trees, trees that have had no chance to grow to maturity. Wood taken from large trees is both very difficult to collect, carry and burn. The risk of deforestation is therefore greater because the trees have been cut at the early stage of their life.

Wood is difficult to burn when wet creating challenges during the wet seasons. It also has to be stored and kept dry.



*This woman spends hours collecting wood for cooking their family's meals.*

The task of collecting wood often takes hours and then the women have to light the fire and prepare the meal. The burning of wood is a dirty business. Apart from the smoke it generates the food is contaminated with ash and particulates. Wood smoke causes respiratory illnesses and leads to early death for many. It is estimated household air pollution from the use of solid cookstove fuels (coal and biomass) causes more deaths than malaria, typhoid and polio combined.

Burning wood also creates social problems. When the mother is away collecting wood her young children are often looked after by the grandparents.

## 6.3 Charcoal and Coal

Charcoal and coal are also dirty to handle and coal often contains contaminants that make its emissions even healthier than biomass.

The distribution channel for charcoal is often through road side stalls. It is frequently the task for small children to collect the daily amount of charcoal needed to cook for the family.



*Children collecting charcoal from a roadside stall in Kenya.*



*Coal briquettes in a wicker basket at a roadside stall.*

## 6.4 Kerosene

Kerosene in many countries is manufactured as a jet fuel for commercial aircraft (Jet A1) as well as being sold as a residential fuel (residential paraffin). Refineries may often produce just one grade of kerosene to meet both applications and call it DPK (or dual purpose kerosene).

With aviation travel growing strongly around the world, and thousands of aircraft in the air at any time, the application of DPK into the aviation sector makes good economic sense.

However despite this, many countries subsidise the use of kerosene in the residential sector to encourage users of traditional fuels to climb the energy ladder.

The idea of manufacturing a fuel designed for modern day jet engine aircraft, and at the same time sell that same product into the residential market for use in kerosene stoves in kitchens, is almost absurd.

But what it does demonstrate is that kerosene is an extremely inflammable product. Witness the strict controls on airfields warning about ignition sources during plane refuelling operations. These warnings are of course nowhere to be seen in the rural residential kitchens. Kerosene is a

dangerous fuel to have around the home because of the risks of spillage and fire.



*Kerosene being sold to children in in soft drink bottles.*

Also, for many people, kerosene is often purchased in small quantities using discarded soft drink bottles. The contents are then sometimes mistakenly drunk by small children.

There is also growing recognition that the emissions from burning kerosene in simple lamps and stoves causes ill-health in much the same way as biomass smoke.

## 6.5 Processed Biomass

A new form of traditional fuel now available is processed biomass.

Raw biomass usually has a high content of volatile matter and ash and lower density and energy values. Processing the biomass into compact, evenly sized pieces such as briquettes or pellets allows the biomass to burn more efficiently and evenly, increasing their energy density. These processed traditional fuels are available now in pellets and briquettes (carbonised and non-carbonised) and are made from sawdust, agricultural residues and other raw materials.

While not as clean as LPG, they form part of the non-fuel, non-liquid cooking fuel mix and

are alternatives that offer more benefits than burning raw solid unprocessed biomass.



*Examples of processed biomass (courtesy [www.cleancookstoves.org](http://www.cleancookstoves.org)).*



## 7.0 General Observations

Each of the ten countries have had to tackle the challenges of switching from traditional fuels and kerosene to LPG.

Any country embarking on a successful switching programme will need a Champion, a clear and simple proposition and the need to adhere to good safety and business practices.

### 7.1 Drivers for Change

In each of the ten country cases studies there were drivers for change.

In Indonesia it was the government, supported by the state oil and gas company Pertamina that took on the massive task of switching 58 million kerosene users to LPG.

In Sri Lanka it was a private company working with the tea plantation industry to drive the

change from wood to LPG across the tea plantations.

In Turkey it was the private sector working with the regulatory authority to initiate change.

It matters not who it is. There has to be a driver who is persistent, and committed, and is prepared to work resolutely to make the change happen.

### 7.2 Proposition

The cost of the initial package (cylinder, regulator, hose and stove) is beyond reach for many people. Then there is the ongoing cost of the refills when the cylinder is empty, and the need for regular maintenance of the assets. and the need for regular change of accessories such as the regulator and hose.

Various schemes have been used to lower these barriers. Subsidies, grants, giveaways, micro finance, incentives. They have all been tried to a greater or lesser extent in a variety of different ways.

The initial entry barrier was removed entirely in Indonesian during the kerosene to LPG conversion programme by giving the complete

package (3kg cylinder, regulator, hose and stove) away free of charge. And then following up with a subsidy on the LPG in the 3kg cylinder through a government programme.

The cost of this was more than outweighed by the elimination of the kerosene subsidy that was being abused in the distribution channel and costing the government billions of dollars.

The on-going challenge of consumers having to find money to pay to refill the LPG cylinder has been tackled in several countries in various ways.

By providing subsidies (Brazil), embarking on micro finance schemes (Sri Lanka) or developing schemes to sell smaller quantities of LPG (Kenya).

The main challenge with subsidising LPG is that it is very difficult to target the subsidy effectively.

If countries subsidise only one cylinder size, or one particular market segment, it is not easy to stop that subsidised product from entering other segments illicitly.

A stack of logs, or a bag of charcoal, or a bunch of sticks, or a bucket of rice husks or a pile of animal waste, are all very visible forms of energy.

For all its advantages LPG is a product you cannot



*Piles of wood alongside the road in Timor Leste.*

pick up and store in the same way as a pile of wood. The consumer cannot see the stock of fuel diminish.

One of inherent challenges of the LPG industry is for the consumer to know how much product is left in the cylinder. Technology is starting to deal with this through innovative material in which to manufacture LPG cylinders that allow the contents to be seen. These composite cylinders though tend to be more expensive than steel, adding to the entry barrier for LPG.

Consumers new to LPG are dealing with a very different form of energy, contained and concealed in a vessel, and one that requires thorough education and understanding not just at the consumer level but throughout the supply distribution chain.



*Composite LPG cylinders allow the contents to be seen through the wall of the pressure vessel but they are more expensive than steel.*

Switching from wood to coal, or animal waste to charcoal, does not require a deep understanding of the properties and characteristics of the respective traditional fuels. It is all reasonably self-explanatory and can be understood quite easily. Each perhaps needs a slightly different approach to ignite the fuel and start the fire.



*Although this consumer has successfully switched to LPG she still retains the kerosene stove (right hand corner) in her kitchen.*

LPG is a gas - a different form of energy altogether - and switching from any of those traditional fuels to LPG requires a deeper explanation, education and training.

If this is not done effectively confidence in this new clean energy will be lost.

In this Indonesian kitchen, where the consumer has been introduced to LPG, the old kerosene stove still remains in the corner even though the new LPG cookstove and 3kg cylinder take centre stage.

Often, there is still a lack of confidence to throw out traditional stoves and hence people use either the LPG or the traditional stoves depending on the task. This phenomenon is known as “fuel stacking”.

Full confidence in the new LPG package still has to be earned.

## 7.3 Safety and Good Business Practices

Educating the consumer (and other stakeholders) – in order to effectively and safely present the proposition – are most important considerations.

The distribution channel also needs educating. Dealers in traditional fuels will see LPG as a threat. Managing this issue is vital to a successful transition programme as was found in Indonesia. Kerosene dealers rioted during the campaign to switch kerosene consumers to LPG.

One of the most important considerations is the control and maintenance of the LPG equipment, especially the cylinder.

The cylinder is one of the most important assets in the LPG industry and companies investing in cylinders want to make sure their asset is not only protected but also well maintained. This will not only ensure the safety of the business it will encourage future investment. After all what company is going to invest in a market where illegal filling is rife and cylinder assets are abused?

Each of the ten countries had a similar but different story to tell and they have all been given a short descriptor to illustrate the key message.



## 8.0 Country Reviews

| Who?             | What?                  | Why?   | Driver?   |
|------------------|------------------------|--|---|
| <b>Brazil</b>    | '...The Big Switch...' | Enormous transition programme over two decades that resulted in 95% of the population having access to LPG | Government subsidy programme with subsequent support from the LPG industry                |
| <b>Ecuador</b>   | '...Bono Solidario...' | Subsidies encouraging illicit use of LPG in non-targeted segments skews consumption                        | Government subsidy programme  |
| <b>Ghana</b>     | '...Rebooting...'      | Restarting a campaign using lessons learned from earlier years   | Government supported programme  |
| <b>India</b>     | '...DBTL...'           | Smart attempt to target subsidies directly into the consumers bank account in a focused way                | Government supported programme implemented by IOC   |
| <b>Indonesia</b> | '... Beyond 3kg ...'   | Follow up campaign to stop misuse of the subsidised 3kg cylinder   | Government supported initiative implemented by State owned oil and gas company, Pertamina |
| <b>Kenya</b>     | '...Micro Fill...'     | Potential game changer of micro filling but serious safety issues undermine it                             | Private initiative by local company   |
| <b>Peru</b>      | '...Concina Peru...'   | Government initiative encouraging switching through subsidised LPG package with 10kg cylinder              | Government supported programme supported by international LPG company                     |
| <b>Senegal</b>   | '...Butanisation...'   | Small fragmented distribution network creates challenges on safety and efficiency of operations            | Government supported programme backed by local companies                                  |
| <b>Sri Lanka</b> | '...Tea Change...'     | Non-government initiative focusing on tea plantation workers   | Private initiative by local company in conjunction with trade association                 |
| <b>Turkey</b>    | '...The Educator...'   | Government backed programme targeting rural communities through schools                                    | Private initiative by local company backed by country regulatory authority                |



## 8.1 Brazil

'... The Big Switch ...'

### Summary

- 200+m population
- Over 95% of the population use LPG for cooking
- Strong penetration of LPG following introduction of subsidies
- Several other key success factors attributed to growth including good business practices
- Several incentives had been removed before 2001
- Last subsidy removed in 2001, prices doubled, demand fell off
- Consumption since returned to pre-2001 levels
- Wood and charcoal still feature in residential energy mix (25% of households)



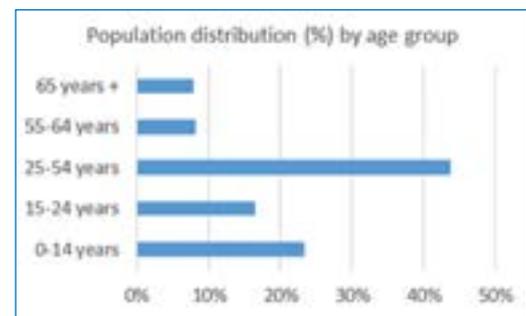
After strong growth in 2007 and 2008, the onset of the global financial crisis hit Brazil in 2008. The country experienced two quarters of recession, as global demand for Brazil's commodity-based exports dwindled and external credit dried up. However, Brazil was one of the first emerging markets to begin a recovery. In 2010, consumer and investor confidence revived and GDP growth reached 7.5%, the highest growth rate in the past 25 years. Growth has since slowed following government measures. Unemployment is at historic lows. GDP – per capita was US\$12,100 in 2013, a rise from US\$11,900 in 2012.

### COUNTRY BACKGROUND

Brazil is the sixth most populated country in the world. More than half of the 203 million population is considered middle class but poverty and income inequality levels remain high.

Well-funded public pensions have nearly wiped out poverty among the elderly, and 'Bolsa Familia' and other social programmes have lifted tens of millions out of poverty.

Brazil's economy is characterised by large and well-developed agricultural, mining, manufacturing, and service sectors, and a rapidly expanding middle class. The economy outweighs that of all other South American countries, and the country is expanding its presence in world markets.



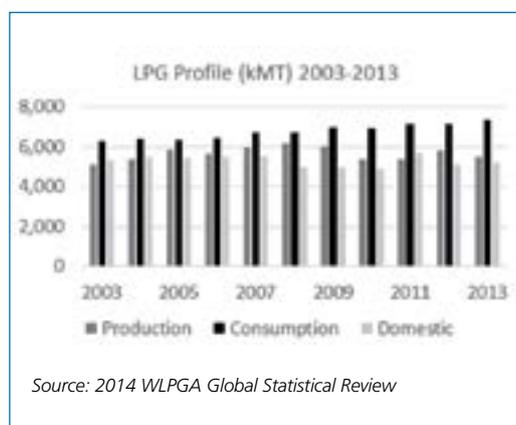
Nearly 44% of the population are between 24 and 54 years old

70% of Brazil's electricity is being generated from hydroelectric plants. The country produces over 2.6m bbl/day of crude oil with reserves of over 13bn bbl allowing it to become, in the near future, a net exporter. However Brazil is a net importer of natural gas, importing 13bcu m in 2012.

## LPG INDUSTRY IN BRAZIL

The LPG industry started in Brazil in the late 1930s. Demand has exceeded production during the last two decades and the country has relied on imports to meet the growing demand for LPG. Over 70% of demand for LPG in Brazil is in the residential sector.

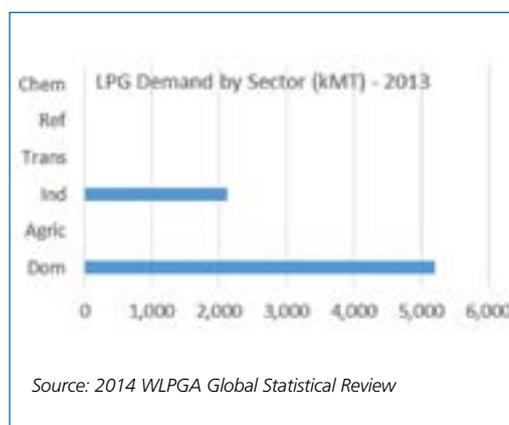
The national oil company Petrobras was established in 1953 and started to produce LPG in 1955. Several new distributors joined the market in the 1950's and the 13kg cylinder became standard.



The latest published statistics from the WLPGA indicates that in 2013 4.6mMT was produced from local refineries and 0.9mMT from natural gas.

LPG demand grew steadily until 2001 when subsidies were removed, then demand fell away. It has since recovered and in 2013 was back to 7mMT/year.

Most of LPG demand in Brazil is concentrated in the residential sector. There is no Autogas and the remainder of demand comes from the industrial sector. Around 5.5mMT of LPG is produced locally with the balance being imported.



## '... The Big Switch ...'

Up until the 1960's much of the population relied on traditional fuels. The large migration from solid fuels and kerosene to LPG didn't occur until the 1960's and towards the end of the 1970's. In those 20 years around 95% of the population switched to LPG.

The main reasons for this were:

- Urban migration.
- Increasing wealth of the population.
- Government subsidies on the price of LPG making it affordable.
- Efficient and well managed distributing companies with good logistics.
- Good, efficient and effective regulations.
- Brand concept on every aspect of the industry, a company could only fill its own branded cylinders.

- Customer was free to choose the brand of choice and the cylinders had to be swapped by the LPG distributing companies.
- LPG distributing companies sold the empty cylinders to the consumer on 'instalments' which made the cylinder affordable by reducing the initial cost.

