

LPG Policy Document

An analysis of why and how governments encourage the use of LPG in the domestic sectors using examples of policy from a selection of countries

2017



The World LPG Association

The World LPG Association was established in 1987 in Dublin, Ireland, under the initial name of The World LPG Forum.

The World LPG unites the broad interests of the vast worldwide LPG industry in one organisation. It was granted Category II Consultative Status with the United Nations Economic and Social Council in 1989.

The World LPG Association exists to provide representation of LPG use through leadership of the industry worldwide.

Acknowledgements

This document was drafted by Mr. David Tyler of the World LPG Association (WLPGA) with the support from a working group that reviewed and approved the final draft.

The working group consisted of:

Alex Evans	ETG Global, USA
Andrew Ford	SHV Energy, Netherlands
Blaise Edja	Oryx Energies, Switzerland
Davide Cavagna	Cavagna Group, Italy
D C Patra	Bharat Petroleum, India
Ercüment Polat	Aygaz, Turkey
Makoto Arahata	Arahata LPG Consulting, Japan
Manuel Sguazzi	Cavagna Group, Italy
Mauricio Jarovsky	Ultragaz, Brazil
Olivier Levallois	Carbon-Clear, UK

The WLPGA would like to thank this working group for their contributions during the drafting of this report and for approving the final version.

The WLPGA would also like to thank the members in the countries that supplied information to the questionnaire.

This project was coordinated by Mr. Michael Kelly of the WLPGA.

Contents

	Acknowledgements	1
	Contents	2
	Glossary	4
	Executive Summary	5
	Introduction	8
	Objectives of the Report	11
	Approach and Scope	12
	Structure of the Report	13
	PART A: MAIN FINDINGS	15
1	LPG - The Product	15
1.1	Key properties and characteristics	15
1.2	Relative performance versus other fuels	16
1.3	An Exceptional Energy	17
1.4	An area of high growth potential for LPG	19
1.5	The Case for LPG	20
2	Global LPG Market Overview	22
2.1	Production sources and trade routes	22
2.2	Country demand by sector and per capita	26
2.3	Main drivers for LPG demand	28
3	LPG Roadmap	31
3.1	Why an LPG Roadmap?	31
3.2	Realising the Potential of LPG	33
3.3	Managing Financial Incentives	33
3.4	Regulatory Policy and Measures	35
4	The Impact of Bad Business Practices	36
4.1	Typical bad practices	36
4.2	Impact on the business	38
4.3	The role of government and industry	39
5	Guidelines for Policymakers	41
5.1	The rationale for promoting LPG	41
5.2	Critical success factors for LPG market development	42
5.3	Formulating an effective LPG strategy	44
	PART B: COUNTRY SURVEYS	47
1	Australia	48
1.1	Market overview	49
1.2	Control of LPG assets	49
1.3	Regulatory framework	50
1.4	Government incentive policies	50
1.5	Competitiveness of LPG against other fuels	51
1.6	Recommendations for improvement	51
2	Brazil	52
2.1	Market overview	53

	2.2	Control of LPG assets	53
	2.3	Regulatory framework	54
	2.4	Government incentive policies	54
	2.5	Competitiveness of LPG against other fuels	55
	2.6	Recommendations for improvement	55
3		Hong Kong	56
	3.1	Market overview	57
	3.2	Control of LPG assets	57
	3.3	Regulatory framework	58
	3.4	Government incentive policies	58
	3.5	Competitiveness of LPG against other fuels	59
	3.6	Recommendations for improvement	59
4		India	61
	4.1	Market overview	62
	4.2	Control of LPG assets	63
	4.3	Regulatory framework	64
	4.4	Government incentive policies	64
	4.5	Competitiveness of LPG against other fuels	65
	4.6	Recommendations for improvement	66
5		Japan	67
	5.1	Market overview	68
	5.2	Control of LPG assets	68
	5.3	Regulatory framework	68
	5.4	Government incentive policies	70
	5.5	Competitiveness of LPG against other fuels	70
	5.6	Recommendations for improvement	71
6		South Africa	72
	6.1	Market overview	73
	6.2	Control of LPG assets	73
	6.3	Regulatory framework	73
	6.4	Government incentive policies	74
	6.5	Competitiveness of LPG against other fuels	74
	6.6	Recommendations for improvement	75
7		Turkey	76
	7.1	Market overview	77
	7.2	Control of LPG assets	77
	7.3	Regulatory framework	78
	7.4	Government incentive policies	78
	7.5	Competitiveness of LPG against other fuels	78
	7.6	Recommendations for improvement	79
8		UK	80
	8.1	Market overview	81
	8.2	Control of LPG assets	81
	8.3	Regulatory framework	81
	8.4	Government incentive policies	82
	8.5	Competitiveness of LPG against other fuels	83
	8.6	Recommendations for improvement	83

Annex 1: References**84**

Glossary

ADEME	French Environment and Energy Management Agency
AEGPL	European LPG Association
CNG	Compressed natural gas
CO	Carbon monoxide
CO ₂	Carbon dioxide
EMRA	National Energy Market Regulatory Authority (Turkey)
GGSP	Global Gas Sharing Reduction Partnership (World Bank)
GHG	Greenhouse Gas
GLR	Gas Liquid Ratios (GLR)
HC	Hydrocarbons
IEA	International Energy Agency
LPG	Liquid petroleum gas
NG	Natural gas
NOx	NO and NO ₂ (nitric oxide and nitrogen dioxide)
NFPA	National Fire Protection Association (USA)
OEM	Original equipment manufacturer
PM	Particulate matter
SNG	Synthetic natural gas (LPG/Air)
WHO	World Health Organisation
WLPGA	World LPG Association

Executive Summary

'...The overriding challenge for the industry is for LPG to have a compelling proposition...and to have that proposition understood not only by the consumer but by policy makers ...'

This document provides guidance for governments and Liquefied Petroleum Gas (LPG) stakeholders to develop sensible governance structures to enable the LPG industry in their country to grow with sound enforceable policy and in a safe and sustainable manner.

The LPG business is capital intensive and one where the packaging (cylinder) is more expensive than the contents (LPG). This can make the entry barrier for LPG high, especially in the residential (domestic) sector.

Ownership of the assets in the business must be protected to encourage investment.

The overriding challenge for the LPG industry is for the product to have a compelling proposition – based on availability, accessibility, awareness and affordability – and to have that proposition understood not only by the consumer but by policy makers.

Nearly half the global demand for LPG is consumed in the residential (domestic) sector. It is used as a primary fuel for cooking and for heating water and homes. There are abundant supplies and most forecasters are predicting a sustained period of low prices barring any major political disruption.

In developing countries LPG competes in the residential sector with traditional fuels such as wood, charcoal and coal. These traditional fuels are often sold to consumers in small quantities because their disposable incomes are limited. The entry barrier for introducing LPG to these consumers can be a challenge.

The Internet of Things (IoT) is creating exciting business models that not only allows small quantities of LPG to be sold to households with limited disposable income, it also eliminates some of the bad practices that undermines the business.

'...LPG needs a Roadmap that clearly sets out an agreed pathway...'

There are hundreds of other applications for LPG in the industrial, commercial, agricultural, transport and chemical sectors. LPG can make major contributions in these sectors to improve air quality in the home

and in the street, reduce greenhouse gas emissions, improve health and quality of life, lift economic activity, improve efficiency and create employment.

Several recommendations have been made to encourage the development of sound policy with a sensible governance structure to ensure the LPG industry grows in a safe and sustainable manner.

- (i) A Roadmap that clearly sets out an agreed pathway for LPG over (at least) the next decade will highlight the advantages that LPG brings across all sectors of the economy to allow it to play a significant role in meeting the country's environmental, health, social and economic targets.
- (ii) The need for policy to be jointly developed between government and the industry and that policy to be consistent over the long term.
- (iii) LPG is an exceptional energy. There is a need for all personnel involved in policy development to have a full understanding of the benefits that LPG brings to society as a clean, powerful, portable and versatile energy source.
- (iv) LPG is a co-product and requires a strong voice to be heard amongst the competing energy options. An LPG association can provide that voice on behalf of the industry. Similarly, governments should have personnel who are focused and support the role that LPG can play.
- (v) LPG champions are needed everywhere. Indonesia and India have demonstrated the power of having champions at the very highest level of government.
- (vi) The proposition for LPG to the consumer must be attractive and compelling. It should be based on availability, accessibility, awareness and affordability.
- (vii) Affordability need not include subsidies. Countries that have introduced subsidies have realised they are expensive to sustain and difficult to target to the end user groups. However, some kind of state sponsored support by way of welfare measures to enable targeted households to cross the threshold level of investment required at the time of initial connection may be helpful.
- (viii) Internationally recognised standards and codes of practice should be used as a basis to develop local regulations for the LPG industry. It is not necessary to re-invent the wheel.
- (ix) Standards and codes of practice must be strongly enforced and there must be the strictest penalties for non-compliance.

- (x) Bad business practices jeopardise investment and prevent the safe and sustainable growth of an LPG industry. They should be stopped.

Introduction

LPG is a co-product from the refining of crude oil and is also extracted from natural gas and oil production.

Traditionally much of the LPG produced during these processes was disposed of through flaring. This not only compromised the environment it wasted a useful and high-quality energy resource.



LPG Flaring still occurs

Although flaring still occurs in some countries, it is being closely monitored by organisations like the World Bank through their Global Gas Sharing Reduction Partnership (GGSFP). <http://www.worldbank.org/en/programs/gasflaringreduction>

Flaring not only generates air pollution and greenhouse gas (GHG) emissions but also necessitates the consumption of equivalent quantities of other fuels.

The increasing uptake of LPG, notably as a cooking, heating and engine fuel, has led to a substantial reduction in global flaring levels.

LPG is a clean, powerful, portable and versatile fuel that can make an important contribution to a country's energy mix by increasing efficiency, improving air quality, reducing deforestation, stimulating the economy, providing jobs, creating a healthier place to live and better standard of living for many people currently reliant on traditional fuels as their primary energy source. Flaring is a waste of a valuable and exceptional energy.

But LPG has been used as a vital energy source for over 100 years and there are many examples around the world demonstrating the LPG industry safely controls its operations, supported by sound and sensible governance.

LPG is readily stored as a liquid, has a very high energy value, can be transported to the most remote locations and burns cleanly with a hot flame which is easily controlled.

These properties make LPG an ideal fuel for cooking, where it finds most use in the developing world, displacing dirty traditional fuels such as wood, charcoal, coal, animal waste and kerosene.

There are hundreds of other applications for LPG in the residential, commercial, industrial, agricultural and transport markets (LPG is a very good engine fuel). LPG is also used as a feedstock for the petrochemical industry.

The properties and characteristics of LPG require it to be treated with care and there is a need for vigilance when storing, handling and distributing LPG. This is achieved through the application of well-established international standards and codes of practice.

These standards and codes of practice need to be fully enforced to ensure that a level playing field exists and there needs to be full compliance by all industry players.

In the absence of sound and enforced policies the LPG industry can be undermined by bad practices. These can include:

- Poorly designed and constructed LPG storage facilities
- Inadequate training of staff
- Unauthorised access to premises
- Use of unsafe containers (LPG cylinders, storage tanks and vehicles)
- Illegal filling (decanting) of cylinders
- Unauthorised acquisition, reworking, and repainting of cylinders
- Under/over filling of cylinders and containers
- Poor maintenance of trucks, plant and containers

Stopping these practices through regulatory and legislative measures will encourage investors to support the industry, enabling it to grow in a well-managed manner, benefiting all stakeholders, especially the consumer.

The LPG industry is capital intensive with heavy investment required to establish storage, handling and distribution facilities. The LPG supply chain may be unbundled for the sake of investment and operation. That would mean private - public participation and private - private participation at different levels throughout the chain.

For LPG to be introduced successfully into countries, especially where per capita consumption is low, there needs to be an incentive for investors to establish the necessary infrastructure and a reassurance that their investment is protected long term.

There also needs to be mechanisms and business models that brings the entry barrier for the LPG proposition down for consumers. The Internet of Things (IoT) has introduced some exciting examples in this arena. Smart valves can now be operated from smart phones to allow small quantities of LPG to be purchased via internet banking.

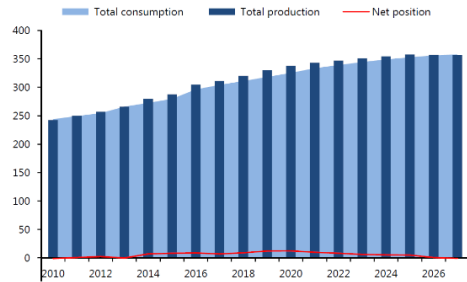


Smart valve on LPG cylinder

Global consumption of LPG continues to grow at around 4% a year with most of it (44% in 2016) being used in the domestic or residential sectors for cooking, and for heating water and homes.

Long term forecasts suggest an abundance of LPG supply giving governments the confidence to commit to long term policies and supporting the inclusion of LPG in their energy mix.

World LPG production and consumption 2010-2027 mn t



Source: 2016 WLPGA Global Statistical Review
Argus Media 2017

The main target for this document are countries where the use of LPG is in

its infancy but it may also be useful for more developed markets by applying it as a checklist for policy review.

Several countries where LPG has played a role in their respective energy portfolios were selected to share their experiences. This has been supplemented with contributions from members of the working group and discussions with some other key stakeholders. Detailed responses from the questionnaires sent to these countries are included in Part B of this document.

The responses include a market overview with a description of the LPG business in that country, and how it has developed over the last ten years including the market structure, supply routes and some information about the LPG equipment.

Several drivers for LPG demand have been identified, including some that are influenced directly by government policy. There is an explanation about how the LPG assets are controlled and a description of the distribution channel.

The regulatory framework is explained with details of the standards and codes used and how they are enforced.