Up until 2001 LPG was subsidised in Brazil by other petroleum products, it took several years cutting different incentives and subsidy.

The last subsidy was removed that year and prices practically doubled, causing a shift to alternative fuels.

Investment in natural gas distribution, especially following the recent growth in imported product from Bolivia, is creating competition for LPG.

According to some commentators the LPG industry in Brazil provides more than 350,000 jobs in over 15,000 companies.



*Wood burning stove in Brazil*

Today, a significant amount of the population still has a dual cooking system. An LPG stove indoors and a wood burning stove at the back of the house. This is especially popular in rural areas.

In the hot and less developed north-northeast of Brazil LPG is used mainly for cooking while in the southern part of the country it is also used for water heating and industries. In poorer areas, where purchasing power is lower, when subsidies are decreased, families switch from LPG to firewood.

In 2008 the Brazilian government considered a series of programmes to increase the access of LPG among the country's lower income groups. The proposals, which included possible tax cuts and the creation of a voucher system for low income groups, were considered but not implemented.

LPG is used as cooking gas in nearly 95% of Brazilian households. The penetration of LPG is so effective in Brazil that the populations of neighbouring countries, living close to the Brazilian borders, often source their LPG needs across the border. But many low income Brazilian households are forced to use firewood to reduce expenditure.

One of the problems with firewood is that when it rains it becomes difficult to light. LPG sales increase during periods of flooding.

LPG is a proven energy in times of natural disaster and when landslides, caused by flooding, damaged the natural gas pipeline from Bolivia, many industries turned to LPG in order to make up the shortfall in natural gas supply. Despite the versatility and reliability of LPG, charcoal and wood still have a strong position in Brazil's energy mix. The barbecue is very important. However 95% of barbecues use charcoal because users prefer the 'taste'.

According to one company '...the barbecue is like soccer, it is a part of life...' and '...there is a cultural barrier with charcoal and LPG...' The company says '...we have been selling LPG barbecue stoves and we try to change the perception on what is best. We have been doing this for the past six to seven years...'

According to one Brazilian Institute approximately 25% of the household energy matrix still includes wood and charcoal in their energy mix. Today the per capita consumption of LPG in Brazil is around 20kg/year.

The last household survey available by the Institute of Geography and Statistics of Brazil in 2002 stated that over 95% of all households in Brazil use LPG.

## 8.2 Ecuador

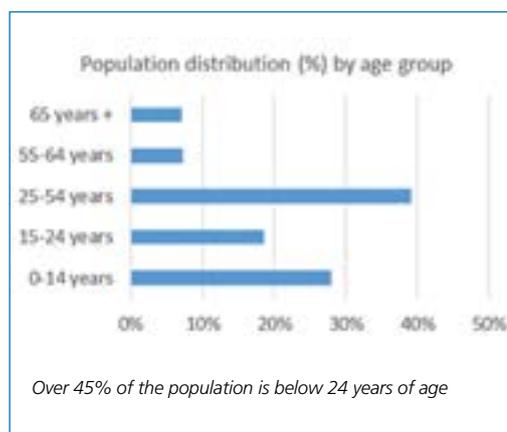
'...Bono Solidario...' (Solidarity Bonus)

### Summary

- 16m+ population
- Extensive use of wood and coal as a cooking fuel in 1950's
- Switch to gasoline and kerosene
- Promotion of LPG through subsidies since late 1980's
- 15kg cylinder of LPG costs just US\$1.60
- Subsidy costing US\$700/m
- Per capita consumption of LPG in Ecuador seems very high compared to GDP/Capita
- Suspected illicit use of LPG in other sectors and cross border smuggling
- Plans to withdraw subsidies in 2017 and promote electric cookstoves
- No sign of any impact yet on LPG demand



of known reserves) and 240m<sup>3</sup> of natural gas. However the country is a net importer of both finished oil products and natural gas.



### COUNTRY BACKGROUND

Ecuador is a small Andean country with a population of approximately 16 million and it is estimated that 1.5 million to 2 million of Ecuador's population live abroad.

The government has increased its social spending to ameliorate poverty and the conditional cash transfer programme, which requires participants' children to attend school and have medical check-ups, has helped improve education and healthcare.

GDP per capita was US\$10,600 in 2013, a rise from US\$9,600 in 2012. Ecuador produces over 500,000 bbl/day of crude oil (with over 8bn bbl

### LPG INDUSTRY IN ECUADOR

The LPG industry in Ecuador has grown steadily from 2000 to 2010 but then demand flattened out and has remained steady at around 1mMT/year over the last five years.

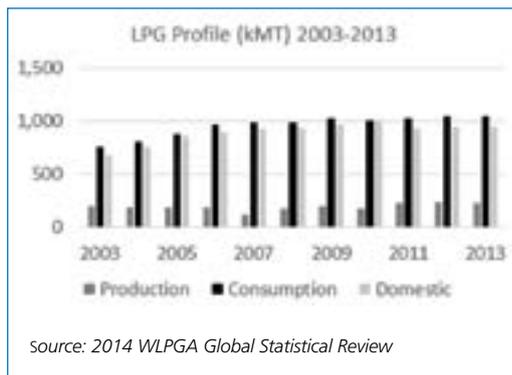
Residential demand is reported in the official statistics to make up 95% of the total which puts LPG/capita consumption at around 60kg/year; high for a country with a GDP/capita around US\$11,000.

With a subsidised price of only US\$1.60 for a 15kg residential cylinder, much of the country's reported residential demand is likely being illegally smuggled across the borders to Colombia

and Peru or being used in non-residential application in the country.

There is a small demand reported for LPG in the industrial sector with transport and agriculture making up the rest.

With local LPG production generally declining since the mid 1990's the country relies heavily on imports to meet demand. In 2013 the latest published statistics from the WLPGA indicated that 226kMT was produced from local refineries and 5kMT from gas processing.



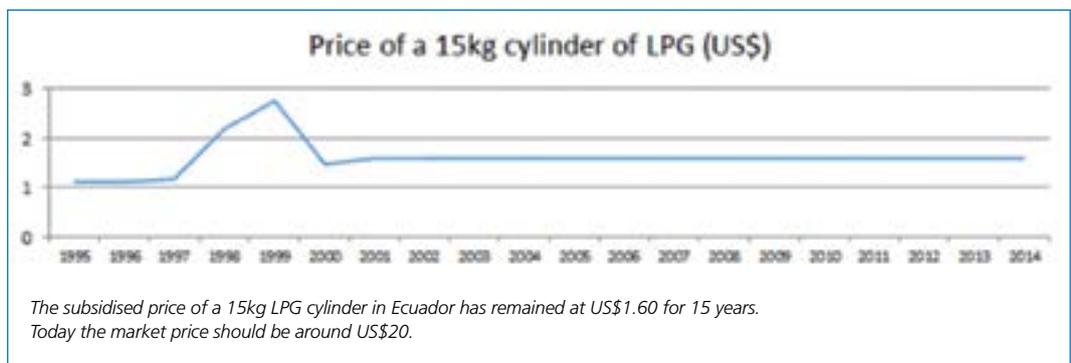
Ecuador began using LPG in the mid 1950's. At that time firewood and coal were the main cooking fuels. LPG was introduced into the market to improve the quality of life of the Ecuadorian rural population as well as reducing deforestation.

However in the 1960's and 1970's low octane gasoline was still the most popular cooking fuel and this was leading to a number of fires in the homes, and burns, especially to children.

As a result the government introduced policies against the use of gasoline and in the 1980's the

use of kerosene was encouraged through the delivery of kerosene stoves to rural areas. However there were continued health problems associated with the use of these traditional fuels and kerosene and so a further government plan was introduced, called Bread, Roofs and Jobs, encouraging the use of LPG through subsidies and giving 'empowerment and leadership' to the people.

LPG is heavily subsidised in Ecuador and apart from a period towards the end of the 1990's when the price more than doubled following massive inflation and a financial crisis in Ecuador, albeit from low levels, LPG demand growth has been steady.



In 2000, the government fixed the retail price of a 15kg cylinder at US\$1.60 and it has remained at that level until today.

The growth in the use of LPG in Ecuador remained at around 6-8%/year, since its introduction in the mid 1950's, until 2000 when growth rates fell. The sustained growth was driven more by price rather than the benefits that LPG brought to the consumer.

When LPG was first introduced the consumer was offered three sizes of cylinder; 5kg, 10kg and 15kg. The smaller cylinders were aimed at facilitating market entry but it created increased operational costs and the 15kg cylinder is now the main offering for residential consumers and 45kg for the commercial and industrial markets.



15kg LPG cylinders being distributed in Ecuador

The high subsidy for the 15kg cylinder, aimed at the residential cooking sector, has also encouraged the use of LPG into other applications such as water heaters, barbecues, space heating and other applications outside the residential sector. This has led to controversy with the subsidy.

With the cost of a 15kg cylinder of LPG in Ecuador being US\$1.60, the prices for a similar cylinder in the neighbouring countries of Colombia and Peru have been over ten times higher. In 2011 in Peru a 15kg cylinder cost US\$22 and in Colombia US\$16. This clearly encourages the illegal movement of LPG across the borders and for a country dependent on imports it is a real challenge. Some reports suggest that up to 25% of LPG is pirated to Peru and Colombia. The impact of this creates LPG shortages in the border areas of Ecuador because of the more attractive alternative market across the border.

This would also explain the relatively inflated per capita consumption levels reported in Ecuador.

Incidents with LPG are reported to be quite common as a result of poor handling.

### '...Bono Solidario...' (Solidarity Bonus)

A programme called 'Bono Solidario' or Solidarity Bonus – better known as 'Bono Pobreza' or Poverty Bonus – was created in 1998 to offset the effects of the financial crisis and improve the economic life of the poorest families in the country.

LPG is the fuel of choice for cooking by 90% of the population, with firewood and charcoal preferred by 7% (source: 2010 Census INEC - National Institute of Censuses).

Growth has slowed since 2007 as a result of controls being introduced to try and stop the illegal smuggling of LPG to neighbouring countries and also attempts to limit the use of LPG to cooking use.



15kg cylinders being delivered

Both of these are aimed at limiting the continued impact of LPG subsidies which cost the government an estimated US\$700/year.

In 2009, Petrocomercial, the State petroleum company, launched a plan in the coastal province of Esmeraldas to sell LPG directly to end users. The aim of this initiative was to take greater control over the LPG supply and distribution channel and attempt to stop the illegal and disruptive activities that were occurring, mostly smuggling, supply problems and price speculation. In addition this direct approach was supported by a campaign aimed at guaranteeing quality of the consumer proposition, quantity and safety.

Ecuador's Non-renewable Natural Resources Minister, Wilson Pastor, suggested the possibility of gradually cutting LPG subsidies to middle and high-income households.



*Cooking in Ecuador*

The Minister of Industry announced that the subsidy for LPG will continue until 2017 although other, more recent, reports state it will end earlier than that. When the LPG subsidy is removed efforts will be directed towards promoting electricity as the primary cooking fuel with induction cookstoves.

Twelve local companies are to manufacture induction cookstoves to support the scheme which is also open to imported foreign made induction cookstoves. The induction cookstove (ICS) programme was introduced in 2014, in advance of the change in LPG subsidy. The date of changing the subsidy will depend in the end on enough ICS being in place at the time. In the meantime, however, the cost of LPG equipment is being allowed to rise via taxes, duties, etc. so that there is already a shift of incentives.

According to the Minister of Industry, an Ecuadorian household currently spends an average of US\$8/month when cooking with LPG. However other reports suggest it is nearer US\$6/month in rural areas and US\$4/month in urban areas. It is intended that the same amount that

is spent on LPG be spent monthly to pay for the new induction cookstove over a number of years. The announcement has caused concern amongst the LPG distributors in the country who understandably see their livelihoods threatened as the LPG price will suddenly increase and make it uncompetitive for cooking and perhaps water heating. Not just to the local market but also to their cross border activities.

In support of this initiative to move away from LPG to electricity the Ecuadorian government has set out to change the energy matrix by investing in eight hydroelectric plants over the last eight years.

Special emphasis has been placed on an 'efficient cooking' campaign which proposes the use of induction cookstoves, and not LPG, to tackle the LPG subsidy burden.

The Ecuadorian government has announced that it will make three million induction cookstoves available over the period 2015 to 2017, of which 500,000 will be given away to the low income populations.

The Chinese manufactured induction cookstoves will be accompanied by an offer of subsidised electricity rates. The government will also offer, for those who purchase the induction kitchens, finance terms of up to 72 months where the cookstove can be paid off in instalments with the monthly electricity bill.

In the current plan everyone who takes up an ICS will get 80 kWh per month free electricity - not just the poor groups. Being the first time in the world such a programme has been attempted, there are likely to be many alterations as it moves forward.

The government's policy is targeted at all groups to stop the use of subsidised LPG without major political risk.

| Population Group Type | Cooking | Business | Vehicle | Water Heater |
|-----------------------|---------|----------|---------|--------------|
| 20% Poorest           | 97.7    | 2.3      | 0       | 0            |
| 20% Wealthiest        | 78.0    | 9.2      | 0.3     | 12.5         |
| Total                 | 89.0    | 6.1      | 0.5     | 4.4          |

*Cooking with LPG dominates usage patterns according to census*

The chart above from an INEC-CVD Population and Housing Census in 2010, demonstrates just how much the affluent classes benefit from subsidised LPG, not just for cooking and water heating but for business too.

The use of LPG for socioeconomic intended use is also outlined in this chart showing clearly the dependence of LPG in the family kitchen, especially the low income groups.

If three million induction cookstoves were made available to the Ecuadorian population the impact on the country's LPG demand would be dramatic. Estimates have been made of a possible reduction of up to 90% of the current LPG demand. This would certainly solve the subsidy problem.

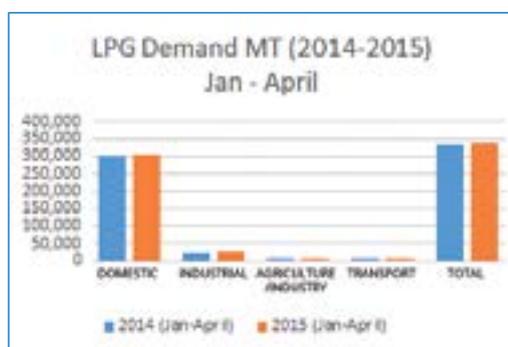
- The price of a cylinder of 15kg LPG has remained at US\$1.60 for twenty years. There might be a high political cost if the subsidy was removed with elections planned for February 2017.
- The price of the induction cookstoves, and the cooking utensils that are needed to use with them, are significant. Even with installment payments.
- Ecuadorians have been using LPG for many years and their cooking habits are well

established. Cooking with gas is very different to cooking with electricity.

- Their kitchen stoves are still in good condition and have many years life left in them '...so the householders argue "...why change?..."'
- The drop in oil and gas prices have affected Ecuador's economy and there will be a reluctance to change (especially with the growing unemployment rate).
- Against this economic uncertainty there is a real risk of deferring the introduction of the hydroelectric plants because of lack of revenues although there has already been heavy investment so there is a motivation to complete them.

In these circumstances it would not be surprising to see the government hold off introducing the induction stove programme and continue the use of LPG.

The case in Ecuador highlights the difficulties faced when an extremely attractive pricing regime has been established for a long period and a decision is taken to alleviate the financial burden of a subsidy programme.



*There appears to have been no significant change in LPG demand during the past 12 months despite introduction of induction stove programme.*



## 8.3 Ghana

'... Rebooting ...'

### Summary

- 26m population
- GDP/capita US\$3,500 in 2013
- Natural resources and agriculture employs half the workforce
- Growing oil industry
- National government driven LPG promotion programme started in 1990
- Based on refinery upgrades and cross subsidies
- Limited success due to several factors including misdirected subsidies
- High dependence still on wood and charcoal in rural areas
- Around 20% of the population use LPG
- Government programme being re-booted with support from SEAAF programme



### COUNTRY BACKGROUND

Ghana has a population of nearly 26 million with nearly half being employed in the agriculture – mainly small landowners – and natural resources sectors. Ghana's economy has been strengthened over the last two decades by relatively sound management, a competitive business environment and sustained reductions in poverty

levels. The services sector accounts for 50% of Gross Residential Product (GDP).

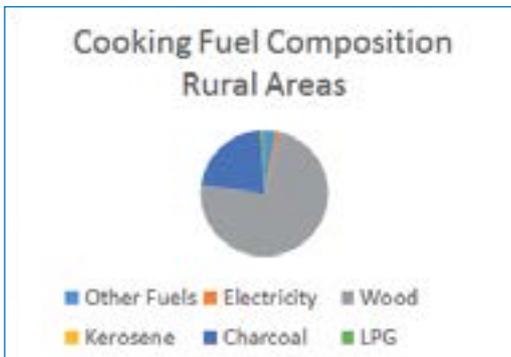
Gold and cocoa production, and individual remittances, are the major sources of foreign exchange. Oil production at Ghana's offshore Jubilee field began in late 2010. Additional oil projects are being developed and are expected to come on line in a few years. Estimated oil reserves have increased to almost 700 million barrels and Ghana's growing oil industry is expected to further boost economic growth.

### LPG INDUSTRY IN GHANA

The LPG industry in Ghana had an inauspicious start with flaring of LPG taking place in the 1970's and then a decade later the product was given away free at the refinery gate.

By about the early 1990s LPG demand had risen to about 6,000MT together with support from international LPG companies.

LPG prices and margins were regulated, with cylinders also being offered at a discount to encourage use. Government institutions and food sellers were encouraged to set an example and switch their kitchen fuels to LPG.



Wood dominates as the primary cooking fuel in rural areas of Ghana

More than 85% of households in Ghana rely on traditional fuels, mainly wood and charcoal, to meet their cooking needs. In rural areas this figure is higher.

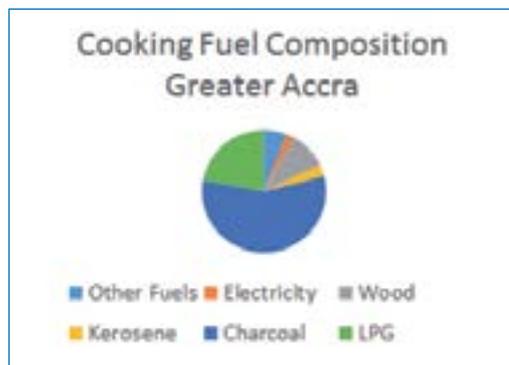
In addition, Ghana's forests are being unsustainably felled to produce these fuels and they are disappearing at a rate of approximately 2% per year.

The situation in Greater Accra is slightly different (see chart) with charcoal dominating. Wood and charcoal still account for around 70% of usage for cooking.

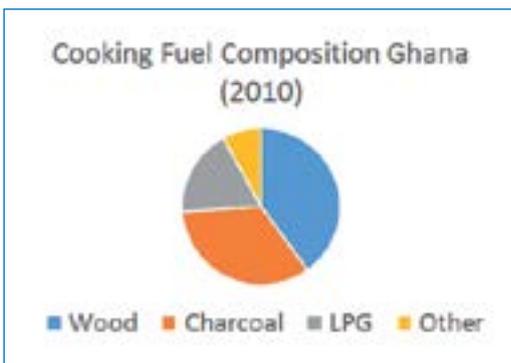
LPG consumption in Ghana continued to grow strongly to around 32,000MT in the mid 1990's. Since 2000 demand increased to over 200,000MT but much was being illicitly used as a transport fuel because of the price difference with gasoline.

A lack of government enforcement of good practices led to illegal filling of cylinders at the roadside and major companies leaving the market. Decanting became widespread.

Ghana has to import LPG to meet its demand which is mostly, officially, in the residential and industrial sectors.

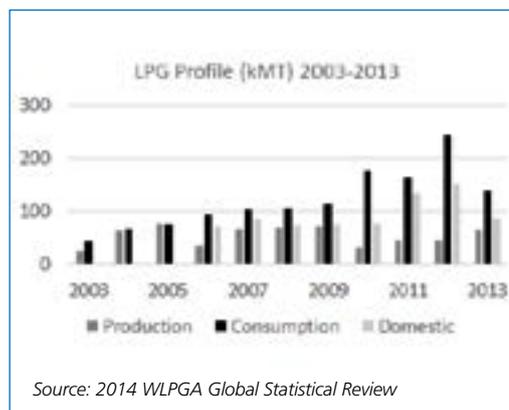


Charcoal is king in the capital

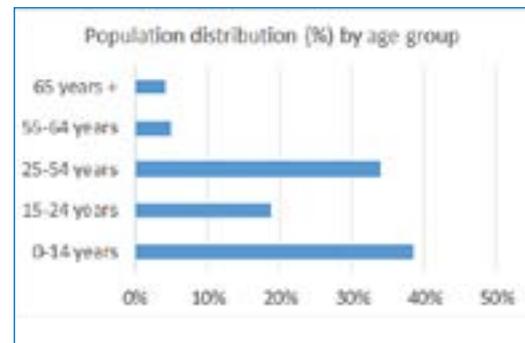
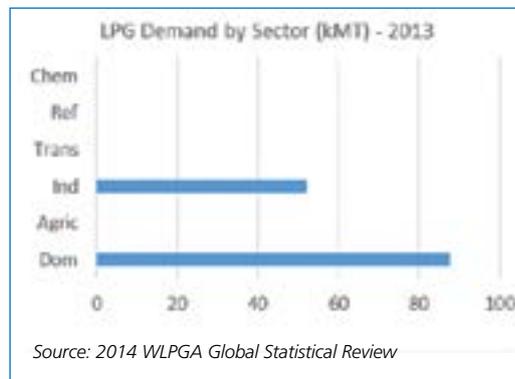


Traditional fuels dominate in Ghana

LPG demand per capita is less than 3kg per year despite a government driven programme to transition the population away from traditional fuels to LPG.



Source: 2014 WLPGA Global Statistical Review



Nearly 60% of the population is under 24 years of age

Today still only around 18% of the population in Ghana use LPG for cooking purposes, and most of these consumers are located in urban areas.

LPG is subsidised in Ghana and despite the official demand statistics by sector, it is clear that many

commercial vehicles still run on LPG since, with the subsidy, its ex-pump price is cheaper than that of gasoline. It is estimated that nearly 60% of unofficial LPG demand finds its way into transport applications although the official statistics deny this. This is a key concern.

### '...Rebooting...'

In order to stimulate better living standards the government of Ghana started a National LPG Promotion Programme in 1989/1990. The LPG programme was based on expanding residential refinery production by upgrading the Tema oil refinery and applying a uniform petroleum price fund (UPPF) which fixed margins on many petroleum derived products.

The government used gasoline sales to cross-subsidise LPG and provide incentives for LPG sales at distances more than 200 km from the refinery.

The success of the programme has been limited due to a number of reasons.

- The Ghanaian rural population is fragmented and makes a challenging target for LPG penetration.
- Income levels are low and even bartering takes place within the communities.
- The entry barrier for obtaining a LPG stove and cylinder is high for these communities and the need for local credit facilities, through possibly micro finance, has not been available.

- The size of cylinder used was inadequate.
- There was a lack of a safety culture and poor enforcement of regulations to ensure good business practices.
- The strong competition from cheaper, subsidised kerosene, was another challenge.
- Finally there was inadequate state policy to stimulate LPG development and a weak LPG rural distribution network made it difficult to get the LPG to the rural communities.

Several recommendations have been suggested to examine this initiative.

These were to:

- Establish a national LPG industry association.
- Initiate a transparent dialogue with stakeholders and the State to discuss structure, incentives, safety and law enforcement levels.
- Develop an affordable and appropriate LPG package.

- Activate local micro-credit facilities.
- Seek bilateral/multi-lateral funding.
- Test these recommendations in the field.

The Government of Ghana's energy policy initiative has since been complemented by others providing business development services. There have been some lessons learnt from this programme.

### 1. TECHNOLOGY GAPS

The national LPG promotion programme is still in effect today, but unreliable LPG supply remains one of the key challenges. The Tema oil refinery has suffered from periodic shutdowns creating shortages in local LPG supply.

Once consumers are encouraged to switch from traditional fuels to LPG any lack of supply creates a loss of confidence which may encourage users to revert back to the traditional fuels they previously used.

Using LPG for the first time requires explanation and education. The physical properties and characteristics of traditional fuels are very different to that presented by LPG to consumers. A lack of knowledge in this area can not only be unsafe but can make operating the equipment difficult.

In some cases it might be possible for cooking appliances to be compatible when used with both traditional fuels and LPG stoves. This ensures an easier transition. In Ghana the rounded bottom pot is commonly used and introducing a LPG stove that does not accommodate these will be an unnecessary challenge.

### 2. DELIVERY MECHANISMS

It is important to avoid a gap in terms of delivery mechanisms. In the case of Ghana there appears to be a lot of small and medium sized LPG enterprises involved in the industry because the unattractive capped margins encouraged larger companies to exit the LPG market.

On the other hand, the small and medium sized LPG distributors find their businesses limited in important ways.

These companies found financial challenges because there was an unwillingness on the part of the local banks to make loans for seed or growth capital. Even established LPG businesses with proven track records had trouble securing short term loans for working capital or acquiring the refinery lifting guarantees at reasonable rates.

These businesses also suffered by the supply shortages. Some were able to secure supplies by purchasing their own bulk trucks and obtaining the legal status as an Oil Marketing Company (OMC), but even then security of supply often relied on maintaining good relationships with the people at the refinery.

### 3. INADEQUATE MARGINS

Supplying to rural areas, which are further from the main distribution facilities, creates economic challenges because the cost of reaching these consumers increases due to the fragmented consumers. This is compounded because rural consumers generally have lower disposable incomes. Without access to micro finance, the entry barriers presented by this – for a LPG stove, hose, regulator, and cylinder – are too high for these consumers making transition too much of a challenge.

### 4. ILLICIT USE

LPG is an extremely versatile energy source enabling it to be used in hundreds of different applications. Apart from being an excellent cooking fuel it also has extremely good engine



*Traditional fuels being used in Ghana*

fuel properties which is why it is the number one alternative transport fuel to gasoline and diesel fuel. If LPG is being subsidised for residential fuel use there is a risk the product is used illicitly in other applications. This is particularly serious if residential cylinders are used in road vehicles because they are not designed for this application and it creates a serious safety risk. In Ghana the official LPG statistics indicate no transport use for LPG but in practice LPG is used in taxis in a significant manner creating a serious risk.

The use of LPG as a fuel for taxis, when done in a proper manner, is a sensible policy for countries which are serious about reducing harmful emissions in urban streets. However there is no place for the illicit use of residential LPG cylinders in vehicles. The practice is very dangerous.

With an already inadequate and intermittent supply of LPG, its use in taxi cabs detracts from its potential to replace firewood and charcoal for cooking.

To compound the problem, it is virtually impossible to modify the existing policy in order to promote LPG for cooking over its use as an automotive fuel.

- As the same cylinders are used both for cooking and transport, it is difficult to limit LPG sales for cooking purposes only.
- Many taxi owners have invested significant resources converting their vehicles to run on LPG and are benefiting greatly from the relatively cheaper price compared to gasoline (petrol). They form an important lobby who are strongly opposed to any reduction or removal of the subsidy.

The Ghana LPG policy was first introduced by the government to promote LPG as a residential cooking fuel to help curb the environmental hazards associated with wood and charcoal. The then Ministry of Fuel and Energy embarked on a nationwide LPG drive by freely distributing 5kg and 14kg cylinders to households and educational, health and penitentiary institutions.

Most of the cost of the LPG was absorbed by the government and an LPG fund was also established. During this period, there was a reduction in wood consumption from 80% in the early 1980's to 73% in 1996. And again households using LPG rose from 4% in 1998 to 9.5% in 2006.

In 2010 the Ghana Energy commission reported that the government was committed to increasing the use of LPG from 10% of the population, to 50%, by 2020.

There has been a general shortage of LPG supply over the years as a result of a subsidy that reduced price, while demand and supply facilities remained unchanged.

In order to increase the supply of LPG among others, the government of Ghana together with Togo and Benin signed an agreement with Nigeria to build a pipeline to transport natural gas from Nigeria through to Ghana in 2000. In that time, wood fuel and charcoal accounted for 40% and 34% respectively of primary cooking fuels as compared to LPG (15%).

With the ongoing electricity crisis, the government is under enormous pressure to provide solutions. With the appropriate regulations and adequate supply, LPG will definitely take a lot of pressure from the overburdened national grid. One of these solutions emerged in 2012.

In 2012 Ghana developed a SE4All action plan using the Sustainable Energy for All Acceleration Framework (SEAAF) developed by UNDP. The 2020 vision and targets are shown in the chart opposite.

Working with SE4All, the Global LPG Partnership and other key stakeholders, the Ghana government published the SE4All Action Plan with a policy target of increasing LPG penetration from the current estimate of around 18% to 50% of the population by 2020.

The policy objective behind this is to reduce the dependence on wood fuels arresting deforestation and improving health.