Fiscal policies are explored with details of any encouragement or restrictive policies for LPG. The competitiveness of LPG versus other fuels is also covered together with any general recommendations for policy improvement.

Reference should also be made to the WLPGA document *Guidelines for the Development of Sustainable LPG Markets* that highlights several important issues for Governments and other LPG stakeholders to address:

<http://www.wlpga.org/wp-content/uploads/2015/09/wlpga-guidelines-for-the-development-of-sustainable-lp-gas-markets.pdf>

Objectives of the Document

The objective of this document is to assist governments and other key stakeholders in the LPG industry prepare policy to oversee the introduction and development of the LPG industry.

The document has gathered information from several countries as to why and how those countries, and their governments, encourage (and in some cases, discourage) the use of LPG in the various sectors and to see what works.

The document provides an overview of the traditional global LPG market together with some details of the LPG industry in the selected countries.

The document also includes the comparative performance of LPG versus competing forms of traditional fuels and looks at what drives growth in the LPG business.

It highlights examples of policies that encourage the use of LPG and examines the effectiveness of those policies.

It concludes with some recommendations for policy makers and other stakeholders on how to develop a safe and sustainable LPG industry with sensible and enforceable policies.

Approach and Scope

The working group identified and selected some countries that could provide some examples of how their respective LPG industries have developed and are governed.

A questionnaire was then agreed and sent to the country focal points asking for information.

A draft report was prepared and circulated for comment to the working group.

Structure of this Report

Part A of this report presents the main findings of the study:

- ▶ Section 1 describes what LPG is and some of its key properties and characteristics. It then assesses its relative performance compared with other fuels, particularly competing traditional fuels, and summarises the main advantages. Finally, this section looks at some of the main applications and uses for LPG.
- ▶ Section 2 provides an overview of the current global traditional LPG market showing the major producing countries and trade routes, and country demand by sector and per capita consumption. Some of the main drivers for LPG demand are discussed.
- ▶ Section 3 describes the need for an LPG Roadmap and how to realise the potential of LPG in a country's energy mix; it then describes some measures to make LPG affordable and discusses the issue of financial incentives and how they can be managed. Finally, it emphasises the importance of strong enforcement measures and the need for stiff penalties for non-compliance.
- ▶ Section 4 describes some typical bad business practices that undermines the safe and sustainable development of the LPG industry. It also looks at the impact on the business and what mitigating measures can be employed to eliminate them.
- ▶ Section 5 provides some guidelines for policymakers including the rationale for promoting LPG in the energy mix, setting out some critical success factors for developing LPG markets and formulating an effective LPG strategy.

Part B of the report contains full details from the responses to the questionnaire from the countries selected.

Key issues covered include:

- ▶ Market overview
- ▶ Control of LPG assets
- ▶ Regulatory Framework
- ▶ Government incentive policies
- ▶ Competitiveness of LPG against other fuels
- ▶ Recommendations for improvement

PART A: MAIN FINDINGS

1 LPG - The Product

1.1 Key properties and characteristics

LPG is derived either as a product from crude-oil refining or from natural-gas or oil production. At present, more than 60% of global LPG supply comes from natural gas processing plants, but the share varies among regions and countries.

With both processes, LPG must be separated out from the oil-product or natural-gas streams. LPG is generally refrigerated for very large-scale bulk storage and seaborne transportation as a liquid under moderate pressure, but it is also transported as a liquid in smaller vessels, and stored locally, in pressurised tanks and cylinders under ambient conditions. LPG can reach the most remote of locations and is used all over the world.

The clean, hot flame created by burning LPG, together with the ease of controlling that flame, makes it an excellent fuel for cooking, especially in Asia where it is used extensively for use with woks.

LPG is portable, multi-purpose and has a high energy-to-volume yield ratio. It can be rapidly put into action in the aftermath of natural disasters and humanitarian crises requiring the local availability of energy for heating, cooking or power generation. The Japanese government recognised the importance of this following the tsunami in 2011.



LPG played a key role in providing energy in the aftermath of the Japanese tsunami

The excellent engine fuel properties of LPG enable it to be used as an alternative to gasoline and diesel in a country's transport fuel mix to reduce street air emissions. It is the world's most popular alternative transport fuel to gasoline (petrol) and diesel.



Japanese taxis run on LPG

The hot flame and clean burning nature of LPG also supports many applications in the industrial and agricultural sectors, especially where it comes into direct contact with food.

Industrial applications include glass making, pottery and shipbreaking yards.

Applications in the agriculture sector include weed control, where flames displace toxic chemicals, and as an alternative to diesel in tractors and other farm equipment.

LPG is also an alternative feedstock for the chemical industry where it displaces naphtha in the production of plastics.

1.2 Relative performance versus other fuels

LPG is an immediately available low carbon alternative to conventional fuels. It offers significant environmental advantages, particularly in terms of indoor and outdoor air quality.

LPG has a high unit energy content compared with most other oil products and traditional fuels, and burns readily in the presence of air.



LPG is a very powerful fuel compared to other forms of energy

LPG has a very low carbon footprint and compared to traditional fossil fuels has significant advantages:

- Well-to-wheel analysis demonstrates the advantage of using LPG rather than other fossil fuels: LPG emits 10% less CO₂ than diesel fuel according to the European Commission
- When LPG burns it generates 15% less CO₂ than heating oil, and 36% less than anthracite coal
- In comparison to traditional fuels such as wood and charcoal, in most applications LPG has a substantially lower greenhouse gas (GHG) impact
- According to the French Environment and Energy Management Agency (ADEME), LPG emits significantly less CO₂ than most fuels when used for water and room heating
- When compared to harvested wood, LPG reduces net carbon emissions by 67%
- LPG produces virtually no particle emissions (PM), has low NO_x emissions, a low sulphur content and has very good results for some unregulated pollutants

1.3 An Exceptional Energy

LPG is used in virtually every country in the world, including areas that otherwise would not have access to modern energy. LPG can therefore be used in the most remote areas (mountains, islands, etc), contributing to regional development.

When used as a clean back-up energy, it also accelerates the development of intermittent renewables such as photovoltaic, solar-thermal, wind and small hydro. Furthermore, LPG is a valuable energy resource in emergency situations (earthquakes, flooding, post-war, humanitarian crisis (refugee camps, etc). Refer: <http://www.wlpga.org/wp-content/uploads/2015/10/Disaster-Recovery-Generic-2015-FINAL.pdf>.

As a transport fuel, LPG is the largest alternative automotive fuel in the world, distributed through a network of 31,600 filling stations to fuel more than 26 million vehicles (mainly taxis, passenger cars and buses) in 2016. LPG is also widely used as a clean engine fuel for forklift trucks.

A typical LPG distribution system creates and maintains local jobs across the country. From primary LPG storage facilities, cylinder filling plants, bulk loading bays, through the distribution channel to the consumer.

In Europe alone over 150,000 direct and indirect employees are involved in the 100-year-old LPG industry.

The exceptional properties of LPG have made it a popular fuel for domestic cooking and heating but it also finds use in the commercial, transport (automotive), industrial and agricultural sectors, as well as an alternative to naphtha as a feedstock in the petrochemical industry.

(i) Residential and Commercial

LPG is a clean and easy option for displacing less efficient and less clean traditional fuels. This substitution has an immediate and positive impact on human health, social and economic issues, deforestation and global climate change.

The residential and commercial sector, which comprises water and room heating as well as cooking, is characterised by an extremely high rate of energy consumption. It is the sector where LPG can make the most significant contribution to protecting the environment and human health and improving the quality of life of billions of people.

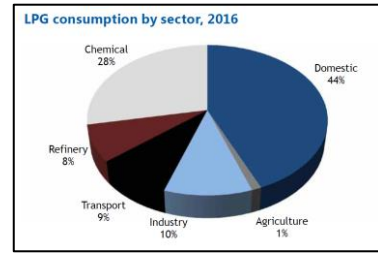


Over 4m people die from indoor air pollution every year

Almost half the world's demand for LPG is in the domestic or residential sector where it is used for cooking, water and room heating. It is in this

sector where LPG, supplied in cylinders from as small as 500 grams, brings most benefits through the displacement of traditional fuels such as charcoal, wood, coal, animal waste and kerosene.

Commercial applications include hotels and restaurants where the same benefits as those in the residential sector attract it as an alternative to traditional fuels for cooking, water and room heating.



*LPG consumption by sector – 2016
(source: Argus -2017)*

In the commercial sector LPG can also be used in combined heat and power (CHP) units, small back-up power generators and fuel cells. For these larger applications LPG can be supplied in bulk with road tankers delivering into small on-site storage tanks.



Skid mounted bulk LPG tank

(ii) Automotive

LPG is already the leading alternative transportation fuel to gasoline and diesel with well over 26 million vehicles running on LPG (Autogas) today.

Autogas makes a significant contribution to improving urban air quality, especially black smoke (particulate matter or PM), NOx, and reducing CO2 emissions from transport.

In addition, LPG, with its extensive reserves derived from natural gas fields, is an ideal substitute for conventional liquid fossil fuels which cannot be easily replaced by renewables.



Diesel emissions are a group one carcinogen to humans (WHO-2012)

Although often seen as an alternative to gasoline there is technology available to easily convert diesel engines to run on Autogas providing a solution to the current problems with the use of diesel in urban areas.

(iii) Industry

There are hundreds of applications for LPG in the Industrial sector where its clean burning properties and hot flame can be utilised.

Popular industrial applications include powering forklifts (both indoor and outdoor), aluminium dye-casting and other metalworking, brick and cement drying, ceramics, distillation, food processing, glass production, industrial heating, waste incineration, laundry, painting (drying/curing/removal), plumbing, roofing and thawing.

(iv) Agriculture

This sector is of importance to the LPG industry as it presents consumers with a modern energy option for those who are located beyond the reach of natural gas piped networks and sufficiently robust electricity grids.

The heavy investment necessary for grid infrastructure means that its development in remote and/or sparsely populated areas tends to be unprofitable and impractical. LPG, with its portability and flexible supply chain, is an essential instrument to facilitate rural development.

A wide range of practical applications for LPG in agriculture already exists. These include its role in crop drying, poultry breeding, thermal desiccation, sanitation, incineration, insect repellent, space (especially greenhouses) and water heating and the fuelling of farm vehicles (as off road Autogas).



LPG used for dairy bed sanitation

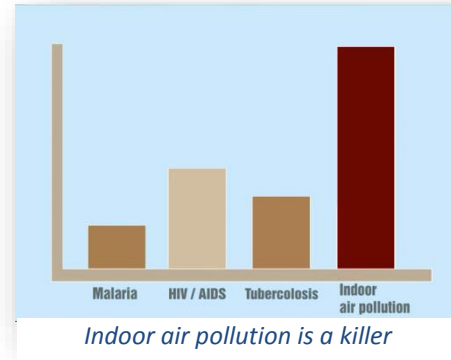
The challenge is to promote the use of LPG in agriculture in these applications where they can make a tangible contribution by replacing conventional fossil fuels, such as traditional fuels, fuel oil, diesel and kerosene, and toxic chemicals.

1.4 An Area of High Growth Potential for LPG

There is an opportunity for governments and the LPG industry to cooperate and identify some key sectors where LPG can make a significant contribution to meeting country's primary energy challenges.

Transitioning away from traditional fuels that are being used for residential and commercial cooking use is an obvious and realistic opportunity delivering comprehensive benefits.

Over three billion people have no access to modern energy and rely on these traditional fuels as their primary source of fuel. The collection and burning of these fuels creates serious deforestation and contributes to climate change.



The burning of them contributes to the 4.3 million deaths from indoor air pollution every year. More deaths than those attributed to HIV/Aids, Malaria and Tuberculosis combined.

LPG can provide an immediate solution to this. The displacement of dirty traditional fuels with LPG brings not just cleanliness in the kitchen but social, economic, health and environmental benefits too.



Cooking with firewood

Women are freed of the drudgery and danger of collecting traditional fuels allowing them to spend more time with their children, or pursue other more purposeful activities. The air in the home is much cleaner, reducing the respiratory dangers of smoke. And forests are saved, especially as the trees cut for firewood are often young saplings.



Women collecting firewood

The WLPGA 'Cooking for Life' programme was launched in 2012 to assist the transition of traditional fuels to LPG by targeting one billion people to switch by 2030.

1.5 The Case for LPG

As the world looks to the future, with all the various energy options available, the case for LPG is clear:

- (i) Ensuring the Protection of the Environment and Human Health
 - Low carbon footprint and emissions
 - Excellent record on air pollution helping to protect human health and reducing the burden on national health systems
 - Displacing traditional fuels and preventing deforestation
 - Releasing women and children from the dangerous and time consuming activity of collecting wood
 - No harmful impact on soil and the marine environment
 - Does not generate waste

- Limited fugitive emissions with negligible impact on the environment and human health
 - Particularly suitable for use with low energy consumption devices
 - Increased uptake of LPG means less environmental damage associated with flaring
- (ii) Ensuring the security of the world's energy supply
- Ongoing development of production and distribution capacity
 - Excellent prospects for long-term availability
 - Increased uptake of LPG means less waste associated with flaring
 - Low vulnerability to supply disruptions
 - A fluid and extensive trading market
 - Wide range of storage options
 - An excellent energy option in a crisis or an emergency situation
 - Increases the diversity of the world's energy mix
- (iii) Stimulating global competitiveness and economic/social development
- Services all aspects of the economy
 - Liberalised and highly competitive international market
 - Contributor in technological innovation and the development of safety standards and codes of practice
 - Significant source of employment
 - Provider of energy for remote areas, boosting regional development
 - Serves as a backup to renewables in remote areas
 - Supports natural gas development with synthetic natural gas (LPG/air)
 - Socially responsible sector promoting safe and efficient use of energy through exchange of best practices and communication with end-users

2 Global LPG Market Overview

2.1 Production sources and trade routes

Remaining proven reserves of oil and gas have more than doubled since 1980. The International Energy Agency's (IEA) *World Energy Outlook* states that the global reserves of gas and oil are more than sufficient to meet projected demand beyond 2030.

Gas reserves are currently equal to approximately 60 years of current production and oil more than 40 years. There are therefore no concerns regarding the availability of LPG in the foreseeable future, and certainly this should be noted in any LPG Roadmap.

It is predicted that in Europe non-fossil energy sources will provide approximately 30% of primary energy consumption in 2030 (with renewable energy accounting for only 10%).

Fossil fuel supplies will remain important with ongoing growth in gas supplies expected to continue until 2040 assuming no major price disruption.

Coal, gas and oil will account for more than 50% of the world's electricity production in 2030 with the gas share increasing to 27%.

The LPG trade is a global market with international price benchmarks such as the Saudi Arabia Contract Price (CP) which is released every month.

LPG suppliers are diverse, with a mix of private and state-owned companies dealing with short & long-term contracts for both small and large volumes as well as spot trades.



LPG bulk tanker offloading

The global LPG trade is robust with low vulnerability to supply disruption. LPG has multiple origins, an extensive dedicated and multipurpose shipping fleet with numerous routes. Once on land, LPG has a flexible supply chain that includes inland or coastal water, rail and road transportation.

This multiplicity of production, transit and distribution alternatives is in stark contrast to the vulnerability associated with fixed transit pipelines and electricity grids.

There are many options for storing LPG through the distribution channel that includes underground caverns, as well as underground, mounded and above ground tanks. This allows a high degree of autonomy throughout the distribution channel and mitigates the risk of supply disruption. In Japan, there is a requirement by government for the private sector to hold 50-day equivalent compulsory stocks and 1.5mMT to be held as a national stockpile.

LPG is stored through the distribution channel in a diverse range of containers, from small cartridges or portable cylinders to large bulk tanks at distributor premises and consumer locations.



Mounded LPG storage facility

LPG is a co-product and often produced well away from the centres of demand. However, the ease that LPG can be transported as a liquid under low pressure allows it to be moved to those regions and countries where there are demand opportunities. Despite this ease of movement, millions of metric tonnes of LPG are flared annually.

With three billion people still reliant on traditional fuels this is a great shame.

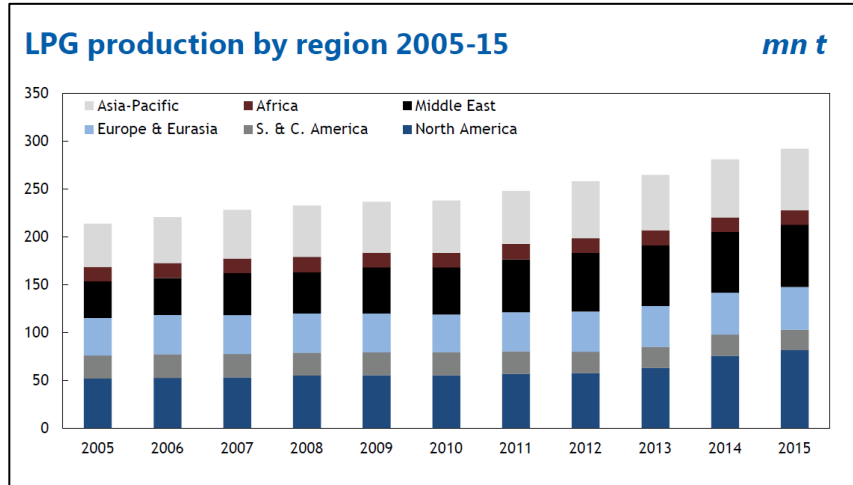
Africa and Asia are two regions where the use of traditional fuels is high and where LPG can play a significant role in displacing fuels like charcoal and wood.

Billions of cubic meters of gas are flared annually at oil production sites around the world when barriers to the development of gas markets and gas infrastructure prevent it from being used. Flaring gas wastes a valuable energy resource that could be used to support economic growth and progress. It also contributes to climate change by releasing millions of tons of CO₂ to the atmosphere. The World Bank Group has a leadership role in gas flaring reduction through the Global Gas Flaring Reduction Partnership (GGFR), a public-private initiative comprising international and national oil companies, national and regional governments, and international institutions. GGFR works to increase use of gas associated with oil production by helping remove technical and regulatory barriers to flaring reduction, conducting research, disseminating best practices, and developing country-specific gas flaring reduction programs

<http://www.worldbank.org/en/programs/gasflaringreductionf>

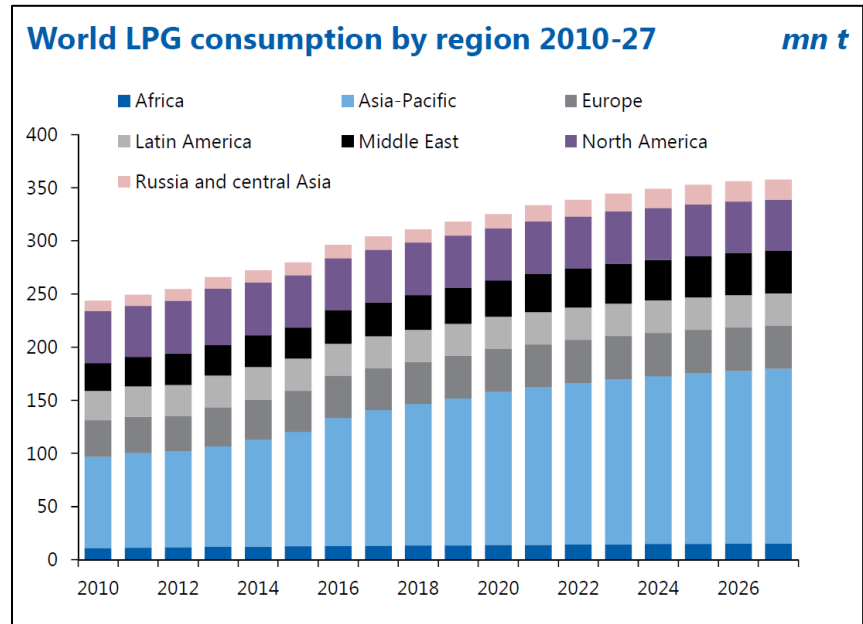
Many new LPG projects, aimed at enhancing both production and distribution capacity, are currently being built and planned.

Furthermore, production of bio-LPG has started and considerable potential for future development has been identified.



LPG production has been growing at a rate of around 4%/year (source: Argus)

Traditionally the Middle East has been the major exporting region for LPG and it still is a significant player. The recent emergence of shale gas in the US though has led to an abundant supply forecast of LPG for the foreseeable future.



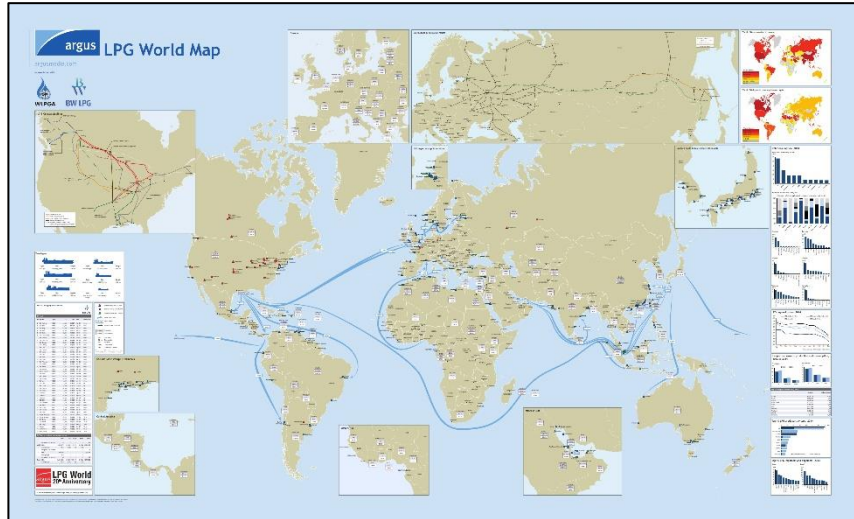
Most forecasters predict abundant supplies of LPG in the future leading to strong demand growth (source: Argus)

The US has gone from a net importer of LPG to a net exporter within seven years.

The expansion of the Panama Canal has opened more competitive trade routes from the US Gulf to Asia leading to countries like Japan to switch suppliers. This competition between the US and the Middle East

producers has resulted in some of the lowest prices seen for LPG for many years.

The forecast by many respected observers in the industry is for a stable period of abundant supplies at low prices. This is a strong message to governments that are considering the role of LPG in their energy mix.



Typical trade routes for global LPG movement by ship (source: Argus)

There are many, mainly developing countries, where the use of LPG is limited. One of the reasons for this is a lack of investment in infrastructure which is needed to bring LPG into the country at affordable rates. Infrastructure such as jetties with sufficient draft and large primary storage facilities allow larger cargoes to be received bringing economies of scale. Larger vessels attract lower unit freight costs to bring down the landed cost of the product. Development of infrastructure provides investment opportunities in the country which creates income and employment opportunities for the people, taking the country on an upward spiral of economic development.

A typical LPG distribution system depends on an extensive road network that enables LPG road tankers and cylinder trucks to reach into most of the centres of population.

Strategically placed LPG cylinder filling plants will ensure reliable replenishment of cylinders for the domestic consumer. Industrial and commercial consumers can be reached with bulk road tankers.

This infrastructure is capital intensive and requires investment which must be justified against projected demand. In most of the developing countries, demand for LPG remains latent, until availability and accessibility is provided. LPG demand is linked to the upward aspiration of people's life style and health consciousness.

Understanding the role that LPG can play in a country’s energy mix and having supportive government policy towards LPG that encourages a level playing field and eliminates bad practices is vital for this investment.

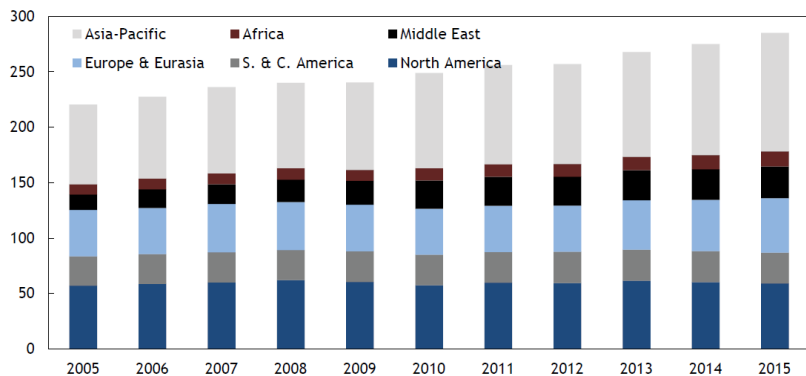
Many countries where LPG has yet to play a role have little or no policies in place to control the development of the industry. In these situations, investors will be cautious because their assets will be at risk of being used illicitly by operators seeking a low-cost market entry without proper regulations and enforcement measures.

2.2 Country demand by sector and per capita

Global LPG production reached over 292MT/year in 2015, a 4% rise from 2014, while global LPG consumption also grew by 3.7% year-on-year to over 284MT/year.

LPG consumption by region 2005-15

mn t



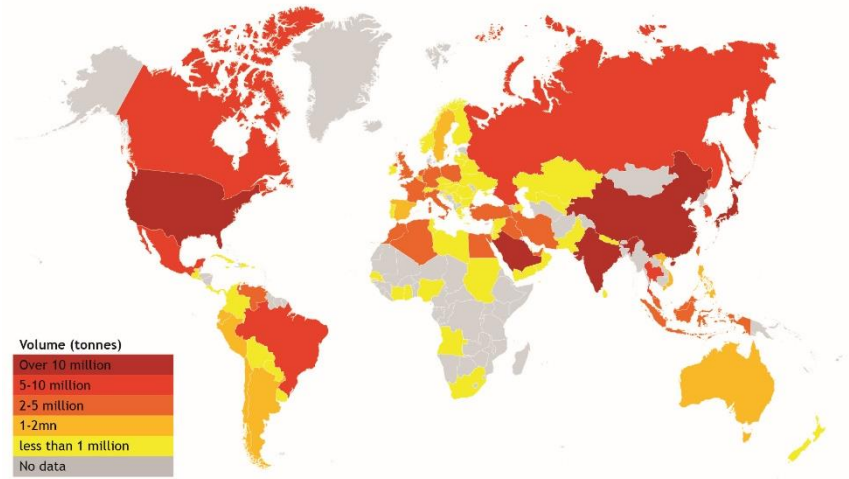
Asia is forecast to consume 50% of the world's LPG by 2021

The single largest LPG consuming region is Asia and it is here where most of the growth is forecast to come from over the next few years.

LPG consumption in North Africa is good but south of the sub-Sahara region has very low consumption.

The following LPG consumption 'heat map' illustrates clearly the countries where the annual demand is greater than 2mMT/year, (marked red). Africa stands out as a region where very little LPG is consumed. The stand out performers are Egypt and Morocco.

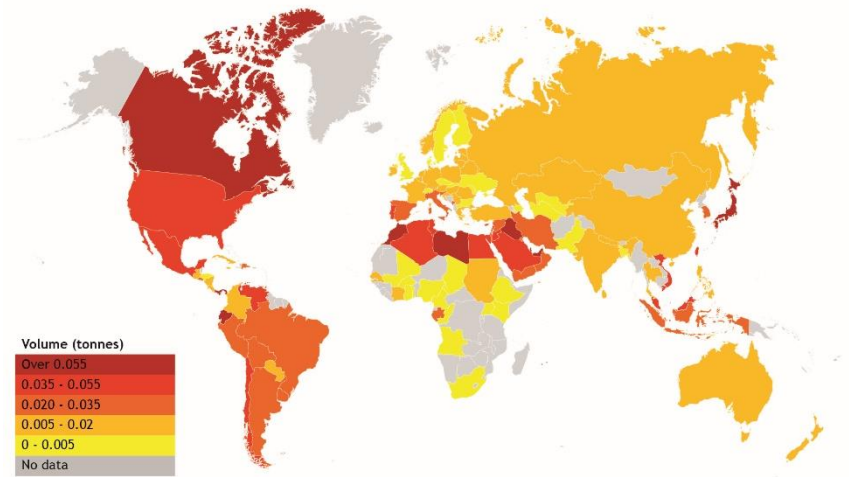
World LPG consumption by volume



Courtesy of Argus Media

However, if the same map is used to examine per capita consumption per year the picture is different, especially in Asia where India and China still have relatively low levels of per capita consumptions.