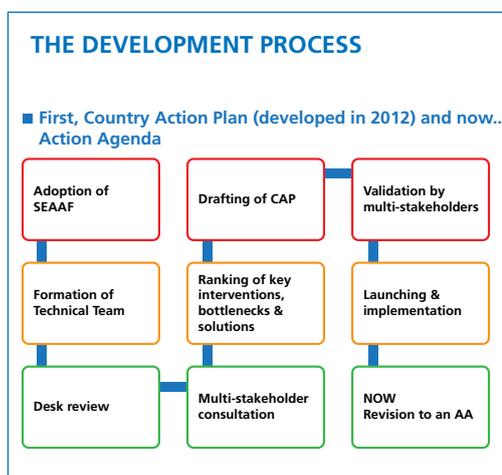
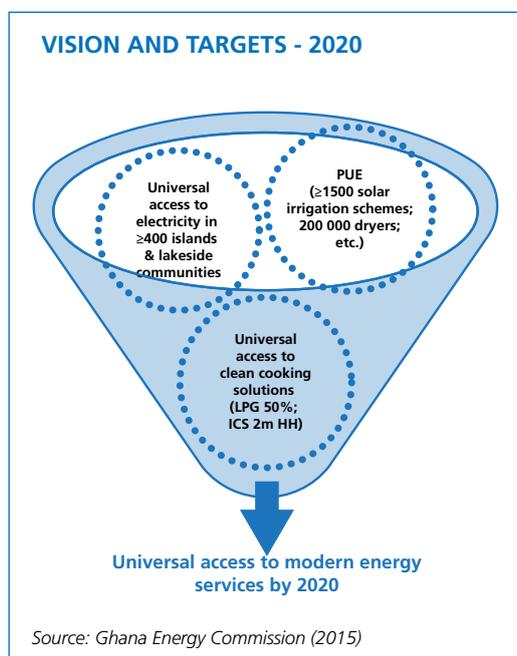
The key objectives of the Ghana SEAAF are to:

- Review existing policies and interventions in the area of SE4ALL.
- Identify the key bottlenecks to the implementation and attainment of the three UN SE4ALL goals by 2030.
- Identify gaps in existing policies and interventions.
- Develop cost-effective solutions that can accelerate progress towards the attainment of SE4ALL goals by 2030.
- Design an overall action agenda (AA) to implement indicative interventions and monitor progress.

There are some major challenges remaining:

- Supply infrastructure remains inadequate to service national LPG demand.
- Bad practices undermine the industry and safety remains a challenge.
- Replacing customer controlled cylinders with marketer controlled cylinders (cylinder recirculation).
- Access to capital.
- Affordability of the LPG proposition.
- Lack of regulations.
- Inadequate public awareness.

The use of LPG as a household fuel has gradually increased (from less than 1% in 1990) to around 22% this year.



The main steps of the SEAAF development process

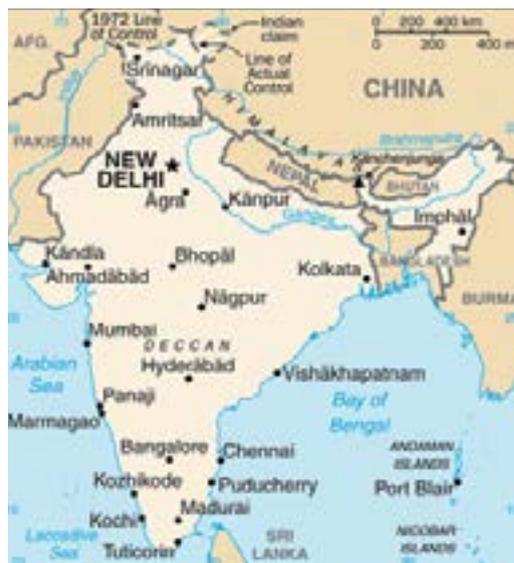


## 8.4 India

'... DBTL ...'

### Summary

- 1,235m population
- LPG used by 63% of the population for cooking
- Subsidised LPG being misused in other applications (Autogas, commerce, industry etc.)
- ...and affluent residential consumers also benefiting directly to consumers' bank account
- Direct Subsidy Transfer of LPG (DBTL) launched in Nov 2014
- Supported by Aadhaar, a unique 12 digit identification number
- Government backed plan to transfer subsidy
- 'Largest cash transfer scheme in the world' – US\$1.9bn already transferred in 2015
- Initial feedback positive with over US\$600m savings in 'leaked' subsidies



initiatives with a renewed emphasis on 'made in India' focusing on the residential manufacturing sector, with 62% of the population aged between 15 and 59 years old.

India's diverse economy encompasses traditional village farming, modern agriculture, handicrafts, a wide range of modern industries, and a multitude of services. Half of the work force is in agriculture but services are the major source of economic growth, accounting for nearly two-thirds of India's output with less than one-third of its labour force.

India has capitalised on its large educated English-speaking population to become a major exporter of information technology services, business outsourcing services, and software workers. India's economic growth began slowing in 2011 because of a decline in investment, caused by high interest rates, rising inflation, and investor pessimism about the then government's commitment to further economic reforms and about the global situation.

In late 2012, the Indian Government announced additional reforms and deficit reduction measures, including allowing higher levels of foreign participation in direct investment in the economy. The outlook for India's long-term growth is moderately positive due to a young population and corresponding low dependency ratio, healthy savings and investment rates, and increasing integration into the global economy. Growth in 2013 fell to a decade low, as India's economic leaders struggled to improve the country's wide fiscal and current account deficits.

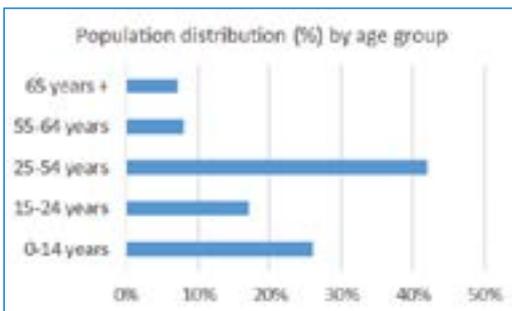
### COUNTRY BACKGROUND

India has a population of over 1.2 billion people making it second behind China as the world's most populated country. Hindi is the most common language although English is widely spoken.

India is developing into an open-market economy. Economic liberalisation measures began in the early 1990's and helped to accelerate the country's growth, which averaged around 7% per year from 1997 to 2011.

In 2014-2015 the forecast growth is predicted to be 7.4%. The economy is expected to benefit from lower crude prices, and the new government is planning structural reform

However, investors' perceptions of India improved in early 2014, due to a reduction of the current account deficit and expectations of post-election economic reform, resulting in a surge of inbound capital flows and stabilisation of the rupee. Fiscal consolidation efforts and strong GDP growth in recent years have helped bring down the government's fiscal deficit.

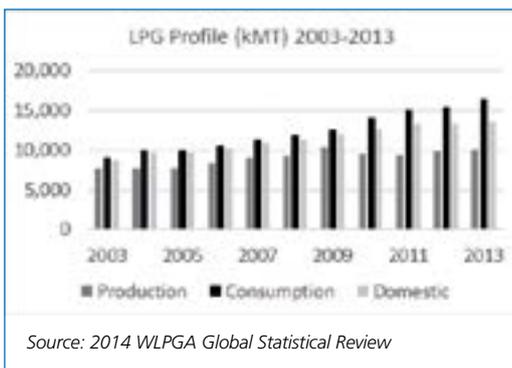


Over 40% of the population is under the age of 24 years – source CIA

However, investors' perceptions of India improved in early 2014, due to a reduction of the current account deficit and expectations of post-election economic reform, resulting in a surge of inbound capital flows and stabilisation of the rupee. Fiscal consolidation efforts and strong GDP growth in recent years have helped bring down the government's fiscal deficit.

### LPG INDUSTRY IN INDIA

The LPG industry in India started in 1955 by Burmah Shell in Mumbai. In those early days it was used exclusively for cooking. State Owned Enterprises (SOE's) [Indian Oil Ltd., Bharat Petroleum Corporation Ltd., and Hindustan Petroleum Corporation Ltd.] entered the market in 1965 and developed new applications for LPG in the non-residential, industry and transport sectors.



Source: 2014 WLPGA Global Statistical Review



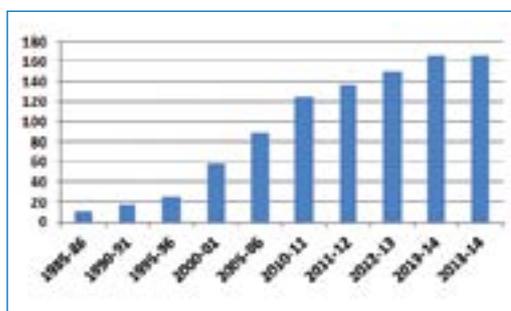
Source: 2014 WLPGA Global Statistical Review

India now has one of the largest LPG markets in the world with demand in 2013 exceeding 16mMT according to the latest WLPGA Global Statistical Review. For a while local LPG production kept pace with demand but more recently that has fallen away and now India imports around 8mMT a year of LPG and that is forecast to grow.

LPG demand has grown steadily over the last ten years and with local production slowing, imports are expected to continue to climb.

Residential demand dominates the industry where subsidies have historically encouraged penetration into this sector.

This growth of LPG demand into the residential sector was driven by the use of subsidies. Private companies have entered the market but almost entirely in the non-residential sectors. They find the presence of subsidies in the residential sector too much of a challenge.



There has been a rapid growth in residential LPG consumers [in millions] in India over the last 20 years - Source IOC

The LPG residential sector is provided for with 5kg and 14.2kg cylinders, home delivered through a distributor network. The 5kg cylinder is also available as a cash and carry proposition where consumers can collect from the point of sale such as a supermarket.

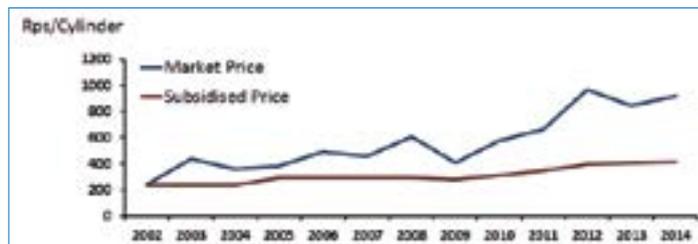
The non-residential sector is serviced with 5kg, 19kg, 35kg and 47.5kg cylinders, also supplied through a distributor network.

The unit cost of supporting residential LPG subsidies has risen gradually over the last ten years (below) with the subsidy on the LPG fuel to the household sector in early 2014 amounting to almost half the market cost.

What has compounded this for the government has been the misuse of subsidies encouraged by the lack of control to the end user. This has attracted the attention of the new government.

An ambitious programme was launched in 2014 to address the issue of LPG subsidies in India. The concept of having subsidies paid directly into the bank accounts of worthy recipients required careful planning and support from a number of stakeholders.

The programme, an outcome from a task force set up in 2011, is called Direct Benefit Transfer (DBTL).



The subsidy on a cylinder in 2014 was around US\$6

### '... Direct Benefit Transfer (DBTL) ...'

The 160 million residential LPG consumers in India use around 1,500 TMT/month. Within this group there is a large proportion who cannot afford to buy LPG at the international market price and this led to the introduction of subsidies.

In an effort to promote LPG as an environmentally friendly fuel, the Government of India has, for several years, provided a subsidy on each LPG cylinder being sold for residential purposes, protecting consumers from both international prices and price fluctuations.

However LPG at market price is also available for users consuming it for purposes other than residential use e.g. commerce (hotels, restaurants), industry, and the automotive sector as a transport fuel etc.

The price differential between subsidised LPG and non-subsidised LPG lures retailers, or their staff,

to divert cylinders for subsidised residential use to non-residential consumers. This results in an additional subsidy burden on the Government. The cost of subsidising residential LPG was costing the government around US\$7bn in 2014.

In order to minimise this leakage of subsidised LPG to both residential users, who can afford the market price, and also to non-residential consumers, the Indian government needed to improve the way the subsidies were provided, so as to:

- Ensure the entitlement reached the intended consumer
- Reduce the misuse of subsidies by eliminating the diversion into other sectors
- Improve the availability of LPG for genuine customers
- Reduce the subsidy burden

A task force was established in 2011 to examine the issues and recommend a way forward. A number of recommendations were made including putting a maximum number on the subsidised cylinders going to a household and the introduction of an Aadhaar (a unique 12 digit identification number) based subsidy transfer mechanism.



Customer opening new bank account

It is the introduction of the Aadhaar - linked to the LPG consumer number and the bank account details of the consumer - that has led the way for the Direct Benefit Transfer (DBTL) scheme. Initially the scheme was designed to link Aadhaar of each consumer with the LPG account and bank account separately. Subsequently during 2014, this was extended to consumers who had not yet obtained their unique identity number by linking their bank account directly with their LPG account.

The DBTL controls the payment of LPG subsidies through an ambitious plan to target the subsidy directly to the, worthy, residential user by transferring the funds directly into their bank account removing the possibility of subsidy misuse.

To enrol into the scheme the LPG consumer has to first obtain their Aadhaar number and then link it to their bank account and their LPG customer account. For those



14.2kg residential cylinder

consumers who do not have an Aadhaar number it is possible to link their 17 digit LPG customer number with their bank account number.

Under the DBTL scheme, a permanent financial advance, enabling the customer to pay the full market price for the LPG, is transferred to the customer's bank account immediately after joining the scheme. This effectively overcomes the entry barrier of using LPG for the first time.

This is then done after every subsequent delivery of a cylinder.



Public announcements using motor bike

The scheme is new and is being heralded as the largest cash transfer scheme in the world (with 150 million users).

It was launched in November 2014, initially in 54 districts of India, and the rest of the country followed from the beginning of 2015. There is a 'grace and parking' period to allow consumers to join the scheme.



Distributing pamphlets at service station

One of the key challenges was to publicise and communicate the scheme to the target group. A variety of methods were used including the use of posters and banners at prominent locations, advertisements on TV, radio and newspapers, the launch of a dedicated web site [[www.MyLPG.in](http://www.MyLPG.in)], targeted SMS messages, and even using a microphone on a motor cycle through markets and distributing pamphlets at service stations.

Other methods included the use of vans and trucks. A call centre with over 300 staff was established to answer any queries of consumers who were joining the scheme. In addition a consumer grievance unit was established to deal quickly with any complaints.



*Promotional activity using trucks*

To date around 130 million consumers have joined the scheme and an amount of INR's 121bn (US\$1.9bn) has been transferred to the bank accounts of consumers.



*Promotional activity using mobile van*

In order to implement the scheme effectively a number of stakeholders were involved.

A reseller network of around 15,000 LPG distributorships, more than 100,000 branches of 400 different banks, officials of the Unique Identification Authority (UIA), district administration and oil and gas company officials, worked round the clock for collecting & validating the UIN/Bank

details of every consumer. These details were then updated in an LPG database for making the customer cash transfer compliant.



*Coordination meeting with distributors*

Some of the key challenges faced in implementing the scheme included:

- Poor connectivity at distant and remote town
- Low literacy rates in rural areas
- Non-availability of UIN or bank accounts with LPG consumers

To address these challenges a series of communication programmes were launched to explain the benefits to at district meetings.



*District meeting with consumers*

The assessment to date of the DBTL scheme, from both within India and external observers, has been positive.