World LPG domestic consumption per capita



Courtesy of Argus Media

2.3 Main drivers for LPG demand

The safe and sustainable growth in LPG demand is driven by several factors but the key issues are availability, accessibility, awareness and affordability.

▶ Availability

- Availability of the product is obviously critical to sustain demand. Local supplies might be generated from refineries or extracted from indigenous natural gas production. Otherwise the product will have to be imported and an infrastructure will need to be in place to receive it.
- Countries with sea access or rivers will be able to receive product by water. Other options might include rail or road fed imports. Access for large vessels will depend on the necessary draft available. The lower the landed cost of supplies will be a contributor towards keeping the cost to the consumer down.
- Landlocked countries can have access to regional pipelines to get LPG from neighbouring countries or by getting access to nearby ports.

▶ Affordability

- The competing fuel landscape is another major factor when accessing the potential demand for LPG. The availability of low cost conventional fuels is an attractive proposition, especially to populations with limited income in developing countries, and when the entry barrier to transition to LPG appears to be high.
- If natural gas is present in a country this creates a competitive threat, especially in urban areas where grid coverage is most likely. However, natural gas also presents an opportunity for LPG. Blending LPG with air to create a synthetic natural gas (SNG) helps to generate demand before the heavy investment is needed for a distribution network. SNG plants can also present an opportunity to supply during periods of peak demand when tariffs for natural gas are at their highest.
- Advantageous government fuel policy, such as tax differentials, will drive demand. Tax differentials applied to LPG and competing fuels will influence the financial proposition. Kerosene subsidies have shown

to adversely impact residential and commercial demand for LPG.

- The LPG industry is capital intensive and requires safe and affordable equipment. This can be met through either locally manufactured equipment or imports. If the industry is reliant on imported products there should be no need for import duties as there will be no local industry to protect. That situation might change later but unnecessary import duties adds costs and does nothing to keep the entry barrier down for the consumer.

▶ Accessibility

- LPG is very accessible. The product is moved in liquid form without the need for high pressures. It is transported very easily but there must be a distribution network in place. If the centres of demand are distant from the points of supply then distribution costs will rise.
- Supportive government policy that enforces good business practices and eliminates bad practices will encourage investment. This will be important as the need for infrastructure grows and both local and foreign investment is needed. An uneven playing field will deter investment and impact badly on safe and sustainable growth.
- Having accessibility and reach of LPG at any locality or region in a country induces demand. Households will switch from conventional fuel to LPG only if LPG is available consistently and reliably and nearby.

▶ Awareness

- Creating awareness for LPG, and what benefits it brings, is one of the biggest challenges for the industry. This is a critical part of the Roadmap. Not just for the consumer but for the government's policy makers. Lobbyists and LPG associations will have a key role to play here
- For some, the use of gas brings thoughts of danger. Underground coal mining in some countries has contributed to accidents caused by methane leaks and explosions. Creating awareness of a distinctive integrated branded LPG network with a compelling value proposition that gives a safe and secure message

helps to dispel fears, particularly for those consumers using gas, and LPG, for the first time.

- It is important to make schools, universities, colleges and other educational establishments aware of the career opportunities in the LPG industry. The younger generation can bring positive measures back to their families. The industry is manpower intensive requiring skilled and well-trained personnel. Global growth is around 4%/year bringing several million tonnes of new to industry product each year. With that growth comes tens of thousands of new personnel needed to operate terminals, filling plants and delivery trucks etc. This brings a need for education and training to ensure the good safety record of the industry is upheld.
- Large scale use of LPG as a cooking fuel in households in a country helps to eradicate energy poverty, which most developing countries suffer from. Energy poverty is both a cause and consequence of economic poverty.

3 LPG Roadmap

This document provides guidance for governments and LPG stakeholders on developing sensible governance structures to ensure the LPG industry in their country grows with sound enforceable policy and in a safe and sustainable manner.

But, the LPG industry is capital intensive and investors need reassurance that the government policy has been established with clear long-term assumptions and goals and will not be subject to abrupt and unplanned changes.

So first there must be a clear understanding by all parties as to what contribution LPG can make towards the development of the country and how that should be weaved into a long-term vision.

There must be an understanding towards a long-term vision for LPG in the country that considers the benefits the product can bring to the quality of life of people, economy and environment.

This can be achieved by a joint commitment to a Roadmap that sets out an agreed vision for LPG in the country's energy mix, and why.

3.1 Why an LPG Roadmap?

An LPG Roadmap aims to demonstrate the capacity of the LPG sector to play a meaningful role in the country's energy mix, both now and over at least the next decade.

It highlights where the potential contribution of LPG is largest and outlines concrete actions to ensure that this potential is realised.

It clarifies the scale of the contribution that LPG can make to meet such vital challenges as protecting human health and the environment, combating climate change and promoting regional development and employment across the country.

Furthermore, it illustrates ways in which the use of LPG can slow the depletion of fossil fuel resources and reduces the country's dependence on external energy sources.

An LPG Roadmap considers the opportunities for any possible indigenous supplies of LPG from refineries and gas processing and production plants. This might reduce the country's external dependency of importing, or perhaps contain flaring.

It also assesses potential supply lines for importing LPG into the country and the possible impact a developing LPG infrastructure would have on demand in neighbouring countries, especially those land locked.

The potential benefits can only be transformed into reality through a concerted engagement by all relevant stakeholders; namely, industry and public authorities.

This engagement will need to take the form of strategic investment, development of improved supply and distribution chains, fiscal incentives, scientific research and enhanced communication.

Such improvements are not only possible but essential for the future growth of the LPG industry which is committed to working together with all relevant players to bring them to fruition.

3.2 Realising the Potential of LPG

Every energy source should be used for the application to which it is best suited according to its sustainability, availability, efficiency, end-

user needs as well as the protection of the environment and human health.

The impact of energy should be analysed on a complete lifecycle 'well-to-wheels' basis. This allows for the performance of different energy sources to be properly compared.

Close cooperation between the LPG industry, equipment manufacturers and public authorities is essential to maximise the opportunities for LPG, especially with research and development programmes.

One of the responsibilities of government authorities is to promote the growth of clean alternative energies, particularly those not well known to the public.

Similarly, where types of energy create adverse health and environmental issues, such as diesel emissions for instance, authorities have a responsibility to curb their use.

For the LPG industry to plan and function effectively there must be an environment that is conducive to investment. This demands a clear and long term fiscal and regulatory framework within the country.

Regulations should be firm but fair and they should be effectively enforced with penalties for any non-compliance. The objective is a level playing field where competition is encouraged.

When a level playing field exists, and bad industry practices do not, investment will be encouraged. It is the role then of the LPG industry to make that happen.

LPG brings many benefits. Improvements in efficiency, reduction of greenhouse gas emissions, improvement of indoor air quality and street air quality, versatility of applications, to name a few.

Governments are faced with many challenges but understanding the important role that LPG can play in the energy mix is a key one for the development potential of the industry.

3.3 Managing financial incentives

Creating an affordable proposition for LPG is not necessarily the role of government but policy can impact on how affordable the proposition is.

Having unnecessary import duties, that are there to protect local industry that doesn't exist, is one example of poor fiscal policy. There are cases where import duties on LPG cylinders are applied even when there is no local manufacturing facility. This unnecessarily raises the entry barrier for LPG by increasing the cost of the essential packaging.

Governments sometimes provide subsidies for products to facilitate and encourage use. This rarely achieves its objectives. Subsidies typically get absorbed in the distribution channel before they reach the end user. If subsidies are to be used they should be delinked from the

product and, for example, be directly credited to the consumer's bank account, as is being done in India.

When subsidies are provided, and governments then realise they are becoming too expensive as well as ineffective, they are always difficult to remove because of political pressure.

India has had subsidies in place for domestic LPG for many years and has recognised that many people have been taking advantage of subsidised LPG even though they can afford it.

The Indian government's initiative targets subsidies more effectively through their PAHAL scheme which puts subsidies directly in to the bank account of consumers who are entitled to subsidies. This has been backed up by a 'give it up' campaign – supported by the Indian Prime minister – which invites consumers who can afford to pay the market price for LPG to voluntarily give up buying subsidised product.



India's PAHAL scheme

LPG marketing in India always bore the characteristics of being a basic public service provision on a commercial business model, based on cross subsidisation. Recent studies have highlighted the prevailing energy insecurity and crippling energy poverty experienced by households in rural India. However, in the last seven years there has been a massive transformation in rural penetration of LPG, enhancing accessibility and availability of LPG. The issue of affordability was long addressed by a regulated pricing regime, making the product subsidised. The universal and open-ended subsidised pricing led to some distortion, incentivising diversion and creating an unsustainable fiscal burden on the state exchequer. During the last three years, driven by the Indian government, addressed these issues by initiatives like the direct transfer of subsidy into the customer's bank account (DBTL-PAHAL), the voluntary surrender of subsidy (give it up) and in 2016, making provision for the free installation of LPG to targeted households at the bottom of the socio-economic pyramid (*Pradhan Mantri Ujjwala Yojana – PMUY*). These drivers, which have taken place during last few years, caused a silent revolution making India energy inclusive. Indian households, otherwise residing in a deep recess of deprivation, have started to feel for the first time that the agony of energy poverty, entrenched for decades, is finally on the wane.

In 2007, Indonesia introduced a free package of 3kg cylinder with hose, regulator and hotplate to 58 million kerosene users to save the kerosene subsidy. The programme succeeded in switching consumers

from kerosene to LPG but the challenge now is to move some of those users to a market priced proposition called 'Bright Gas'.

Indirect incentives to use LPG can be effective, so too can deterrents. Providing waivers to congestion charges in high emission zones for Autogas vehicles is one example of encouraging LPG use. In the wake of the diesel emission scandal several countries (e.g. UK and France) have announced measures to ban the use of diesel vehicles in urban cities which opens the door for LPG.



Non-subsidised 'Bright Gas'

Governments may encourage the use of Autogas by having a differential excise duty compared to gasoline and diesel. The loss of revenue from a lower taxation of Autogas, or Autogas vehicle sales, may be used by the government as an excuse for not providing fiscal incentives – especially in countries where fuel-tax revenues make up a large share of the overall government budget. In practice, however, any reduction in taxes from Autogas sales can easily be offset by marginal increases in taxes on gasoline and diesel.

Autogas brings benefits in terms of air quality bringing savings in terms of public health expenditure and building degradation, although these are not always easy to quantify.

3.4 Regulatory policies and measures

The LPG industry is over 100 years old and there is a long history of well proven international standards that has been in place for decades. There is no need for governments to re-invent the wheel when looking to regulate the industry.

Good regulation based on recognised and well proven international standards and codes of practice has also to be properly enforced.

Without proper enforcement rules will be ignored resulting in unsafe practices which are not only unsafe but undermine investment.

Any non-compliance must be stopped by strong enforcement measures carrying significant penalties.

In Brazil, penalties for non-compliance are so severe that any illegal filling of competitor cylinders may result in businesses being closed and proprietors being sent to prison.

It is essential that a level playing field is in place to instil confidence, encourage investment and cultivate a safe and sustainable LPG business. Otherwise bad business practices will undermine these goals.

4 The impact of bad business practices

The global LPG industry has developed, over many decades, a comprehensive set of technical and safety standards which are currently used worldwide as a global reference for best practices.

In countries where the use of LPG is limited there is especially a need for the application of good governance by both the LPG industry and the government to ensure the industry develops on a level playing field and in a safe and sustainable manner.

4.1 Typical bad practices

When developing an LPG market, a framework is needed within which LPG is marketed and delivered to consumers in a manner where the customer proposition, based on a safe, reliable and consistent product, is fully met.

Maintenance of the cylinder and storage tank is the responsibility of the owner; proper and safe use is the responsibility of everyone in the distribution chain including the customer.

Within the market framework there is a clear role for a partnership between industry and government. While industry works to provide a sustainable modern energy supply, government should be aware of, and work to rectify, some of the more egregious practices of unscrupulous operators including:

- Poorly designed and constructed LPG storage facilities.

This is one of the more capital-intensive investments in the LPG industry. Poorly designed plants and other facilities can result in unfair competition due to lower capital outlay by unscrupulous operators, and greater safety risk to employees, customers and the public

- Inadequate training of staff.

Inadequately trained staff leads to a high-risk environment, operational errors, and endangerment of customers and the public

- Allowing unauthorised premises/personnel to operate.

LPG plants contain hazardous goods. It is essential they operate in accordance with approved procedures adapted and suited to their environment. Unauthorised operation can lead to inequitable competition, the encouragement of bad practices by others, sub-standard equipment in service, danger to the public and governments being deprived of legitimate revenue

- Use of unsafe containers (LPG cylinders and storage tanks).

LPG containers when constructed to established codes are durable and have a long useful life. When no longer safely usable, they should be made unserviceable. The use of unsafe containers results in unfair competition, a serious risk to the public, and possible litigation for reputable manufacturers

- Illegal filling (decanting) of cylinders.

One of the more destructive practices in the LPG industry is the illegal filling (pirate filling) of cylinders by someone other than the cylinder owner. This dangerous practice can result in:



Cylinders being illegally filled

- No control over the condition of the cylinder
- No control over the quality or quantity of the product in the cylinder
- Serious risk of damage or injury to those handling including the customer, and
- Inequitable and often unsustainable competition.

- Unauthorised acquisition, reworking, and repainting of cylinders.

This practice involves one company stealing the cylinder of another company, repainting it with the brand of that other company, and then re-introducing it into the market. This can result in:

- no control over the cylinder condition,
- serious risk exposure to those handling the cylinder, including the customer
- inequitable competition, and
- loss of assets of the legitimate owner.

- Under-filling of cylinders and containers.

LPG is generally sold by weight, in cylinders, and by weight or volumetric meter in larger containers. Under-filling can be a deliberate act or one of negligence. The customer is entitled to receive all the product purchased

- Over-filling of cylinders and containers.

The over-filling of cylinders and containers is unlikely to be done deliberately but poorly calibrated filling equipment might lead to this. Over filled cylinders and containers is a dangerous practice that increases the probability of an uncontrolled loss of product.

- Poor maintenance of trucks, plants and containers.

Whether an operator chooses to have attractive equipment is a matter of choice. Maintenance of that equipment is not a matter of choice. Poorly maintained equipment can lead to leakage of product, unsafe cylinders, unsafe trucks on the road and hazardous plant conditions. All these conditions will result in risk to employees, personnel and the public

4.2 Impact on the business

LPG cylinder distribution, is unique in the energy industry. LPG is one of the very few common consumer products sold in a metal or composite plastic container that is often costlier than the product it contains. In the distribution system, many parties may physically handle the cylinder before it reaches the customer.

Once the cylinder of LPG has been sold, the seller (who is frequently the cylinder owner) has no direct control over its subsequent use. This makes the importance of maintaining the cylinder or container integrity throughout the distribution chain an essential part of customer safety.

Some unscrupulous merchants elect to fill cylinders owned by others, steal others' cylinders and pay little or no attention to proper procedures for filling and handling LPG and maintaining related equipment.

Equally important, once the cylinder leaves the direct control of the owner, there is no guarantee as to when or if the cylinder will be returned. Yet, the owner is exposed to the risk that misuse of the cylinder could result in injury to personnel, loss or damage to property, and loss of customer business.

Accidents caused by circumstances or people beyond the control of the owner can expose the owner to severe liability claims, damage the reputation of the owner, damage to the company's brand, and damage to the overall reputation of the industry.

Cylinder filling and distribution may be unbundled as far as ownership is concerned. Both the agencies can have contractual long term commercial relationships. That may make the supply chain lengthy; but customers are generally better taken care of, as the distribution link comes closer to customers. This provides the opportunity to create a network of LPG distributors (franchisees), mostly in the hands of private

entrepreneurs. These distributors take care of last mile delivery, customer service, including technical service, and local transportation.

4.3 The Role of government and industry

These aspects of the LPG industry make it of special importance that the market framework within which the LPG is sold and delivered ensures that cylinders and containers are properly maintained.

Maintenance of the cylinder and container is the responsibility of the owner; proper and safe use is the responsibility of everyone in the distribution chain including the customer.

Government plays a vital role for the LPG industry. Two essential areas of government involvement are the elimination of bad practices/bad operators and providing a competitive business climate. There has to be room for public and private participation in the LPG value chain.

LPG has a unique role for both developing and developed economies. It is often the first, and sometimes the only, modern form of energy available.

In developing countries, the first use is frequently for cooking. Because LPG is a clean burning and portable fuel it:

- Brings the benefit of modern energy to many, without the need for costly infrastructure in transmission lines or pipelines
- Saves precious trees and forests, frequently the only source of fuel for many
- Creates a safer world for the women in the household who have to collect the traditional fuels, often in dangerous circumstances
- Improves the air quality of homes where children and the elderly are particularly exposed

For the LPG industry to fulfil its role, it must operate within a framework of 'good business practices'. It also must rely on the establishment and enforcement of sound governmental practices that:

- Ensure common rules for all participants in the market equally applied and enforced
- Clearly defines the rights and responsibilities for all participants including the customer
- Offer those with investments an opportunity for a fair and reasonable financial return on those investments, and
- Provides an avenue of redress for those aggrieved by 'bad practices'

For private business to bring the benefit of LPG to those wanting or needing its products and services there must be a level playing field where the rules are the same for all players.

Only then will business take the risk of investment, provide jobs, and contribute to the economic welfare of the communities in which it operates.

A business climate that favours some over others, either by lack of enforcement or inequitable enforcement of regulations, will ultimately prove a disincentive to the legitimate operators and encourage a reduction in industry standards and inevitably a reduction of industry competition.

It is not only government that has responsibilities. During its over 100 years of existence, the LPG industry in cooperation with government and international organisations (CEN/ISO), has consistently developed standards of practices that, in many countries, have been incorporated into government regulations.

The LPG industry works continuously to evolve these standards in response to new technologies, new applications and other new challenges.

The LPG industry is also accountable, and accepts its responsibilities, for:

- Providing a safe, dependable energy to its customers
- Providing training for its staff
- Operating its plants, transportation and equipment in a safe manner
- Treating employees, contractors and customers fairly
- Operating its business ethically
- Cooperating with local and national officials

The purpose of this approach is not to encourage a global uniform business structure. Rather, its purpose is to create a solid common base on which LPG businesses can be built and compete fairly.

The important element of differentiation within the industry is encouraged as companies continue to strive towards best practice. Only then will customers receive and enjoy the many benefits provided by LPG.

5 Guidelines for Policymakers

Before developing a policy framework for LPG there must be a clear and agreed vision in place with at least a ten-year timeframe. This not only provides policy makers with a framework within which LPG can sit in the overall energy policy directive, but also gives confidence to investors and all other stakeholders who operate, or plan to operate, in the LPG business.

LPG is a co-product and occupies a small part of the total energy picture in a country and can be easier overlooked. In the past, LPG has been flared as a waste product because its value was not fully understood.

That is changing, and the exceptional properties and characteristics of LPG are now assisting governments to meet local air quality and greenhouse gas emission targets as well as improving people's lives by displacing traditional dirty fuels such as wood, coal and charcoal.

These same properties and characteristics are also enabling LPG to be used in the commercial, industrial, agricultural and transport sectors to improve efficiencies and economic output. LPG is also being used as a feedstock for the chemical industry to manufacture plastics.

Utilising LPG makes improvements in health, the environment, the economy, transport and society. The development of a long-term vision for LPG must therefore involve many stakeholders and many aspects of government.

The initial step for a country considering using LPG for the first time, or for extending the use of LPG, is to develop a comprehensive vision – a Roadmap – of what LPG can bring to the country.

This Roadmap can then be used as both a reference document and as a tool to develop a policy framework around.

5.1 The Rationale for Promoting LPG

The strength of argument for promoting the use of LPG will vary from country to country and depend on questions such as:

- Is there an LPG industry in place and what is the state of its development?
- Is LPG being produced locally and what happens to it?
- How feasible is it to import supplies of LPG?
- What is the current energy mix in the country?
- Does diesel play a dominant role?
- Are traditional fuels being used in the residential and commercial sectors?

- Is deforestation an issue?
- What is the urban air quality like?
- Does the country have targets for GHG emissions?
- Is there a good understanding of what LPG can bring to the energy mix?
- What is the forecast for future economic activity?
- Is there a plan to introduce renewable energy and could LPG play a role as a clean fuel partner in hybrids?

This will require involvement from both government representatives, and stakeholders from the LPG industry, to discuss and reach agreed positions on these issues.

5.2 Critical success factors for LPG market development

When developing a pathway for LPG, government policymakers will need to take account of some of the critical success factors behind the development of sustainable LPG markets.

LPG use will not necessarily take off until critical market mass is achieved:

- ▶ The market needs to be large enough to demonstrate to potential LPG users and fuel providers that the fuel is safe, reliable and a cost-effective alternative to traditional fuels. The more visible LPG is (e.g. branded distribution networks and retail outlets, service stations), the more confidence consumers will have to switch fuels
- ▶ LPG must be widely available with a comprehensive infrastructure. Lack of retail outlets, or the facilities to supply commercial cylinders or bulk, is a major impediment to consumers switching to LPG, even if the rest of the proposition is compelling
- ▶ The LPG industry must be large enough to support a viable distribution network with properly-trained technicians and operators to service consumer demand
- ▶ Safe and reliable LPG equipment must also be readily available with adequate after sales support

The role of the government in providing support for the development of demand and supply infrastructure in collaboration with all stakeholders is vital.

Favourable taxation of LPG relative to other competing fuels is a useful but not essential condition for establishing and sustaining an LPG market.

Other government policy encouragement measures may be necessary where the market has not yet reached critical mass. Government grants, or giveaways – an initial LPG cylinder/stove package – have been particularly successful in switching consumers away from traditional fuels where the entry barrier is low or non-existent.

The use of wood, which has been gathered for free, might be economically attractive for the householder but it has a serious impact on many aspects of life including the health and living conditions of the population and deforestation. Governments might be keen to address this by restricting the use of wood and charcoal.

Improving urban air quality might be a goal for governments. Promoting the use of LPG in taxis to displace diesel fuel for example will require a consolidated effort from several stakeholders. This will include vehicle manufacturers, taxi associations and the LPG industry that have to develop the refuelling infrastructure.

The use of LPG as a transport fuel can be stimulated with lower road and vehicle registrations combined with financial support for the refuelling network. Lower taxes that favour Autogas vehicles can also be an effective policy with relatively low implementation costs and few negative side-effects. Conversion of public vehicle fleets to Autogas is also an effective way of demonstrating the benefits of Autogas and driving the development of distribution infrastructure.

Technical and safety standards are another important area of responsibility for governments in partnership with the LPG industry. This is typically a discussion between government and LPG Associations but it will also involve equipment suppliers, contractors and original equipment manufacturers (OEM's).

Implementation of these standards is an essential role for the authorities to ensure harmonised operating standards for all aspects of the LPG industry, including LPG installations and Autogas distribution and vehicle equipment.

Poor-quality installations can undermine performance and emission claims which will jeopardise the sustainable development of the market

The choice of cylinder valve type is normally a decision for the LPG company to create differentiation in the market place. There are examples where governments have imposed a common valve policy with domestic cylinders across the industry to allow greater access and ease of competitor switching for the consumer. Although this might allow greater access it also creates opportunities for illegal cross filling of cylinders which is dangerous and leads to loss of investor confidence.

Safety should be an overriding priority for policymakers everywhere. Fuel providers and end users need to be reassured that the transportation, handling and storage of LPG poses no safety risks. This

will be achieved through the implementation of safety regulations, specific to LPG, based on an objective assessment of risk.

In some countries, standards, regulations and practices still limit unnecessarily access and parking of LPG vehicles, the siting of terminals and cylinder filling plants and consumer storage facilities.

Often these restrictions are unjustified and unnecessary. An example from the use of Autogas illustrates this. Some countries do not allow the positioning of Autogas dispensers alongside gasoline and diesel pumps. This increases the station's capital and operating costs and undermines the customers' confidence in the safety of Autogas refuelling. Experience in countries where this is permitted, such as Australia, the UK, France and the Netherlands, shows that there is negligible risk if good equipment and appropriate procedures are put in place.

There are many countries that have developed effective policy frameworks based on years of experience of using LPG and these should be used wherever possible.

5.3 Formulating an effective LPG strategy

There is no single model or approach to formulating and implementing a government programme to encourage the promotion of a safe and sustainable LPG market.

The appropriate strategy for each country depends on specific national and regional circumstances. These include budgetary considerations, which might limit available funds for promotional programmes, the seriousness of local air pollution problems, the international commitment to reducing GHG emissions, fuel-supply, availability and cost issues, the stage of development of the LPG market and the prevailing barriers to fuel switching, including restrictive regulations and the local cost of transitioning.

In summarising the elements that contribute towards the making of sound policy the importance of an agreed Roadmap for LPG cannot be over emphasised. The presence of LPG champions, who actively promote the benefits of LPG, can also be powerful advocates for change.

- (i) The importance of a Roadmap that clearly sets out an agreed pathway for LPG over (at least) the next decade. The Roadmap should highlight the advantages that LPG brings across all sectors of the economy to allow it to play a significant role in meeting the country's environmental, health, social and economic targets. The Roadmap should identify a



AEGPL Roadmap for LPG

long-term vision for LPG, for policy makers and the industry, to ensure that its potential in a country's energy portfolio can be fully achieved. This should include the role of LPG as a synthetic natural gas (SNG) in support of a developing natural gas (NG) network.