- The self-selection process of DBTL discouraged some LPG consumers from joining the scheme (These consumers probably included consumers who previously were taking advantage of a subsidy they didn't really need and to continue might have led to some embarrassment)
- The need for Aadhaar and bank account information has resulted in very targeted consumers resulting in the 'weeding out' of previous duplicity fraud
- There have been some serious savings in subsidy payments through the reduction of subsidised product being diverted to other uses

- The waiting time for LPG deliveries has been reduced
- Inactive bank accounts have been activated
- A INR568 (US\$9) float has been made available to users following the permanent advance
- There is a potential for other schemes to be introduced onto the back of the DBTL model

Communicating the DBTL initiative to so many people was one of the key success factors and this was achieved through a variety of means at local level.



Newspaper article on DBTL

This local communication was supported by mass media through newspaper articles which brought also spread the word.

The Indian government is expecting to save INR's40bn (US\$625m) annually in subsidy 'leakage' following the successful implementation of the scheme.

The Indian programme is evolving. The heavy media campaign initiated in the last few months has resulted in more than 1.5 million consumers voluntarily giving up their LPG subsidies. The government goal is to convince 10 million to do so. Each consumer who gives up the subsidy is linked to a new below poverty line consumer taking it up.



## 8.5 Indonesia

'... Beyond 3kg ...'

### Summary

- 254 million population
- Widespread country consisting of 17,000 islands suits LPG's portability
- Kerosene subsidy driven out by ambitious LPG conversion programme
- One of the world's largest residential energy transition programmes
- Indonesia has gone from a net LPG exporter to one of Asia's largest LPG importers in 6 years
- Thousands of jobs created, new infrastructure built, massive environmental improvement
- However, over 87% of LPG sold today is in 3kg cylinders and is heavily subsidised
- Non subsidised cylinder being introduced to attract 3kg users
- Based on a new differentiated package
- Direct subsidy transfer scheme being considered



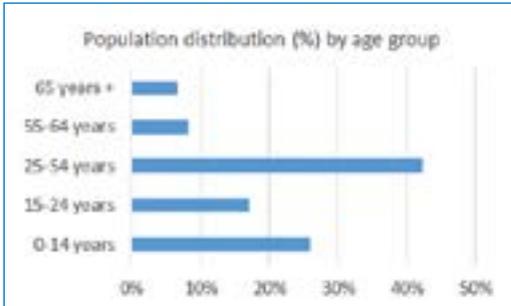
### COUNTRY BACKGROUND

Indonesia has a population of 254 million people. It is the world's fifth most populous country. Gross Residential Product (GDP) per capita is US\$5,200 and the country has an economic growth rate of 1.2%.

GDP in 2013 was spread mainly across agriculture (14.3%), industry (46.6%), and services (39.1%). Within agriculture the main activities were rubber, palm oil, poultry, beef, forest products, shrimp, cocoa, coffee, medicinal herbs, essential oil, fish, and spices. Industry activities included petroleum and natural gas, textiles, automotive, electrical appliances, apparel, footwear, mining, cement, medical instruments and appliances, handicrafts,

chemical fertilisers, plywood, rubber, processed food, jewellery, and tourism. Indonesia is rich in crude oil and natural gas with crude production in 2012 almost 1m bbl/day. Natural gas production was around 75 billion cu m.

Indonesia, a vast nation of over 17,000 islands, has grown strongly since 2010. During the global financial crisis, Indonesia outperformed its regional neighbours and joined China and India as the only G20 members posting growth. The government has promoted fiscally conservative policies but still struggles with poverty and unemployment, inadequate infrastructure, a complex regulatory environment, and unequal resource distribution among regions. The government also faces the challenges of reducing fuel subsidies.



Over 40% of the population are under 24 years of age

### LPG INDUSTRY IN INDONESIA

Indonesia provides a good example of how governments, by being a Champion, can proactively drive switching to LPG and the benefits that can accrue.



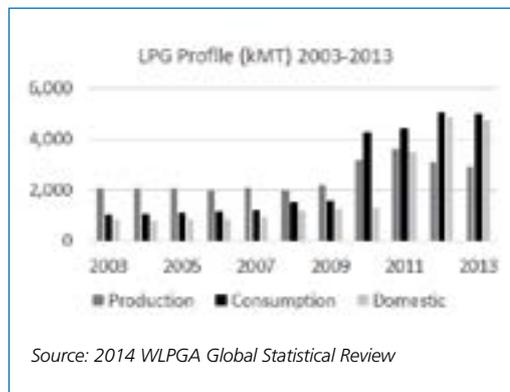
The 3kg LPG package provided free to kerosene users

In 2007 Indonesia embarked upon what was to be one of the most ambitious transition programmes from traditional fuels to LPG that has ever been undertaken. The announcement by the government to convert 50 million users of kerosene, primarily used as a cooking fuel, to LPG within five years was greeted with scepticism by many.

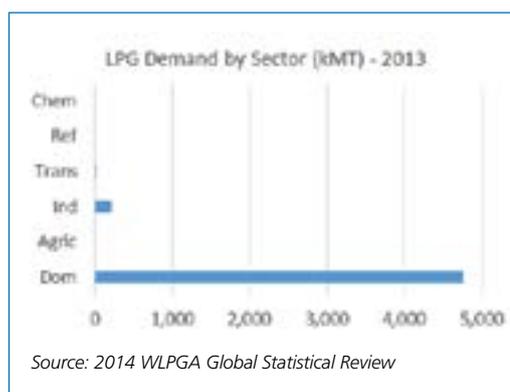
All citizens meeting the programme requirements had the right to receive the free 'initial package', consisting of a 3 kg LPG cylinder, a first gas-fill, and a one-burner stove, hose and regulator. The programme proved highly successful.

The state oil and gas company Pertamina were tasked with implementing the programme and have silenced their critics by meeting the targets. Almost the whole country (>95%) has been covered by the programme which has now been extended with Pertamina now embarking on completing the task by reaching out even to those most remote areas of Indonesia. The new target is around 58 million households and micro-sized businesses, or around 250 million users.

Prior to Indonesia's kerosene to LPG programme, kerosene was subsidised, with the subsidies accounting for 9%-18% of total state expenditures. The country was also able to export LPG that was surplus to requirements. Once the campaign got under way the country started to import (from 2011).



Source: 2014 WLPGA Global Statistical Review



Source: 2014 WLPGA Global Statistical Review

The key driver for this ambitious kerosene to LPG conversion programme was the removal of the kerosene subsidy. The elimination of these subsidies was very important, not only because of the burden on public finances, but also because kerosene was being illicitly diverted to other areas of the economy and smuggled out of the country.

The temptation to channel this low cost product into other main fuels, especially diesel, was too great for many in the distribution channel. In short the subsidy was being abused, was not benefiting the consumer and it encouraged a dirty, dangerous cooking fuel to exist in the kitchen.

The conversion scheme (ref: Kerosene to LP Gas Conversion Programme in Indonesia - A Case Study of Residential Energy, WLPGA) involved government giving away a free starter package which included a 3kg cylinder, hose, regulator and stove to each of the target users.

The programme targets households and micro-businesses. In July 2012, Pertamina, the state-owned oil and gas corporation, reported that it had distributed 54 million packages and saved IDR 61.6 trillion (US\$6.5 billion) in fuel subsidies since the start of the conversion programme. By 2015 the target had been adjusted and over 58 million of these packages had been distributed. The LPG in the 3kg cylinder is also subsidised (but not to the same extent as the kerosene was). LPG is also available in Indonesia in larger cylinders but this doesn't receive the subsidy.

Safety concerns have been raised due to individuals siphoning off LPG from the small, cheaper, cylinders to transfer it to larger cylinders. This practice has been largely blamed for some of the LPG cylinder incidents in Indonesia which led to a number of deaths and injuries in the early stages of the kerosene-to-LPG conversion campaign.

The prices of gasoline, diesel, kerosene (for households and small businesses), and LPG are controlled and subsidised. LPG sold in 3-kg cylinders is heavily subsidised at IDR 4,250

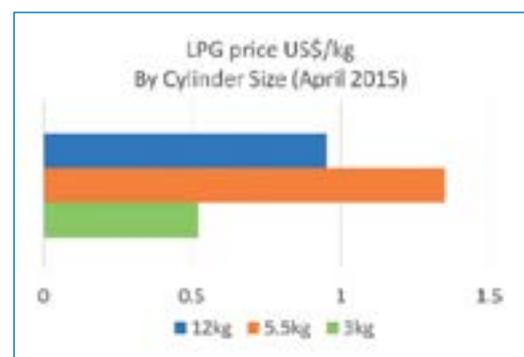
(\$0.44)/kg. LPG in 12-kg cylinders is sold at IDR 5,950 (\$0.62)/kg and LPG in 50-kg cylinders at IDR 7,455 (\$0.79)/kg. The price of LPG government subsidy has been frozen for years.

Apart from displacing kerosene, and all its inherent dangers with clean burning LPG, the programme had several other side benefits:

- A new LPG equipment manufacturing sector emerged creating thousands of jobs
- Thousands of trees were saved as a result of the lower CO<sub>2</sub> emissions
- In order to cope with the sudden increase in demand a new storage and handling distribution model was created in Indonesia

The traditional 12kg LPG cylinders are supplied to the market at a non-subsidised price (US\$0.95/kg in April 2015). However in order to sustain the 3kg programme the LPG supplied to this sector is subsidised (US\$0.52/kg in April 2015) and this has led to the package dominating the business.

It is estimated that in April 2015 up to 87% of all LPG sold in Indonesia was in 3kg cylinders. Many, more affluent, users have switched away from the more expensive larger cylinders to use the subsidised product.



LPG sold in the 3kg LPG cylinder is well below the price of the others

It is also clear today that some of the 3kg cylinders are being used in applications other than in residential kitchens and small micro sized enterprises, e.g. small fisheries and irrigated rice paddies.

### '... Beyond 3kg ...'

The 12kg and 50kg cylinders were introduced in 1968 and along the way they were sold under the market price which became a financial burden to Pertamina.

A series of price hikes during the 2012-2015 period led to a more economical price but the increased price led to a fall in demand and a move towards the 3kg cylinder.

Pertamina will embark on a new programme of trying to move users of the 12kg cylinder, who are also using the 3kg cylinder, to a new proposition. Introducing a new, un-subsidised, cylinder is one of the ideas being considered to achieve this.



The 3kg cylinder which was introduced to displace kerosene use

The new proposition is based on:

- A larger cylinder with a more attractive package
- A safer cylinder valve (to enable easy switching)
- A home delivery service
- A market related, non-subsidised, price

The cylinder will be priced to generate a positive margin and trials are underway to test the market using an above the line and below the line campaign.

In addition the Indonesian government, in cooperation with Pertamina, is planning the introduction of a direct subsidy scheme and/or a closed distribution system to mitigate the cost of subsidies. Studies are being done to target certain cities.





## 8.6 Kenya

'... Micro Fill ...'

### Summary

- 45m population
- LPG industry grew strongly until 2009, then collapsed
- Most of the population are dependent on traditional fuels
- The LPG industry has many challenges with cross filling of competitor cylinders prevalent
- Local company introduced vending machines to dispense small quantities of LPG
- The model is seriously flawed because of major safety issues associated with the cylinder & ...
- ... Issues with the weights and measures authority
- Nevertheless the concept of dispensing small quantities of LPG dismantled the entry barrier



Kenya relies on has hampered economic growth. Recent acts of terrorism in Kenya and the surrounding region threatens Kenya's important tourism industry. GDP per capita was reported as being US\$1,800 in 2013, a slight increase on the previous year.

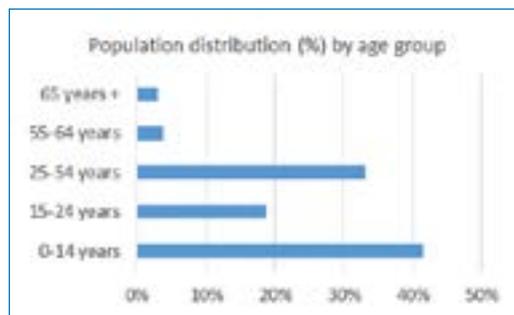
Agriculture remains an important part of the economy with tea, coffee and wheat amongst some of the important products. Small scale consumer goods, horticulture, oil refining, aluminium and cement make up some of the other industries

### LPG INDUSTRY IN KENYA

The LPG industry in Kenya grew to almost 90kMT/year in 2009 but then collapsed to around 60kMT the following year and remains today at that level. Most of the demand is in the residential sector although Autogas features strongly.

The LPG industry in Kenya is very fragmented and despite the good intentions of the larger, established LPG marketers and government, illegal practices are widespread in much of the industry. Many of these bad practices are carried out by smaller LPG operators and the impact is damaging to the potential growth of the industry.

It is the declared intention of the Kenyan government to encourage the use of LPG as a measure to counter deforestation, and to this end the government has laid out several policy initiatives that it hopes will reduce the price of LPG for consumers. One was to standardise LPG



Over 40% of the population is under 14 years old

### COUNTRY BACKGROUND

Kenya has a population of around 45 million with over 40% under the age of 14 years and unemployment is high at 40%. Kenya's has the largest economy in East Africa but that is now under threat. Low prices of primary goods that

cylinders, valves and regulators, which it was hoped, would allow consumers to choose their LPG supplier based on cost alone.

Standardising the valve on the residential LPG cylinders in 2009 – in this attempt to make LPG more accessible to the community – has probably not helped to control illegal filling because different valves made illegal filling more difficult for the companies that were practising that.

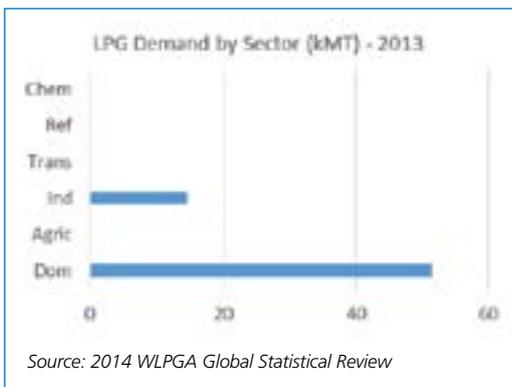
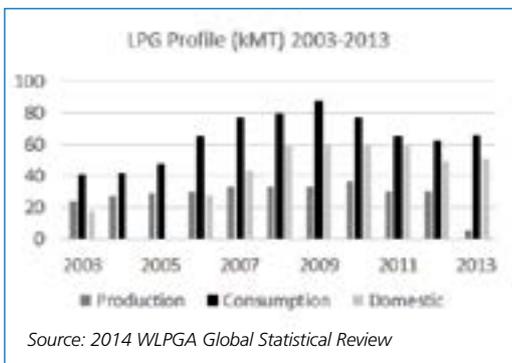
The impact of these illegal practices on potential investors to the Kenyan LPG industry is naturally negative. No company is prepared to invest in a business where their assets are being used by others.

The use of charcoal and wood are widespread in the country and the lack of disposable income makes the penetration of LPG into the residential energy sector very challenging. A typical fuel purchase of 50 Kenyan shillings (US\$0.50) would buy a plastic bag of charcoal, a bundle of wood or a half filled drinks bottle of kerosene.

With the cost of a residential cylinder of gas, together with a traditional LPG stove, being out of reach from most of the population a private company took the initiative and ran a trial based on selling very small quantities of LPG using a vending machine.

The result was the opportunity to sell a very small quantity of LPG for the same amount that a bag of charcoal would cost.

There are some serious safety issues involved with the concept and these have still not been resolved. The initiative is described here because of its potential ability to break through the entry barrier for the most impoverished section of the population.



### '... Micro Fill ...'

Pima is a Swahili word meaning 'to measure'. The concept of selling small quantities of LPG to consumers who can only afford wood, charcoal and kerosene presents a potential 'game changer' for the LPG industry. The challenge to the industry is to control the process to allow LPG to be presented to the consumer in a safe and sustainable manner enabling clean, modern household energy to become a reality for consumers currently reliant on wood, charcoal and kerosene.

The initiative provides the consumer with an entry point into LPG usage through a small volume dispensing model.



*There are many concerns about the dispensing model but the concept of selling small quantities of LPG to traditional fuel users does break down the barrier to entry.*

The pilot programme to trial this initiative of dispensing small quantities of LPG through vending machines was located in low income areas of Nairobi, on the outskirts of the city, in 2010.

The initiative followed extensive research and development over a period lasting more than 24 months. The research centred on the access to and utilisation of clean modern energy services amongst low income households in Kenya focusing specifically on LPG.

The market surveys and feasibility studies that were conducted highlighted the fact that any viable solution to traditional biomass would have to be a close substitute in terms of cost, units purchased and distribution model.

Charcoal for example is currently bought by the consumer in small tins or plastic bags. Typically the cost of a tin of charcoal shown in the photo opposite would be 50 Kenyan shillings.

The dispensed LPG was positioned as a substitute for charcoal and kerosene in all key aspects including; hardware (sold ready to use - cylinder, burner, stand and grill), distribution (reach, place and units of purchase), supply chain (availability, ease of access) as well as cost.



*Charcoal being sold on the street in Nairobi.*

### **Important note:**

It has to be stressed that the inclusion in this report of the dispensing model does not provide endorsement of the practice. There is much work to be done if that is to be achieved. However the concept of marketing small, affordable quantities of LPG to a population that currently sees the product out of reach is compelling. The challenge is to be able to do this in a safe and sustainable manner.



Marketing efforts focused on the street with demonstrations by trained staff to potential consumers.

The supply chain is direct - eliminating the multiple middlemen that characterise the supply chains of wood, charcoal and kerosene - by having at most two levels (wholesaler and vendor) between the company and customers.



A 1kg LPG cylinder and stove that forms the package.

The model was built around a portable LPG dispenser, affordable LPG hardware, the partial filling concept (the 1kg cylinder is topped up or refilled at the dispenser with as little as 100 grams) and a rigorous and continuous consumer education programme.

Dispensers were placed at authorised vendor outlets in selected locations in close proximity to consumers allowing them to switch from biomass and kerosene at a price point that was within their means and eliminated the challenge of having to travel long distances in search of cooking and heating fuel.

Programmes geared towards educating vendors and consumers on LPG storage, handling, basic cylinder testing and emergency response were developed.

These programmes are also aimed at sensitising the public on the dangers of burning biomass and kerosene in confined spaces as well as on the benefits of LPG over biomass and kerosene through the use of demonstrations.

Feedback today from the company that initiated the concept is that, although there are several more sites dispensing LPG in Kenya in this manner, many consumers have now moved away from the dispensing model and upgraded to the traditional LPG cylinder exchange programme.



Although the microfill concept is not endorsed by the WLPGA it does create the opportunity of moving away from potentially more hazardous operations.



## 8.7 Peru

'... Cocina Perú ...'

### Summary

- 30m population
- Heavy dependence on firewood and kerosene for cooking in rural areas
- Government launches Cocina Perú
- Programme targets nearly 1 million people to switch from traditional fuels to LPG
- LPG kit consists of 10kg LPG cylinder, regulator, hose and stove
- Coupons issued to redeem for 10kg of LPG
- Heavy emphasis on LPG demonstrations and safety training
- Programme supported by Repsol



### COUNTRY BACKGROUND

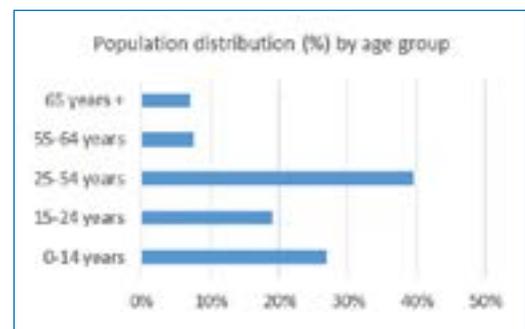
Peru has some prominent neighbouring countries that includes Brazil, Chile Colombia, Bolivia and Ecuador. Its population of over 30 million is mainly Amerindian (45%) and Spanish is the main language. Over 80% of the population are Roman Catholic.

Peru's urban and coastal communities have benefited much more from recent economic growth than rural, Afro-Peruvian, indigenous, and poor populations of the Amazon and mountain regions. The poverty rate has dropped substantially during the last decade but remains stubbornly high at about 30% (more than 55% in rural areas). Peru's malnutrition rate began falling in 2005, when the government introduced a coordinated strategy focusing on

hygiene, sanitation, and clean water. However many poor children drop out of school to help support their families.

Peru was a country of immigration in the 19th and early 20th centuries, but has recently become a country of emigration. More than two million Peruvians have emigrated in the last decade, principally to the US, Spain, and Argentina.

Peru's economy reflects its varied topography - an arid lowland coastal region; the central high sierra of the Andes; and the dense forest of the Amazon, with tropical lands bordering Colombia and Brazil.



*Over 45% of the population are under 24 years old.*

A wide range of important mineral resources are found in the mountainous and coastal areas, and Peru's coastal waters provide excellent fishing grounds.

Peru is the world's second largest producer of silver and third largest producer of copper. The Peruvian economy has been growing by

an average of 5.6% for the past five years with a stable exchange rate and low inflation.

Dependence on minerals and metals exports, and imported foodstuffs, makes the economy vulnerable to fluctuations in world prices. Inequality persists and continues to pose a challenge to the goal of social inclusion and a more equitable distribution of income. Poor infrastructure hinders the spread of growth to Peru's non-coastal areas.

Since 2006, Peru has signed trade deals with the US, Canada, Singapore, China, Korea, Mexico, Japan, the EU, the European Free Trade Association, Chile, Thailand, Costa Rica, Panama, Venezuela, concluded negotiations with Guatemala, and begun trade talks with Honduras and El Salvador, Turkey and the Trans-Pacific Partnership.

Peru also has signed a trade pact with Chile, Colombia, and Mexico, called the Pacific Alliance. Since the US - Peru Trade Promotion Agreement entered into force in February 2009, total trade between Peru and the United States has doubled. GDP per capita in 2013 was estimated at US\$11,100, a rise from the previous year (US\$10,700).

## LPG INDUSTRY IN PERU

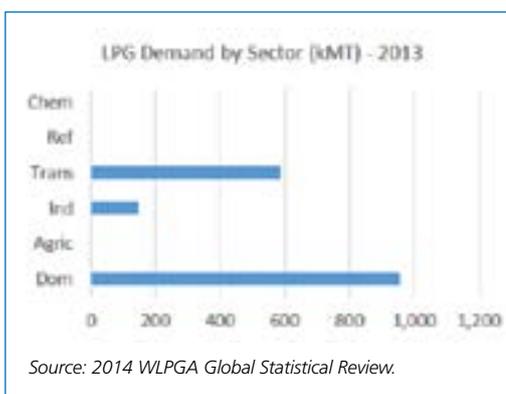
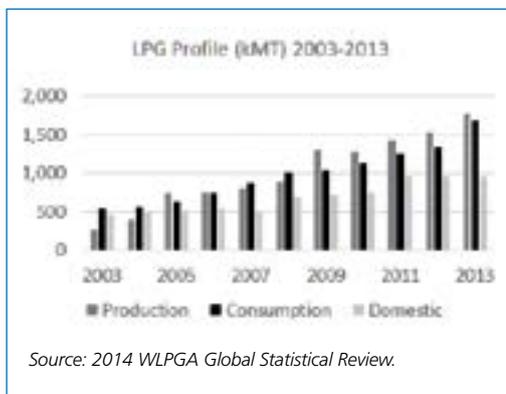
The LPG industry started in Peru in the late 1930's.

In 2013, the latest published statistics from the WLPGA indicates that 165kMT was produced from local refineries and 1.6mMT from natural gas. The country's principal LPG producers include state-owned oil company Petroleos del Peru, Argentina's Pluspetrol, Repsol YPF's La Pampilla refinery, US Aguaytia and Spain's Empresa de Energia Peruana (EEPSA).

LPG demand in 2013 was reported as 1.7mMT and 230kMT of LPG was exported.

LPG demand is mostly from the residential sector (953kMT in 2013) with the rest industrial (148kMT) and transport (586kMT). The demand for LPG has grown steadily over the last 10 years.

Today the per capita consumption of LPG in Peru is around 30kg/capita.



## '...Cocina Perú ...'

Wood is used extensively as a residential cooking fuel in Peru creating serious health challenges for the local population. In response to this threat from traditional fuels the government responded with a traditional fuels to LPG switching programme.



Soot dangling from a thatch roof created by wood smoke.



Wood smoke from indoor cooking causes serious health issues to Peruvian families. For this 80-year-old grandmother, breathing while cooking for an hour '...is equivalent to inhaling the second-hand smoke of 400 cigarettes...' (Environmental Health News).

The Peruvian Government's Programme of Social Inclusion aims to encourage to use of LPG consumption in vulnerable sectors. It finances this through a Social Inclusion Energy Fund (Fondo inclusión social energético).

In 2012 the Ministry of Energy and Mining in Peru launched a National Family's Kitchen Programme (Cocina Peru).



Phase one of the Cocina project was completed in 2013 with over 300,000 kits delivered.

The objective was to serve as a mechanism of compensation and promotion of access to LPG for families of limited resources. The goal was the substitution of nearly one million families, from kerosene and firewood to LPG, by 2016. The investment was around US\$50m.

The mechanism of this programme is to give access to LPG to families in poverty, by offering them a kitchen kit with a cook stove, gas regulator, hose and a 10kg LPG cylinder.

The campaign started in December 2012 and ran throughout 2013 and 2014. It consisted of the acquisition of over 300,000 LPG kits. This was followed up with a further campaign in 2014 promoting an additional 550,000 kits by 2016.



The kit consisted of a LPG stove, regulator, hose and 10kg LPG cylinder.

The ongoing programme was supported through the distribution of discount coupons of US\$16 for a 10kg LPG cylinder. In support of this government initiative Repsol, through its foundation projects, focused on a twin headed campaign to:

- Convert 16,300 households to LPG and
- Conduct training for 127,400 new users in the correct usage of LPG.

The accumulated investment for this Repsol programme, benefitting 143,700 families, was US\$1.15m. A feature of the programmes was the intervention of the United Nations Office for Project Services (UNOPS) which

conducted field audits to identify areas of improvement.

They noted:

- The importance of safety training and the use of graphics.
- The recipients appreciated the improved quality, ease of use and functionality of the kitchen.
- The recipients valued the impact of LPG on their health, safety and time.
- Cultural barriers remained when switching from firewood to LPG.



Simple graphics are effective to educate new users of LPG in safety

Phase two of Cocina involves the distribution of 550,000 kits during the period 2014-2016. So far 260,000 have been delivered to three regions in the north, central and south of the country. Total investment in phase two is US\$33.7m.

The LPG kits were distributed and experienced staff were on hand to demonstrate how to use them safely and effectively.



The introduction of LPG into the community created huge interest.

The programme attracted huge interest in the rural regions where firewood had been the primary source of energy for the population.



Phase two of Cocina programme is under way now.



## 8.8 Senegal

'... Butanisation ...'

### Summary

- 13m+ population
- Economy heavily dependent on agriculture, phosphates, fertilisers and fish
- Iron ore and oil exploration projects
- Reliance on donor and foreign aid
- IMF supporting reforms
- Unreliable power supplies
- 'Butanisation' policy introduced in 1974 with subsidies and tax exemptions
- 2010 Government report to remove subsidies...
- ...focus on energy, forestry and fiscal measures

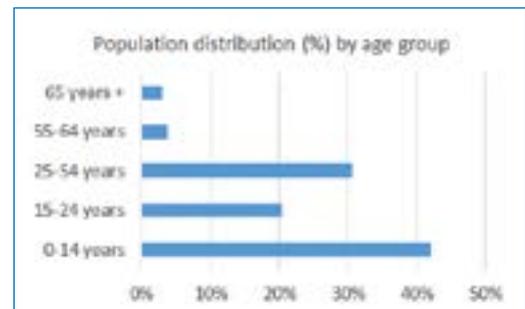


### COUNTRY BACKGROUND

Senegal has a population of 13.6 million with over 60% under the age of 24 years. The economy is heavily dependent on agriculture but exports phosphates, fertilisers and fish. Unreliable power supplies is a problem. So too is the rising cost of living.

This has led to public protests and high unemployment (15% in the 15-24 year range) prompting some migration to Europe.

Senegal has no crude oil reserves but does produce natural gas. The country's capital is Dakar which is located on the western most tip of Africa.



Over 40% of the population are under 14 years old.

### LPG INDUSTRY IN SENEGAL

The LPG market in Senegal has been through several 'boom and bust' cycles since 1974, the year the government launched its 'butanisation' programme. Demand in that year was around 3,000MT.



Traditional wood burning stoves.

The Senegalese LPG market is centred around the country's capital, Dakar. More than 90% of the city's households now use LPG for cooking (ANSD 2006; Sarr and Dafrallah 2006; Sokona et al. 2003) with estimates of around 1.5 million LPG stoves in use.

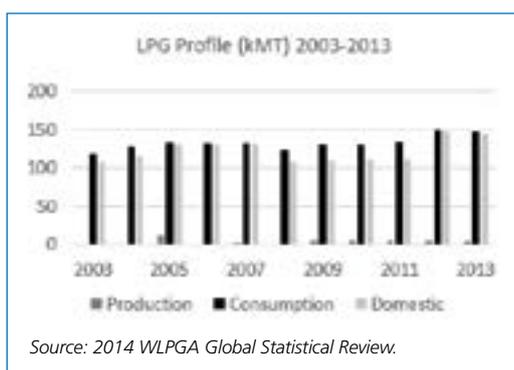
Two thirds of those in the other main urban areas now own LPG stoves.

The Societe Africaine de Raffinage (SAR) has a legal monopoly on the production and importation of oil products in Senegal. Throughout the 1970's, the SAR refinery in the capital Dakar produced enough LPG to meet local demand, which was around 3,000MT/year throughout the decade.

In the 1980's LPG consumption surged leading to the need to import. During this period government measures affected both supply and demand for LPG.