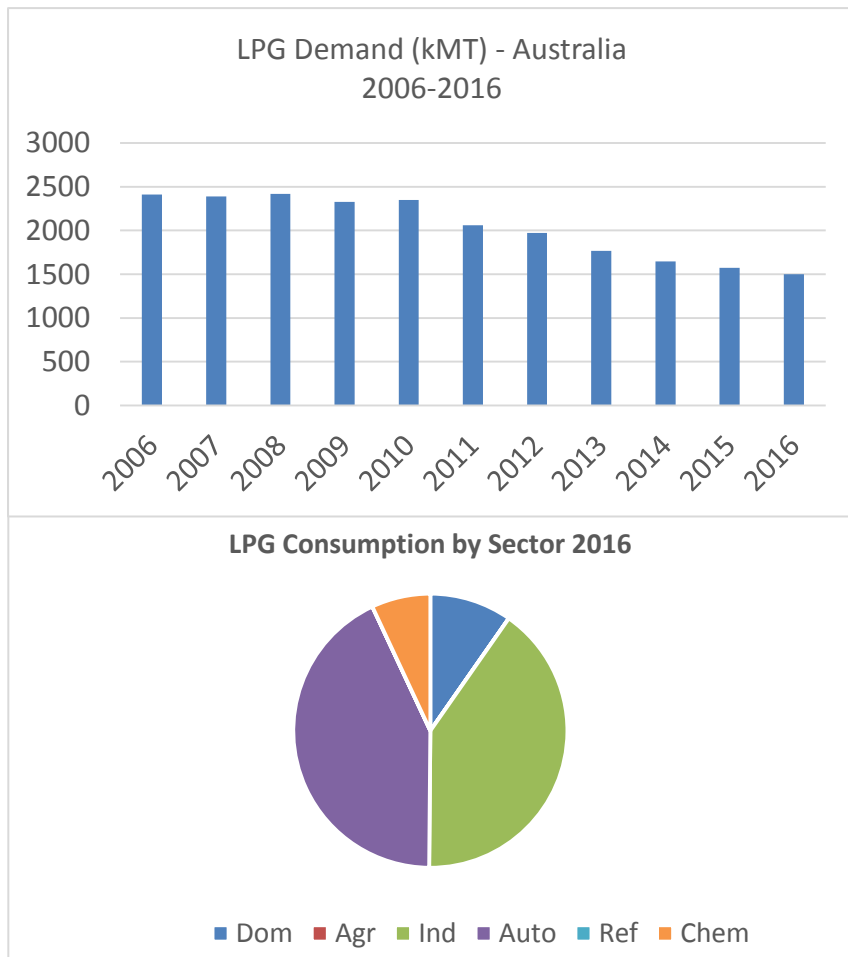
- (ii) The need for policy to be jointly developed between government and the industry and that policy to be consistent over the long term – at least ten years. But it should also be jointly and regularly reviewed and improved as technology develops.
- (iii) LPG is an exceptional energy. There is a need for all personnel involved in policy development to have a full understanding of the benefits that LPG brings to society as a clean, powerful, portable and versatile energy source and be both knowledgeable and focused when developing policy implementation and enforcement measures. The LPG industry has a role to play here through training.
- (iv) LPG is a co-product and requires a strong voice to be heard amongst the competing energy options. An LPG association can provide that voice on behalf of the industry and deliver positions in a consolidated, compelling and consistent manner. Similarly, it is particularly useful for governments to have personnel who are focused and support the role that LPG can play in helping the economy, and in meeting social, health, air quality and environmental goals.
- (v) LPG champions are needed everywhere. Indonesia and India have demonstrated the power of having the very highest level of support from government. The Deputy President of Indonesia, Jusuf Kalla, and Indian Prime Minister Modi are both good examples of successful champions of their respective LPG conversion campaigns.
- (vi) The proposition for LPG to the consumer must be attractive and compelling. It should be based on the four 'A's' - availability, accessibility, awareness and affordability.
- (vii) Affordability need not include subsidies. There are several business models that facilitate access of LPG to low income households without the need for subsidies. Countries that have introduced subsidies have realised that they are not only expensive to sustain but they are difficult to target to the end user group. They are also challenging to remove when budgets become tight. However, some kind of state sponsored support by way of welfare measures to enable targeted households to cross the threshold level of investment required at the time of initial connection may be helpful.

- (viii) Internationally recognised standards and codes of practice should be used as a basis to develop local regulations for the LPG industry. The first US NFPA standard on LPG was introduced in 1932 and they have been regularly updated since then and used as a benchmark for regulations in many countries outside of the USA. It is not necessary to re-invent the wheel.
- (ix) Standards and codes of practice must be enforced and there must be the strictest penalties for non-compliance. Anything less will prevent a level playing field and undermine the business.
- (x) Bad business practices jeopardise investment and prevents the safe and sustainable growth of an LPG business. For example, the practice of illegally filling competitor cylinders is not only dangerous it dissuades investors from entering and growing the market.

PART B: COUNTRY SURVEYS

1 Australia

- 80+ year history but now mature and declining
- Dependency on Autogas with government support (grants)
- But these now withdrawn and volumes dropping
- Gas Energy Association representing LPG and CNG
- Regulatory structure extensive and enforced
- Renewables taking centre stage
- Growing LPG export trade
- Greater focus needed from government towards LPG



Source: Argus Media – WLPGA Statistical Review of Global LPG - 2017

1.1 Market Overview

LPG was introduced into Australia in the mid 1930's from the USA, which strongly influenced its early development.

Demand in 2016 was 1,276MT, a decline of 5% over the previous year.

Demand has been traditionally dominated by Autogas but that sector has suffered a decline in recent years as government support has gradually been withdrawn.

There are a few large privately-owned wholesale suppliers which also retail and many privately owned smaller retailers.

Australia is a net exporter of LPG with domestic production from oil and gas fields and from petroleum refineries amounting to 1,981kT in 2016, a 9.1 per cent increase in production over 2014.

The growing Autogas industry created a strong Autogas equipment sector and the country manufactures and exports a range of LPG equipment including Autogas nozzles and dispensing equipment, regulators, brass and steel fittings, LPG industrial and dispenser hoses, rubber expansion joints, breakaway couplings, LPG refuelling nozzles, storage tanks & cylinders, bypass valves, pipes, technical support and training, clamps, pumps, test points, cylinder manifolds, pump sets, tools, hoses, pressure gauges, underground Autogas LPG stations, marine and industrial dry disconnect and breakaway couplings, and valves. Australia also imports a range of LPG equipment for the traditional sector.

The Australian LPG market is described as '...Competitive against a range of other energy sources...'

1.2 Control of Assets

LPG assets in Australia are privately owned with strict controls on requalification to ensure fit for purpose.

The requalification period for LPG pressure vessels varies. It is ten years for LPG cylinders and storage tanks and three to six years for road tankers. Requalification is typically outsourced, apart from LPG cylinders, which are generally requalified by the asset owners.

Apart from road there are movements of LPG by sea and rail which are managed by the LPG companies or their contractors

The LPG distribution channel in Australia is described as '...a multi-branded network of LPG suppliers. Some sell LPG appliances but most appliances are sold by non-LPG outlets...'

The control of LPG assets is described as ‘...Privately owned but heavily regulated by government. Ownership is more concentrated at the wholesale level and less so at the retail level...’

1.3 Regulatory Framework

The LPG industry in Australia is heavily regulated at State and Territory level with very little Federal Government involvement.

There are many Australian Standards covering the regulation framework and these are listed in the references.

Regulation is extensive and enforced, especially at the distribution level.

The regulatory authorities control compliance through reports and audits with commercial and criminal penalties. The severity of penalty depends on the nature of the offence.

The government’s position regarding LPG in the country’s energy mix is described as ‘...non-committal...’.

1.4 Government Incentive Policies

The Australian Autogas industry has had a history of government support in the way of excise support and vehicle conversion grants. At State, Territory and Federal level.

This led to the country having a strong international position as an Autogas champion but this has changed in the last few years as excise support and conversion grants have been phased out, driven more by budgetary constraints than deliberate policy change against LPG.

In 2010, the Federal Government announced that it would apply fuel excise to LPG used for transport for the first time. The excise was increased in stages over a four year period commencing on 1 December 2011. On 1 February 2017, the fuel excise on LPG was 13.1 Australian cents per litre.

Import duty rates for LPG equipment vary from 0% to 10%, with an average rate of 4.6%. There are no tax breaks.

The grants for conversions ended in 2014. Before that it was possible to receive a grant of up to A\$3,000/vehicle.

No tax credits targeted at LPG but to encourage the use of alternative fuels, including LPG, LNG, CNG and biofuels, the government have said they should not be taxed at more than 50% of the rate applicable to petrol and diesel.

While there are no restrictions on the use of LPG there are no benefits (e.g. special access to congestion zones etc.) to using it either.

There are some government funded safety campaigns but any marketing campaigns are funded by LPG retailers.

The government's attitude towards LPG is best described as being overlooked. There is more focus on renewable energy sources.

The public attitude regarding the environmental benefits of using LPG is '...not well understood...'

1.5 Competitiveness of LPG against Other Fuels

The price of Autogas relative to petrol and diesel varies from State to State but can be as low as 50% of the pump price. In May 2017 for example, the A\$ prices of regular unleaded petrol (91 RON), diesel and Autogas LPG in major Australian cities were in the ranges of \$1.27 to \$1.29, \$1.29 to \$1.32, and \$0.67 to \$0.84 respectively.

LPG is supplied into the traditional markets in a variety of sizes with 4.5kg and 9kg used for outdoor leisure and 45kg, 90kg and 210 kg used for fixed stationary energy applications.

About 15 years ago a cylinder exchange program was introduced into Australia and is now widely used, especially in cities. The current cost of LPG through the exchange cylinder programme is around US\$2.1/kg.

LPG is also supplied in bulk countrywide and the price varies depending on location, drop size and competitive environment.

Consumers in Australia do recognise that LPG is a competitive fuel to alternatives.

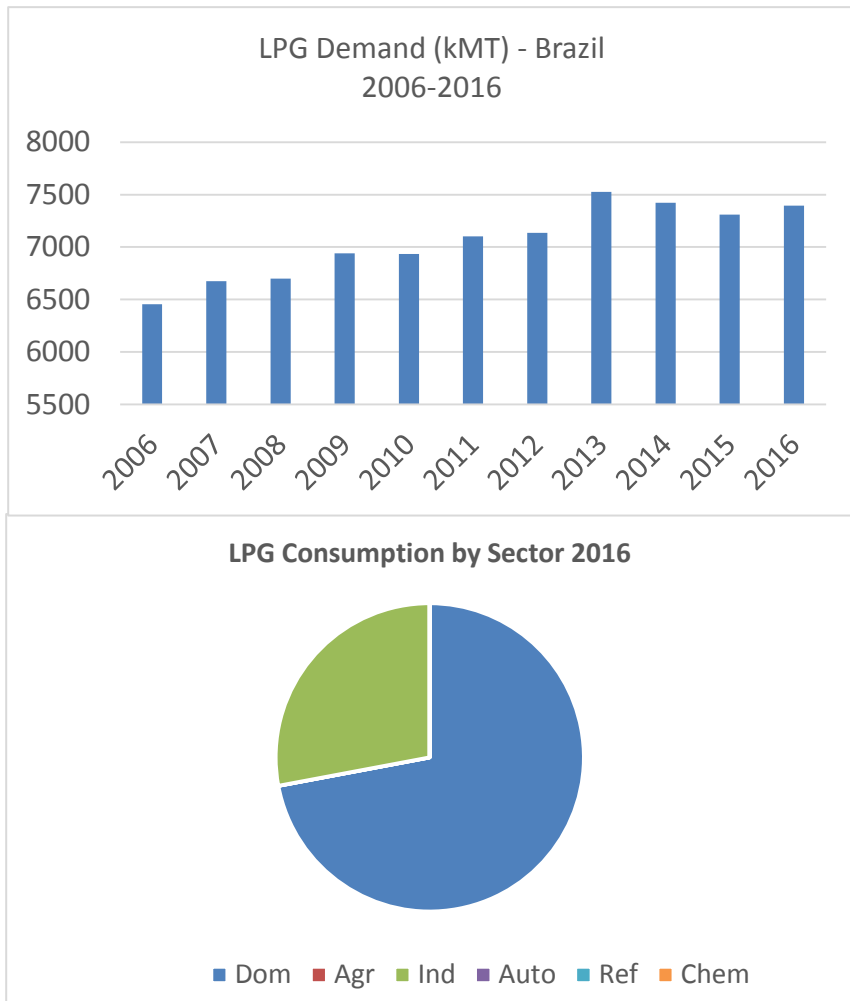
1.6 Recommendations for Improvement

One of the things suggested to improve the policies for LPG in Australia was a plea for government to recognise the clean burning properties of LPG and treat it the same as renewable low emission energy sources.

One thing to improve the opportunities for LPG was an original equipment manufacturer (OEM) backed LPG powered vehicle with wide appeal.

2 Brazil

- Residential use of LPG encouraged by government
- State Company Petrobras controls LPG supply
- LPG reaches 95% of population
- ‘Social fuel’ tag restricts other uses (no Autogas)
- All LPG equipment locally manufactured
- Strong regulatory framework championed by ANP
- Non compliance heavily penalised
- Encourages good business practices



Source: Argus Media – WLPGA Statistical Review of Global LPG - 2017

2.1 Market Overview

As with Australia, LPG was introduced into the Brazilian market in the 1930's but it was not until after the second world war that demand started to grow with investment in infrastructure – storage tanks, filling plants etc. – to develop the industry.

The 13kg cylinder was introduced in the 1950's and has become the standard. Today there are over 100 million cylinders in circulation serving most of the population.

Domestic consumption is the main driver of demand, both cylinders and bulk.

The Brazilian market is very consolidated and the state company Petrobras is still responsible for almost 100% of the Supply to the associated companies.

Over 70% of the supplies are produced locally with the rest being imported, mainly from the Mexican Gulf. The national infrastructure is very extensive and complex.

The State company also owns a share of the distribution market through Liquigas which has 22% share of the total market. There are plans for the State to sell that share though. The market leader is Ultragas (24%). Supergasbras (19%) and Nacional Gas (20%) are the other main players.

Almost 100% of the LPG equipment (cylinders, valves, storage tanks etc.) used in Brazil is manufactured locally.

LPG is a social fuel in Brazil and so Autogas, being a transport fuel, is not allowed.

The LPG market is consolidated, mature and very well regulated by the local authorities. It is a market with a high level of competition through a enormous distribution chain made up of over 60,000 retailers.

Due to its portability LPG can reach all the remote rural areas and so 96% of the population uses LPG in Brazil.

2.2 Control of Assets

LPG assets in Brazil are very well controlled through the National Petroleum Agency (ANP).

LPG Cylinders have an initial interval of requalification of 15 years and then every 10 years.

Requalification of cylinders is mainly (70%) outsourced and amounts to over 10m/year.

All LPG cylinders in Brazil are branded. Bulk LPG can be sold through a single distributor in in-situ cylinders or bulk tanks.

Retailers are limited to the cylinder sales only. They cannot operate in the bulk sales market.

Retailers who decide to become branded, can either be tied to one brand or they can be independent and buy and sell different cylinders

brands. In the latter case, they are obliged to create an identity that differentiates from any of the majors' brands.

The option of become independent removes from the retailer the rights of advertising. It's unusual to see an LPG retailer to be involved in any appliance sales.

The LPG retailer is often are dedicated to only one product, LPG in cylinders.

2.3 Regulatory Framework

The regulation framework in Brazil is complex and composed of many different interests. These include transportation, weights and measures, safety, labours restrictions & regulations and fire-fighting departments.

However, the main body overseeing the regulations is the ANP (National Petroleum Agency) which attempts to harmonise all of the regulations and best practices in order to maintain a safe and sustainable LPG industry.

The objective is to achieve a smooth flow through the supply chain, good customer service, high safety standards and a well supervised competitive market, where the final consumer can have access to good information and strong power of decision.

All regulations are strictly enforced and supported with very strong compliance. Penalties are huge, either financially or suspension of permits and trading rights.

Non-compliance can put a company out of business.

The Brazilian government pays a lot of attention to LPG and the LPG industry. However, it is seen by government as a social product which tends to restrict its opportunities in other applications.

A good example of this is the government's decision to not allow LPG to be used as a transport fuel as it doesn't fit the 'social' usage description.

The regulatory framework in Brazil has been described as '...exceptional, but perhaps too beaurocratic...'.

2.4 Government Incentive Policies

In Brazil, the main government policy that restricts the use of LPG is its description as a social fuel.

This limits its use because applications outside of 'social' are not allowed. For example, LPG cannot be used to heat swimming pools, or be used as an engine fuel of any type, both on-road and stationary.

The use of subsidies in the early days of LPG being introduced encouraged its growth but today there are no incentives in place to support its use. Nor are there any government funded campaigns to

support LPG. Within the constraint of being a social fuel LPG exists with a neutral stance from government.

In its role as a social fuel, LPG has wide acceptance from the public. Recent market research confirms this.

2.5 Competitiveness of LPG against Other Fuels

LPG operates in a free market in Brazil and is competitive to other fuel choices.

There are a great range of cylinders and tank capacities offered in the market. The most popular size is the 13kg cylinder. Over 35 million of these are sold every month in Brazil.

There are many types of offerings using loans and purchase options for consumers to facilitate the penetration of LPG into all households. It is estimated over 95% of the population uses LPG.

Brazil is a free market economy and there are no fixed prices for LPG. The National Petroleum Agency (ANP) do run weekly surveys indicating the average price of a 13kg cylinder.

In February 2017 for example the ANP indicated the 'average' price of a 13kg cylinder in Brazil to be US\$1.4/kg.

LPG is supplied in bulk in Brazil but these prices vary depending on drop size, volumes etc.

2.6 Recommendations for Improvement

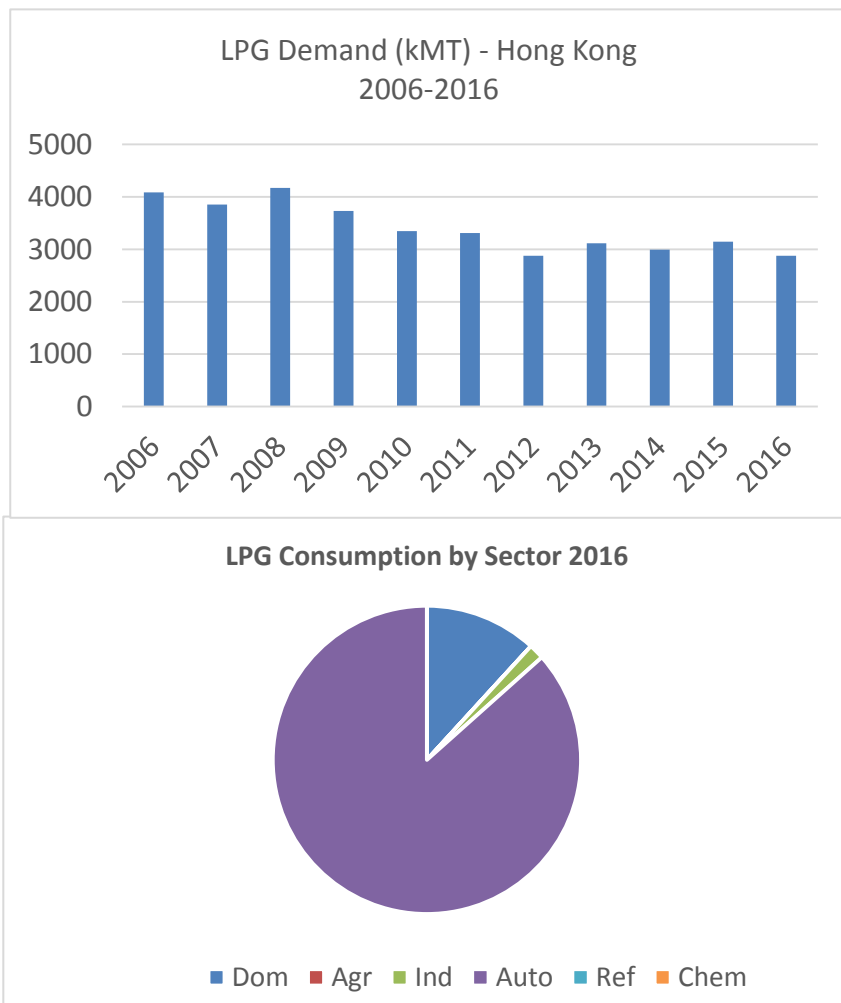
The role of LPG as a social fuel, and the governments support of that position, has enabled it to reach almost all the households in the country.

However, this has also been a restriction for using LPG in so many other applications.

The main recommendation would be for the social fuel tag to be lifted and expanding to allow LPG to fully compete in all the other sectors.

3 Hong Kong

- Long history of LPG in Hong Kong
- Tightly enforced government regulatory framework
- Free market economy but government favours NG
- LPG Safety and Technical Committee formed
- Good safety record in a highly densely populated area
- Pioneered reticulated LPG into high rise buildings but...
- Piped gas policy does restrict LPG cylinders in buildings
- Autogas introduced in 2000 and now dominates



Source: Argus Media – WLPGA Statistical Review of Global LPG - 2017

3.1 Market Overview

LPG was first introduced into Hong Kong in the 1960's. LPG cylinders played a vital role in providing the population with modern energy. The early development of LPG in Hong Kong was mainly influenced by the oil companies.

It is best described as a '...mature and declining...' market.

The industry tried to establish an LPG association in the 1980's but this was hindered by concerns from some US companies over antitrust issues. To overcome this, an LPG Safety and Technical Committee was formed to represent the industry on those issues with government.

The LPG industry competed with towns gas, and later natural gas. There has not been much development of the market during the last ten years. The main feature has been continued decline in the traditional cylinder and piped LPG sectors as new players entered the market. The exception being Autogas which was successfully introduced in the late 1990's displacing diesel in the taxi and minibus sectors.

Hong Kong relies totally on imports of LPG either directly into the Tsing Yi terminals or via China. The main sources are the Middle East via refrigerated cargoes.

There is virtually no manufacturing of LPG equipment in Hong Kong with most of it being imported from other countries, mostly Asian, Europe and the USA.

3.2 Control of Assets

The Hong Kong government has a very strict control of the LPG industry, and its assets, through the Gas Standards Office (GSO).

LPG cylinders and storage tanks are requalified every five years. The asset owner is responsible for this although the actual work is done by a government certified *Competent Person*.

LPG is transported in Hong Kong by road vehicles, both bulk and packed. This is done by licenced appointed contractors or distributors. One unique feature of the bulk LPG vehicles is the need for a fire protected coating to be applied to the pressure vessel. The industry has argued unsuccessfully against using this coating because it adds weight to the vehicle, and therefore reduces the carrying load, resulting in more deliveries per load. The coating also contributes to added brake and tyre wear.

The LPG marketing companies retain ownership of the cylinders through a rental arrangement with the dealers who pass this onto their

consumers. Bulk tanks are also owned by the LPG companies who have a leasing arrangement with the consumers.

The cylinder business is predominantly sole branded with LPG companies having distinctive colours for the distributor outlets.

Most of the LPG companies provide LPG equipment and appliances through their distributor outlets.

3.3 Regulatory Framework

The regulatory framework in Hong Kong is tightly controlled and enforced by the government through the Gas Standard Office (GSO) which was established in the early 1980's following a number of gas related incidents. The GSO is the government's gas regulatory authority.

The LPG industry follows the local Code of Practices issued by the GSO.

The Hong Kong LPG industry claim that the policies applied to their industry are more stringent than those applied to the natural gas and electricity sectors.

Most of the residential buildings in Hong Kong are high-rise and the population density is greater than perhaps anywhere else in the world. With limited land available for storing bulk tanks they are inevitably located underground to meet the necessary safety distances and risk assessment criteria.

When the government introduced its 'piped gas policy' in the 1980's the LPG companies were forced to invest in reticulated LPG systems to service the new residential high-rise buildings.

The LPG industry pioneered this initiative and led the world in developing systems and technology to deliver LPG through a metered connection from a central LPG storage facility.

The LPG industry worked closely with the GSO in developing regulations to ensure this was done safely.

3.4 Government Incentive Policies

With the government supporting natural gas there are no incentives offered to encourage the use of LPG. However, LPG still has a major role to play in providing the populations living in older high-rise buildings with no access to piped gas.

One of the reasons the government supports the natural gas industry is because, unlike LPG, it does not have the challenge of finding suitable storage locations for up to 20MT of underground LPG tanks.

Another challenge is the safe movement of bulk trucks carrying up to 6MT of LPG on the congested roads of Hong Kong.

The LPG industry struggles to compete to supply new residential buildings because of these challenges and the concerns of government.

However, the industry has a very good safety record despite these constraints.

The one area of support for LPG is with Autogas. Since the introduction of Autogas into the public transport sector to displace diesel in the late 1990's there has been an improvement in street air quality, especially in the reduction of particulate emissions (PM) and NOx.

The government have provided land leasing subsidies for some of the Autogas station sites to encourage good coverage of refuelling outlets across Hong Kong to service these vehicles.

There are some restrictions on the use of fossil fuels but these are related mainly to environmental issues such as sulphur content.

The densely populated areas in Hong Kong create a lot of challenges for LPG cylinder vehicles. The challenges here relate to parking during deliveries and when the vehicles are being left parked unattended parked overnight.

The government's piped gas policy restricts the use of LPG cylinders in buildings that have a piped gas supply. This has left no room for growth in this sector and it's in steady decline. The advantage of this policy though is to protect the investor, who has capital invested in all the equipment necessary to pipe gas into the building, from competitive aggression from LPG cylinder suppliers.

3.5 Competitiveness of LPG against Other Fuels

LPG is available in cylinder sizes from 2kg (dim sum trolleys) to 15kg domestic. The terms of trade are pay on delivery, but the home delivery is included. For old buildings with no lifts the cylinders are carried up stairs several floors to the customer but these often incur a tip for the delivery man.

The retail price of LPG in cylinders is about HK\$250 (US\$32) - HK\$300 (US\$38) per 15kg cylinder. Or US\$2.1 to 2.5/kg.

LPG is supplied in bulk to end customers through meters in high rise buildings through an agent. LPG is also supplied in bulk directly to industrial and commercial consumers such as factories, restaurants and

hotels. The current metered price for piped gas is about HK\$33(US\$4.2)/cubic meter.

LPG pricing is set between the cost of traditional fuels and electricity. The price of LPG through a metered supply is slightly more expensive than the price of LPG in cylinders.

Most consumers consider LPG to be expensive but a necessary commodity. The powerful hot flame is ideal for Asian cooking.

3.6 Recommendations for Improvement

The LPG industry would prefer a more balanced position from the government with respect to natural gas.

Intervention by the government in the early 1980's was driven by a series of incidents that were more related to good ventilation than the safe use of LPG.

Flueless water heaters were being used inside bathrooms which led to several fatalities resulting from carbon monoxide poisoning.

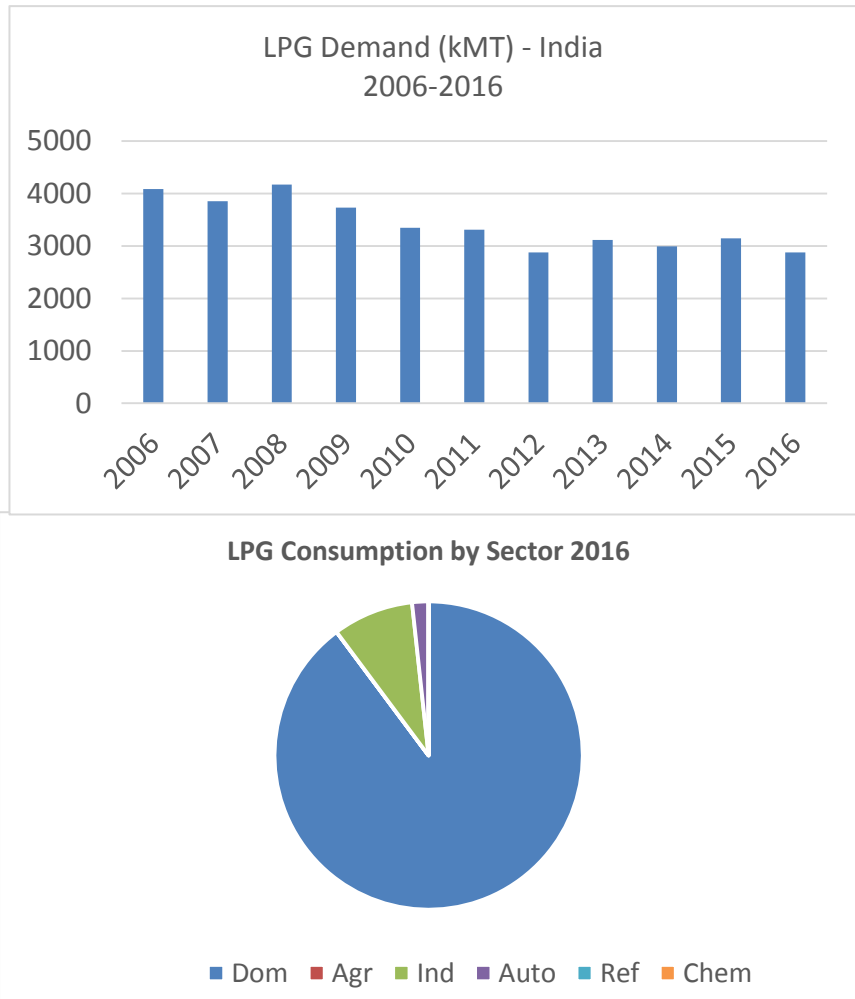
At that time, the government started to introduce vigorous controls and regulations on the LPG industry that have continued ever since.