In 2013 LPG demand was over 140,000MT, representing an annual increase of over 10%, and relying almost entirely on imports.

Residential demand accounts for nearly all of this, according to official reports, with some industrial demand.



## '...Butanisation...'

During the early 1970's the environment was on top of the agenda for many Sahelian countries with concern over declining forest cover, soil erosion and local climate changes.

Senegal was facing a severe drought and a deforestation problem. Some of the drivers for this were overuse of grazing and pasture land, the expansion of farming into marginal and ecological fragile areas, bush fires associated with various rural activities and charcoal production.

At that time charcoal and wood were being used extensively (> 60%) across the country as the main energy sources. Household energy accounted for 90% of this, with wood and charcoal use increasing most rapidly in urban areas where populations were growing fastest.

In a survey of village women carried out in the 1990's, charcoal producers were seen as the 'bad guys'. They were being blamed for the destruction of wood and fodder, conflicts over water rights, the disappearance of game species and social problems.

It was recognised that although stopping charcoal production in Senegal would not halt land clearing, it was believed that it was a key cause of environmental degradation in the country.

The government needed to respond. It did so by devising strategies aimed at reducing the impact of biomass energy use through inter-fuel substitution, improved efficiency of wood stoves and charcoal kilns, and improved woodland management. This was the birth of the 'butanisation' programme.

The goal of the 'butanisation' programme was to increase LPG consumption and decrease the reliance on biomass, particularly among the most vulnerable, low income, sections of the population. At that time wood and charcoal represented around 60% of total energy consumption in Senegal.

At the time of the 'butanisation' programme the standard LPG package available for residential use was a 12.5kg cylinder, regulator, hose and stove. Not only was the cost too high

for the low and middle income households, it was also unsuitable for their cooking habits.

The government first allowed LPG equipment to be imported tax free and promoted LPG cooking appliances based on a 2.75kg cylinder, regulator, hose and simple cooking stove called the 'Blip Banekh'. The stove was screwed into the top of the cylinder.

The initial package was found to be unsuitable because the cylinder was too small and the design flimsy. Initially the uptake was slow and the scheme was later expanded to include a LPG subsidy (80%) for the 2.75kg cylinder.

The scheme was later further extended to include a more robust cooking stove together with a LPG subsidy (60%) for the 6kg LPG cylinder. It was thought that the 6kg cylinder was better suited to the cooking habits and income levels of the population and the subsidy made LPG cheaper, on an energy equivalent basis, than both charcoal and kerosene.

**'Butanisation'** - The effect of the LPG programme in Senegal was to substitute part of the charcoal consumed in urban areas with LPG. The government support was initially focused on customs duty exemptions on LPG equipment. Later, LPG subsidies were introduced. As the programme developed, cooking appliances was also subsidised. The programme led to a remarkable increase in LPG consumption. Nearly 85% of households in Dakar, and 66% of those living in other urban areas now own LPG stoves. Although the programme has not fully replaced other fuels with LPG it has at least encouraged some diversification of cooking fuels and brought significant environment benefits. However subsidies have now been phased out.

The use of fuel subsidies, and equipment and appliance subsidies, to encourage switching away from traditional fuels has been a common approach by developing countries in the past.

The cost of this has often been justified by the benefits to the environment, improvements in health and the support they provide to low income families.

In order to keep LPG prices stable, against a fluctuating international price, the government subsidises the import parity price at the importer level. LPG is still exempt from VAT and customs duties.



*LPG cylinders in Senegal market*

The government applied two different price structures, one for the 2.75kg and 6kg cylinders, and one for the 12.5kg and 38kg cylinders.

The price structure was set by Presidential decree following joint recommendations from the Ministries of Energy and Trade. The LPG subsidies were financed from taxes on other oil products such as fuel oil.

Initially LPG use was concentrated among the rich households in Dakar, and its vicinity, but over the years the use of LPG has spread to poorer households all over the city and beyond.

However 80% of the LPG consumed in Senegal is in Dakar. About 50% of the urban households now use LPG cookstoves. The reliance on imports has meant that prices are lowest in



*LPG cylinders in Senegal*

the towns near the west coast such as Dakar, Thies and Mbour where internal transport costs are low.

It is in these west coast towns where LPG has become the main cooking fuel because charcoal is brought in from towns as far away as 600km. In other towns LPG remains a back-up fuel for charcoal and wood.

The Senegalese Ministry of Environment estimate that the additional use of LPG has prevented the consumption of about 70,000MT of wood and 90,000MT of charcoal annually, representing a decrease of 15% in the rate of deforestation.

In 1985, the LPG subsidies were withdrawn as part of International Monetary Fund (IMF) loan requirements. Two years later, in what has



Gas riots in Senegal

come to be known as the 'gas riots', crowds of women marched towards the presidential palace protesting about the cost of LPG. The level of unrest was such that the subsidy was hastily reintroduced.

The LPG subsidies continued to be funded from taxes from other petroleum products and designed to encourage fuel switching.

In Senegal, after nearly four decades of LPG price subsidies, the International Monetary Fund (IMF) estimated in 2008 that not only were the subsidies fiscally unsustainable (in 2005 the cost of subsidising the consumption of LPG was 0.2 per cent of GDP) they were not hitting their intended target, the low income groups.

The IMF also found that not only were less than 20% of these lower income groups benefitting from the LPG subsidies, over 60% of the higher income groups were receiving the benefit.

According to the World Bank, LPG subsidies have often deterred investment in a number of markets and even led to fuel shortages.

A government report published by the Ministry of Energy in 2010 (*La Politique de substitution du gaz butane aux combustibles ligneux au Senegal*) made a number of recommendations in an attempt to tackle the LPG subsidy issue. It focused on three main policy areas, energy, forestry and fiscal.

### 1.ENERGY POLICY

- A return to the actual prices of the different residential cooking fuels, through the progressive removal of subsidies on the 'popular' packaging.
- Removal of 'price fixing' mechanisms but ...
- ... maintenance of a price fixing limit for LPG – which has become a highly strategic product.
- Replacement of the 'import parity price' by the 'customs declared value' in the price structure.
- Building of new LPG storage facilities enabling economies of scale through the ability to handle larger cargoes and cutting freight costs.
- Promoting the establishment of ... regional LPG filling centres.
- Support by providing revolving credits, improving the household sector and other initiatives targeted to diversify the supply of cooking fuels.

### 2.FORESTRY

- Increasing the price of charcoal until it reflects the real cost of production - including replanting and production of standing timber.
- Development of a taxation formula, equivalent to the price of standing timber and not the final product (charcoal).
- Extending forestry development to other regions where #PROGEDE intervenes and supports new plantations (village forests, trunk roads, private forests, etc...)



*#The Sustainable and Participatory Energy Management project – PROGEDE – was implemented by the Government of Senegal between 1997 and 2004. Study on the cost of supply, transportation, and LPG distribution in Senegal, Trans African technology*

### **3. FISCAL**

■ Exempt LPG from customs duties and value added tax (VAT) at the community level (UEMOA) with a view to harmonising residential energy policies and preventing illegal cross border trade of LPG and LPG cylinders

Although the ‘butanisation’ policy may not have succeeded in fully replacing charcoal and wood, it has at least encouraged the diversification of cooking fuels.

The elimination of the LPG subsidy continues as the private sector takes a more active role in the market.

As a result of competition between companies, LPG prices remain affordable for most households. It is now the primary cooking fuel in most urban households.

A feature of Senegal’s private LPG sector has been the use of smaller, distributed filling plants to serve non-urban areas.

This has given rise to a growing illegal filling/ cross filling problem which will damage the industry and will need attention through the application of good practices, training, standards and enforcement.

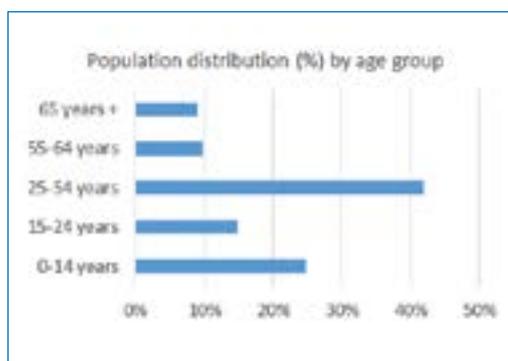


## 8.9 Sri Lanka

'... Tea Change ...'

### Summary

- 22 million population relying mainly on wood
- No natural gas in the country
- Tea industry important for economy and employing 1m people
- Historically poor living conditions
- New initiative to target lpg into this community
- 'Wathu praja diwi naguma' (gas for cleaner cooking & healthy life)
- Supported by local lpg industry
- Based on 5 kg LPG cylinder, easy payments, local availability
- 50,000 families converted during last 18 months
- 200,000 targeted in next 3-4 years
- Major improvements in health, living conditions, productivity and environment



Over 40% of the population are between 24 and 54 years old

Fiscal consolidation efforts and strong GDP growth in recent years have helped bring down the government's debt. Low tax revenues remain a major concern.

The global financial crisis and recession in 2008-2009 exposed Sri Lanka's economic vulnerabilities and nearly caused a balance of payments crisis. Agriculture slowed due to a drought and weak global demand affected exports and trade.

In early 2012, Sri Lanka floated the rupee, resulting in a sharp depreciation, and took steps to curb imports. A large trade deficit remains a concern, but strong remittances from Sri Lankan workers abroad help offset the trade deficit. Government debt of about 80% of GDP remains among the highest in emerging markets.

### COUNTRY BACKGROUND

Sri Lanka has a population of nearly 22 million with 11% living in urban areas. Nearly 75% of the population are Sinhalese and Buddhism is the official religion. Nearly half of the population is in the age bracket 25-54 years.

Sri Lanka continues to experience strong economic growth following the end of the 26 year conflict in the north of the country. The government has been pursuing large-scale reconstruction and development projects in its efforts to encourage growth in war-torn and disadvantaged areas, develop small and medium sized enterprises, and increase agricultural productivity.

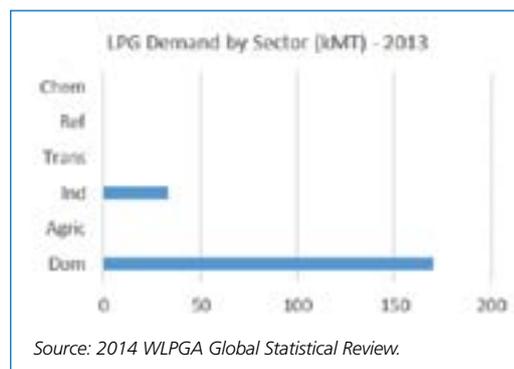
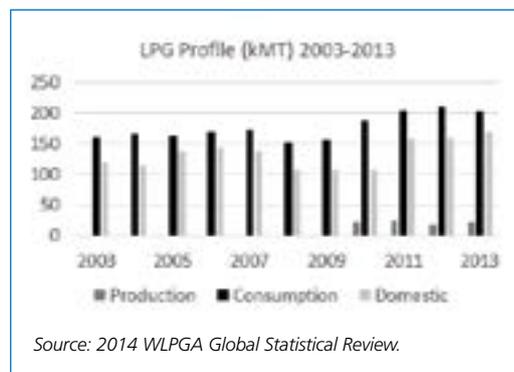
Almost a third of the workforce is employed in the agricultural sector where tea remains one of the key crops. GDP per capita was US\$6,500 in 2013, a rise from US\$6,200 in 2012. This puts Sri Lanka around 145th in the world. Unemployment is around 5% with an estimated 9% of the population living below the poverty line.

Sri Lanka has almost 2.7m kWh of installed electricity capacity with nearly 55% being generated from fossil fuels and 45% from hydroelectric plants. The country has no crude oil or natural gas reserves. It imports crude oil and has 35kbbbl/day of refinery production capacity.

### LPG INDUSTRY IN SRI LANKA

LPG demand in Sri Lanka has grown steadily over the last two decades with the exception of a small fall in 2008-2009.

Since then demand has recovered and is now around 200kMT/year. Demand in 2015 is reported to be strong following the fall in global LPG prices towards the end of 2014.



The majority of LPG is imported and distributed mainly to the residential sector. There is some industrial demand for LPG, for example in the ceramics industry. There is also some Autogas use. Per capita demand for LPG in Sri Lanka is around 10kg/year.

The LPG industry in Sri Lanka is dominated by two companies who have both been instrumental in developing the market to meet the increasing demand.

It is estimated that over 80% of the population still rely on traditional fuels, mainly wood, as their primary energy source which has led to serious deforestation issues.

With the absence of natural gas in the country LPG has great opportunities, especially in rural areas.

Sri Lanka relies on imports and there is a large existing import terminal built by Shell 20 years ago near Colombo on the west coast.

Plans are being drawn up for a larger import facility in the south west of the country.

### '... Tea Change ...'

The tea industry in Sri Lanka is 185 years old. It is critical to the economy and employs around one million people.

Historically tea plantation workers have not enjoyed the best of living conditions with poor housing, water and sanitation.

Their main source of energy is firewood and this generates smoke inside the houses, especially when wet.



Traditional wood burning stove.

Issues associated with burning wood include respiratory and cardiovascular related infections and diseases due to inhaling the smoke. The use of fire wood also causes burns to children and leads to fires, and homes being destroyed.

One of the local LPG companies, Laugfs Gas PLC, explored the possibility of encouraging the switching of wood burning stoves to LPG in 2014. They discovered that women and children collecting wood were being subjected to the risk of accidents, reptile attacks and harassment. Other social issues, apart from health, were the time spent away from their families and the risks from an unguarded wood fire.

Laugfs took the initiative and developed a Corporate Social Responsibility (CSR) switching programme by establishing a small team to conduct further research. The team held discussions with the tea plantation community and discovered that although switching from wood to LPG reflected an elevation of status it was challenged with barriers. These included the high initial cost of switching to LPG, the lack of a dealer network to sustain the business, a lack of knowledge of the product and also a fear of using LPG.

It was also clear that for a LPG company to promote the switching programme a trusted mediator was needed. Laugfs prepared a proposal to the Plantation Human Development Trust (PHDT).



*Sri Lankan tea worker.*



*LPG cylinder and stove being used.*

Laugfs Gas and PHDT developed an initiative called Wathu Praja Diwi Naguma (Gas for Cleaner Cooking and Healthy Life). The scheme is based on a 5 kg cylinder with regulator, hose and stove being supplied to the households in a way that matches their monthly budget by using easy payments by instalments and no initial down payment.



*The 5 kg LPG cylinder can be easily carried when full.*

The size of cylinder was selected because it was sufficient to provide more than three weeks of daily cooking requirements for the family and small enough not to be cumbersome and inconvenient in the kitchen.

The full 5 kg cylinder was also light enough for a woman to carry it back to her home.

### The Plantation Human Development Trust

PHDT was established in 1992 to improve the living conditions of the tea plantation work force and drove initiatives to improve housing, infrastructure, water, sanitation, health, nutrition, child care and schooling.

The LPG cylinders, refill and accessories are made available for the convenience of the community through the Estate Cooperative Societies which are available on each tea plantation.

The Estate Cooperative Societies have emerged as a key Community Based Organisation (CBO) in the country through this initiative and make the LPG proposition available 24/7.

These Cooperative Societies are appointed as sub dealers to the LPG supplier and generate a margin for their service and support to the programme.

An important part of this fuel transition programme was to educate the new users about the characteristics, safety issues and use of LPG as a cooking fuel.



*Education was an important part of the launch with hands on demonstrations.*

Laugfs conducted pilot project selecting the Hatton region in the Nuwara Eliya District of Central Province. The pilot consisted of educational programmes to promote the benefits of LPG, examined the type of dealer network required and other logistical and impact criteria. Following the pilot project the programme was rolled out to other areas.

A customer service support group constantly monitors the whole process and conducts monthly evaluations.

As the programme focuses on social and welfare benefits it is considered a CSR initiative of Laugfs Gas. This enables the company to secure special rates from suppliers for the equipment. Managing the costs of this initiative is an important consideration.



*The initial package includes a 5kg cylinder, regulator, hose and cook stove.*

According to a spokesman for Laugfs Gas, the result has been dramatic improvements in air quality in the home, leading to improved health of the workforce who now breathe more easily. During the last 18 months 50,000 families have been converted and the balance, 200,000 families, have been targeted over the next three to four years.

For Laugfs Gas there are some positive benefits: LPG penetration is increased to new users, the concept can be applied to other sectors (rubber, coconut etc.), the CSR aspect enhances the brand and raises awareness, and partner relationships are developed.

Some negative aspects include cash flow issues, and opportunity costs where staff could be applied to more financially attractive projects.

For the consumer LPG has been found to be more efficient than firewood through the ability of the housewife to turn the flame down, or off, when there is no cooking to be done. Unlike firewood which cannot be 'turned down' and requires the fire to be sustained throughout the day, wasting energy and polluting the home.

The introduction of LPG also reduces the damage to the environment through less tree felling and improved air quality.

The task of chopping wood has also brought a safer environment with less personal injury and reduced fire risks, and also attendance at work has improved improving the productivity of the workforce.



*The transition from wood to LPG in the tea plantation industry of Sri Lanka has made a significant impact on a very large rural community in a vital part of the country's economy*



## 8.10 Turkey

'... The Educator ...'

### Summary

- Approximately 80m population
- 3.5mMT LPG demand but dominated by Autogas
- Residential LPG sector in decline for last ten years
- 25% of population under 14 years old
- Primary school education is a challenge in remote mountainous rural areas
- Government developing a programme to convert heating in these schools from traditional fuels to LPG
- Aim is to improve air quality, increase attendance and educate children about clean energy
- Potential target of 3m



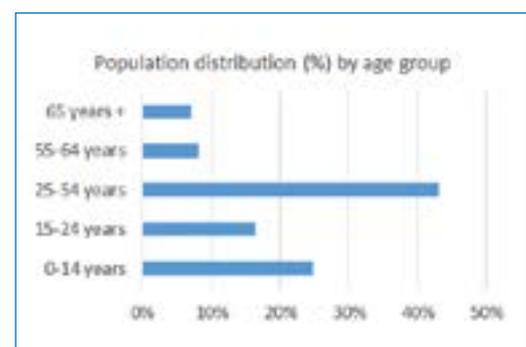
### COUNTRY BACKGROUND

Turkey has a population of approximately 80 million which puts it in the top twenty most populated countries in the world.

The country straddles the East and West, having borders with countries that include Bulgaria and Georgia.

Turkey's largely free-market economy is driven by its industry and service sectors, although agriculture still accounts for about 25% of employment. An aggressive privatisation programme has reduced state involvement in basic industry, banking, transport and communications.

Traditionally textiles and clothing have been an important part of the economy but automotive, construction, and the electronics industry are becoming more important.



Over 25% of the population are under the age of 14 years.

Oil began to flow through the Baku-Tbilisi-Ceyhan pipeline in May 2006 and brings up to one million barrels per day from the Caspian to market.

Several gas pipeline projects will transport Central Asian gas to Europe through Turkey, which over the long term will help address the country's dependence on imported oil and gas.

The government has adopted financial and fiscal reforms as part of an IMF programme which has strengthened the country's economy. Turmoil within some of the countries in Turkey's neighbourhood threatens the economy and investor confidence.

## LPG INDUSTRY IN TURKEY

The LPG industry in Turkey is dominated by its use as Autogas, a road transport fuel. Turkey has the largest Autogas market in Europe and is second to South Korea as the largest Autogas market in the world.

Total demand for LPG exceeded 3.5mMT in 2013 but nearly 2.8mMT was used as Autogas. Residential demand was around 0.8mMT with a small amount being used in the industrial sector.

Residential demand peaked at 1.8MT in 2004 but since then has slowly declined. The expanding natural gas grid is the main reason behind the decline.

With GDP per capita around US\$15,300 the expectation is that LPG demand would be greater than 12kg/capita.



This has provided a stimulus for creating an opportunity for development of LPG in the rural sector, particularly in some of the more mountainous regions.

## '...The Educator...'

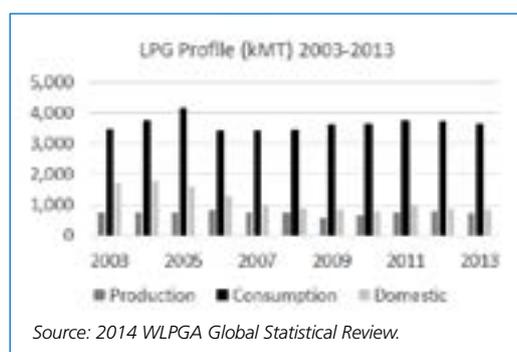
Rural populations represent 70% of the world's poorest people and 72% of the population of the least developed countries. Rural/urban inequalities are a major obstacle to sustainable development. Rural areas comprise human settlements of less than 10,000 people and the rural space is dominated by farms, forests, water, mountains and/or deserts.

Typically, rural people depend on agriculture as farmers, nomadic herders, or fishermen; they deal with animal production, transformation and marketing of food and non-food agricultural products and services. Rural communities are diverse culturally, socially and economically.

Their labour is cheap because gainful employment options are limited. Usually rural people lack access to adequate basic social services because they lack a political voice and rural areas have a low national priority.

In Turkey it is estimated there are over one million students attending schools in some of the most challenging parts of the country where temperatures drop to below freezing and heating is needed for two thirds of the year.

These schools have typically four or five classrooms with around 100 pupils. Wood and charcoal stoves are used for heating and the air quality is poor and the classrooms frequently cold. The use of traditional fuels also creates the need for high maintenance.



Following discussions between the LPG industry, the Turkish energy market regulatory authority (EMRA) and the Ministries of Education and Health, a plan has emerged for a switch from these traditional inefficient stoves to LPG fired heaters, especially in the regions where natural gas is not present.

This initiative is included in this report, not because it is an existing case study, but because it is an example of an initiative where several stakeholders have joined together to find a solution that will not only improve the health of young people but it will also create a better environment to encourage better education for the rural population and create a platform for the children to communicate the benefits of LPG over traditional fuels back to their families.

According to the Constitution of the Republic of Turkey every citizen has the right to education and this is free of charge, and compulsory, at primary level except in specially licensed and foreign institutions.

The Ministry of National Education (MEB) runs the educational administration of Turkey and is responsible for drawing up curricula, coordinating the work of official, private and voluntary organizations, designing and building schools and developing educational materials.

Although primary education is compulsory from age five, pre-primary education (three to five years) is only optional. Creating a pleasant environment for pre-primary school children will discourage non-attendance.

The purpose of education at pre-primary level is to ensure physical, mental and sensory development of children and the acquisition of good habits. It is also to prepare children for primary education, to create a common atmosphere of growth for those living in inconvenient and challenging circumstances.

Pre-primary education is provided in kindergartens, day care homes, nursery classes within primary schools, and in private nurseries. They are all under the supervision of the Ministry of National Education and usually concentrated in larger towns and cities.

EMRA and the Ministry of National Education are raising a new and innovative project with the LPG industry targeting traditional fuels. The idea is to convert the schools in some of the most challenging rural areas from using charcoal and wood to LPG.

According to both industry and government representatives the aim of the initiative is to focus on a number of schools with the objective



*Schoolchildren in Turkey [photo courtesy of UNICEF]*

of improving the health and reducing the mortality rate within this young age group, improving the attendance level at school and increasing the effectiveness of the children's education through better classroom conditions.

One of the key reasons for the success behind the initiative is that the promotion of the use of LPG to displace traditional fuels has not been hidden. It is a key driver for several of the stakeholders, especially the LPG industry and EMRA. For the government the prize is the opportunity to improve the well-being and quality of life of a significant part of the Turkish population through improved health (improving infant mortality rates) and education.

In order for the scheme to move forward, the old traditional wood/charcoal fired stove has to be replaced by a LPG system that includes a LPG storage tank (with sufficient capacity to provide energy throughout the winter months when access is difficult for a bulk LPG tanker). The cost of switching the old system to LPG is estimated to be around US\$30,000 for each school. The plan is for this to be funded by the LPG industry for a certain period of time while some tax concessions will be granted by the government.

These remote mountainous regions are also susceptible to natural disasters and the use of LPG as an energy in these circumstances are well documented (ref WLPGA report).

With up to 8,000 schools and an average family size of 4.2 people the potential reach of this programme is significant, with over three million people benefitting.

By focusing on schools the government is not only targeting the next generation, they are using that generation to carry the message of cleaner fuels for the kitchens back to their homes and educating their families.



## Appendix One – WLPGA/UNDP Rural Energy Challenge

Over ten years ago the WLPGA worked with the UNDP on a project called the Rural Energy Challenge. This was a public/private partnership aimed at addressing the lack of access to clean energy and improving living standards through the use of LPG.

The target group was populations living in rural and peri-urban areas of developing countries and the aims were to identify and address barriers to rural, and peri-urban, market development.

Access to energy was identified as a key issue in meeting basic needs. These included cooking and heating in the home, tackling household tasks such as pumping water, manufacturing bricks and ceramics and supporting social services including health care and education.

Seven countries were selected for multi stakeholder workshops with the objectives of:

- 1. Initiating dialogue between the public and private sectors, and consumers.**
- 2. Agree priority actions to remove barriers to development.**
- 3. Identify projects to demonstrate feasibility of rural market development.**

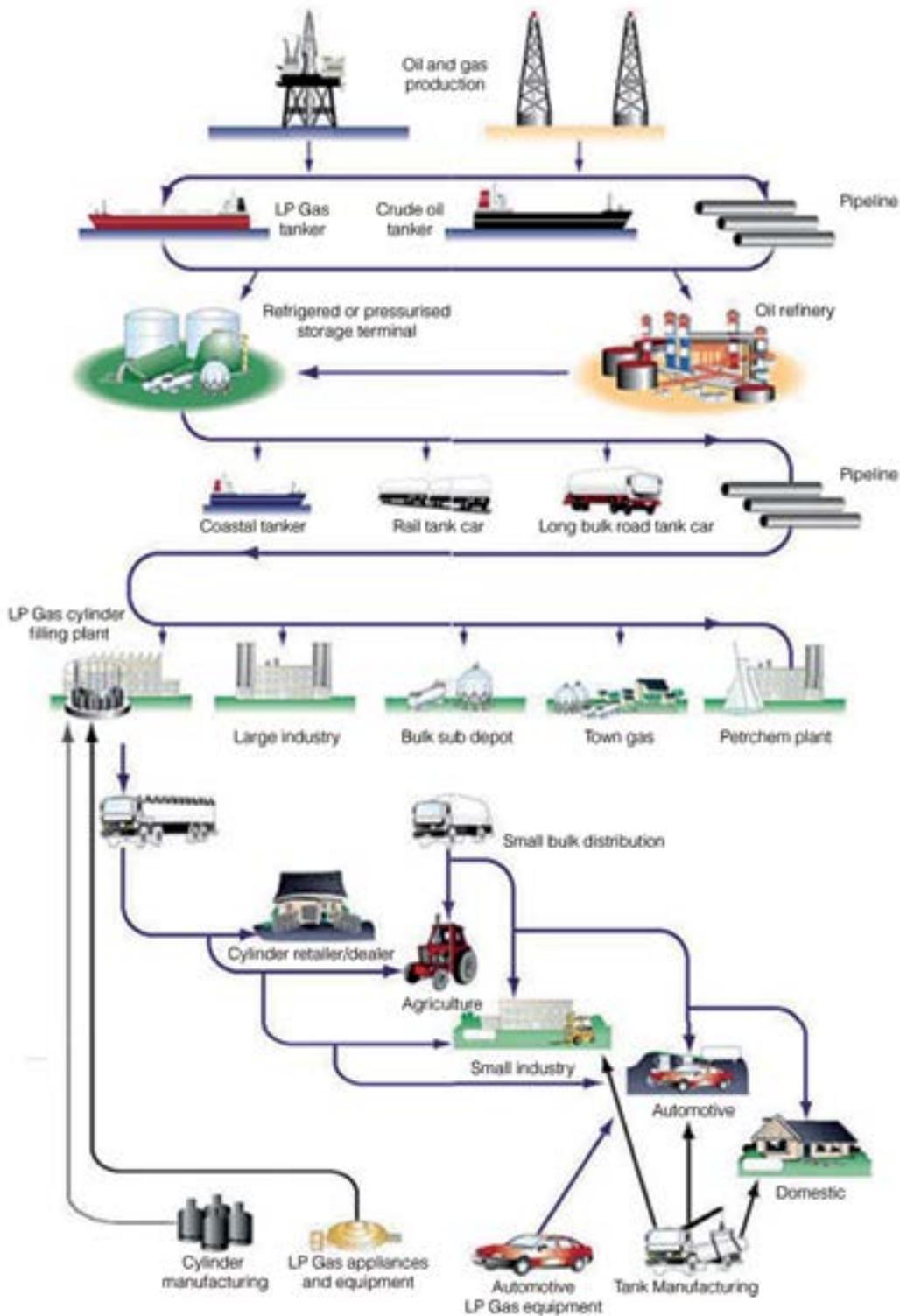
These workshops were held over a period of four years in Ghana and Honduras (2003), South Africa, Morocco, and Vietnam (2004), China (2005) and Turkey (2007).

Despite the cultural diversity across these countries the outcome of the programme highlighted similarities in terms of barriers to penetration of LPG. These were:

- 1. Low density of LPG target population.**
- 2. Low purchasing power and even sometimes barter communities.**
- 3. Need for local credit facilities.**
- 4. Inadequate cylinder size.**
- 5. Lack of safety culture and poor enforcement of regulations.**
- 6. Strong competition of cheaper alternative energy sources (sometimes subsidised).**
- 7. Inadequate energy State policy to stimulate LPG development (sometimes driving major players away).**
- 8. Weakness of LPG distribution networks in remote rural area.**



## Appendix Two – Typical LPG Distribution Channel



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