The steel LPG cylinder has changed very little since its introduction in Hong Kong in the 1960's. Recent innovation with LPG cylinders has included the use of plastics and composite materials to improve the visual proposition and also to reduce weight and improve corrosion protection.

The composite cylinder is a good example of this and the industry is looking to introduce this into the market. More support from government towards LPG might encourage this to happen.

4 India

- Long history of subsidised LPG
- Targeted subsidy scheme for domestic use
- Committed government with PM as champion
- Extensive media coverage to promote LPG to masses
- Use of IoT linking bank accounts
- State company investment in infrastructure
- Long term vision for LPG



Source: Argus Media – WLPGA Statistical Review of Global LPG - 2017

4.1 Market Overview

The history of LPG in India dates back to the 1950's, when Burmah Shell marketed LPG as Burshane gas from its refinery in Mumbai.

As the country continued to develop, people in India used more and more LPG, recording a consistent growth of over 10% annually over the last 50 years.

In 1970 LPG volumes were 176,000MT but this has risen to over 21mMT in 2016.

Today over 70% of the population use LPG serviced by 19,000 distributors, 42% of which are in rural areas.

India is third largest LPG consuming country in the world, following USA and China. India is also the seventh largest LPG producing country in the world, following USA, China, Saudi Arabia, Russia, UAE and Qatar. However, because of its size and growth rate India is forecast to become the largest LPG importing country in Asia by 2021.

Local LPG production comes from state owned refineries (52%) and fractionators (20%). Refineries in the private sector (18%) and in the joint sector (10%) produce the balance.

LPG domestic consumption is handled by three state owned marketing companies but the industrial and commercial markets are open for private marketers. Just 2.5% of LPG sold in the country was imported by private marketers in 2015-16.

About 50% of the country's LPG consumption is imported and this is expected to increase over the next couple of years when India will be Asia's largest importer of LPG.

Most of the imported product is sourced from the Middle East, Saudi Arabia and Qatar.

LPG consumption during the last decade recorded growth rates over 6%/year. That rate of growth was lower than the preceding period when the rate of growth was over 8%/year.

Demand was constrained earlier due to inadequate import facilities and burgeoning subsidies which have since been addressed.

The government is extending the reach of LPG users in the country through free/subsidies connections to below the poverty (BPL) line households.

Over 20 million households are enrolling into the LPG scheme every year.

Subsidies on LPG in India were historically universal and open ended. This led to abuse and reform measures were introduced to stop the subsidy leakage.

In September 2012, a cap was introduced on the number of subsidised LPG cylinders a household could have in a year, couple with controlling

duplicity. By then the subsidy burden on the state had reached Rs41,565 crores (415.65 Billion USD).

Nearly 87.5 % of LPG consumed in India is used as fuel for cooking; industry and commercial sector consumed 11.5%; transport sector consumed 1%. (source: WLPGA Global Statistical Review 2016).

During 2015-16, India consumed 19.5mMT of LPG. Nearly half (8.9mMT) was imported.

There are 15 ports, located both on both the east and west coasts of India, where the LPG is imported. The port facilities are owned and operated by state owned companies as well as some private and jointly owned companies. Further expansion is planned.

India has over 160 LPG cylinder manufacturers, 48 valve manufacturers and 44 regulator manufacturers. All these are in the private sector.

The LPG market in India is described as ‘...having carved out a significant position in India’s clean and inclusive energy ecosystem...’.

4.2 Control of Assets

LPG assets, such as tanks, bulk and packed vehicles, can be owned by individuals and companies provided they meet the safety requirements. These safety and quality requirements are well defined and the enforcing agencies ensure compliance.

LPG cylinders are requalified 10 years after their date of manufacture and thereafter every five years until they are disposed of. Bulk storage tanks and road vehicles are requalified every five years. The responsibility for requalification is the asset owner. This may be outsourced to a private company by LPG marketing companies.

Some state-run LPG marketing companies have developed their in-house testing facilities to requalify equipment.

LPG road deliveries are done by independent transporters. Any movement by rail is undertaken by the state-run Indian Railways although some LPG marketing companies own some rail tank cars.

Movement of these are managed jointly by the LPG marketing companies and Indian Railways.

LPG in cylinders are branded products in India. Each marketing company has its own brand, which is prominently displayed on cylinders of various sizes.

LPG equipment is freely marketed. All LPG equipment, for both domestic and commercial use, is available from non-LPG outlets (e.g. hardware stores) in free market environment.

LPG distributors also market some equipment such as hotplates and hoses. Pressure regulators are an integral part of the domestic LPG connection and are marketed by distributors.

4.3 Regulatory Framework

LPG for domestic use is regulated by the government, through the three state owned companies, via the subsidy administration mechanism.

However, LPG for commercial, industrial and transport use, operates under a free market, subject to the safety, quality and quantity regulations

There are regulatory agencies in India for different activities. The regulations and rules for each activity is well defined.

Most are covered by Factories Act, Gas Cylinder Rules, Essential Services Act, Gas Control Order, SMPV Rules, W & M Rules, OISD Standards, BIS standards, IS-3196, IS- 4576, IS-6044, IS-3043 etc.

Compliance and enforcement is achieved through various statutory authorities, operating under both state and federal government.

In parallel, LPG marketing companies also have framed 'Guidelines' to ensure compliance of the various rules and regulations. These 'Guidelines' of LPG marketing companies are approved or overseen by India's Ministry of Petroleum and Natural Gas.

Penalties for non-compliance, and resolution of disputes mechanisms, are defined in the relevant laws and guidelines. Since India operates within a democracy and has a sound judicial system, generally rules are enforced on a rational basis.

The overriding principle behind India's approach to LPG is '...the government is promoting the use of LPG as a clean cooking fuel...'

4.4 Government Incentive Policies

There is a customs basic rate duty on imported LPG of 5% together with a countervailing duty (CVD) of 14%, a cess of 3%, and a special CVD of 4%.

The Indian government is promoting the use of LPG as a clean cooking fuel to displace dirty traditional fuels such as charcoal, wood etc. The target is for most households in the country, with the exception of some

due to various socio-economic reasons (<5%), to use LPG as cooking fuel within the next three years.

State policy permits the use of LPG in vehicles so there is an opportunity for Autogas. However, there is serious competition from compressed natural gas (CNG) and other liquid fuels. The free market economy drives the choice where cost and technology are the main determinants of the fuel.

There are some extensive programmes being sponsored by the government of India, implemented by state run LPG marketing companies, involving all types of media, to make people aware of the use of LPG as clean and healthy cooking fuel and for its safe use.

These include continuous TV advertisements on all channels, including regional channels, during the last two years. The adverts highlight the benefits and safe way of using LPG.

Door to door campaigns are also being conducted in rural areas to demonstrate the safe use of LPG. Rural households, which have taken new LPG connections, are being motivated to regularly use LPG as they switch from conventional fuels.

There are no general restrictions on using LPG or alternative competing fuels provided the necessary safety requirements are met. However,

kerosene (for cooking purposes) has been completely phased out in some cities and in some states.

As LPG consumer numbers increase, kerosene quotas are being reduced at state level.

There are no incentives in place to encourage the use of LPG (e.g. no emission zones) other than the targeted government subsidies for residential use.

Many Indian households, including those in rural areas, have come to improve their purchasing power and life style aspirations, and encouraged them towards LPG.

Access and availability of LPG continues to remain an issue in some geographic areas, but that continues to be addressed.

The Indian government attitude towards LPG is described as '...upbeat...' with support from the very top.

4.5 Competitiveness of LPG against Other Fuels

Generally, LPG is one of the most competitive fuels in India compared with other conventional fuels. However, this is not the case where wood and charcoal is available.

The state oil marketing companies (OMC's) make LPG available in many different size cylinders. They include 5 kg, 14.2kg, 19kg, 35kg, 47.5kg & 450kg.

Cylinders marketed by the private companies include 2kg, 3kg, 12kg, 17kg, 21kg, 33kg and 450kg.

The common domestic cylinder supplied by the state companies is issued on a Rs1,450 (US\$22) deposit. Importantly the cylinder remains an asset of the company and is maintained by the company.

The retail selling price for the 14.2kg cylinder (ex. Delhi) as at April 2017 was Rs723 (US\$11) inclusive of the Rs282 (US\$4.2) subsidy for domestic cooking applications. A 19kg cylinder for commercial use was Rs1,265 (US\$19.7).

LPG is sold in bulk to industrial customers to compete with diesel and fuel oil. Typically, customers will receive the product in road tankers from the bulk loading terminals of LPG marketing companies.

LPG marketing companies will generally own the storage tanks. Consumers will own the storage tanks in their own premises. As at April

2017 the bulk LPG basic selling price in Delhi was Rs54,507(US\$845)/MT.

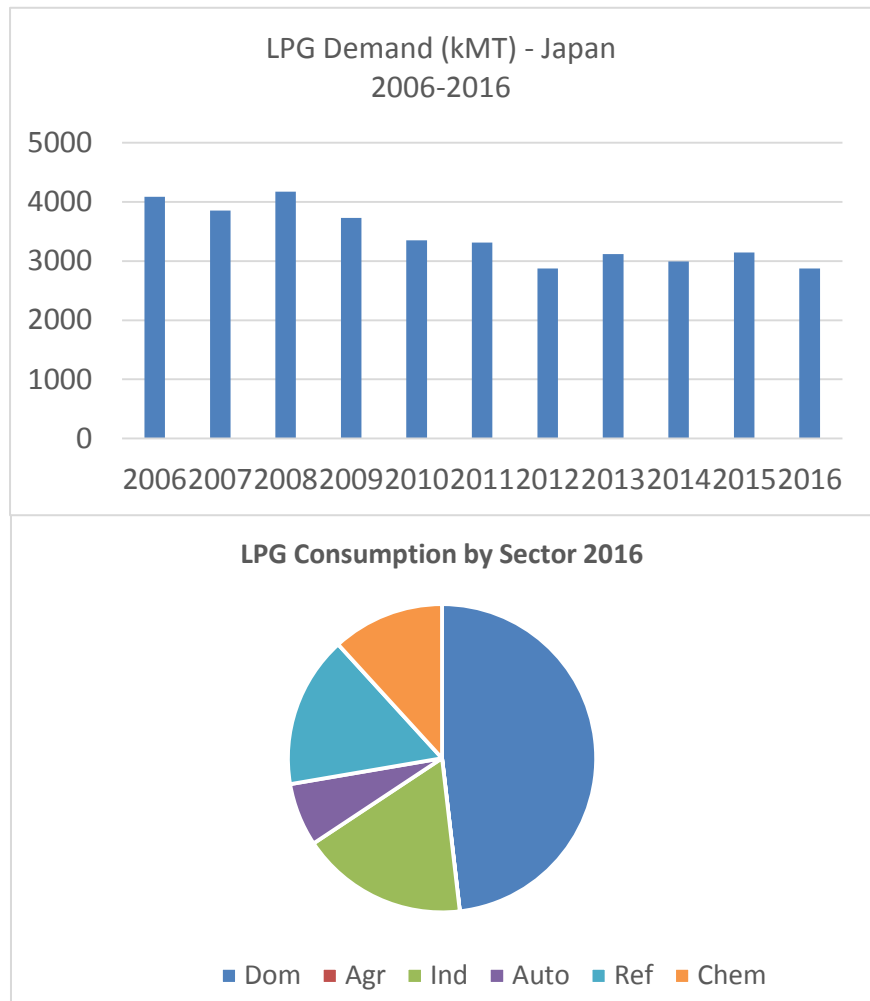
4.6 Recommendations for Improvement

Although major steps have already taken place with the government's policy towards encouraging domestic LPG use with targeted subsidies, the big prize would be to dispense with subsidies altogether.

Another piece of policy support would be to encourage the displacement of liquid fossil fuels with LPG, especially in urban areas.

5 Japan

- LPG introduced in Japan before WW2
- Local industry now in decline but government supportive
- LPG is seen as a key energy option in emergencies
- Vital LPG equipment industry supplying global market
- Domestic LPG sold by volume through meters
- Important OEM industry for Autogas but...
- Under threat from hybrids
- Good regulatory balance



Source: Argus Media – WLPGA Statistical Review of Global LPG - 2017

5.1 Market Overview

The Japanese started to use LPG before WW2, but the marketing of LPG only really started to develop after LPG imports began in 1962. Before then only refinery LPG was available.

In the Japanese government energy policy, LPG has a position as a gaseous fuel, like natural gas. Although LPG is a fossil fuel, it is confirmed as environmentally friendly.

After the 2011 tsunami disaster, LPG proved it to be an ideal energy source at the time of a crisis. The government now fully understands that LPG is "a go to fuel" during an emergency.

In Japan LPG is used for many purposes because of its ease of handling and distribution.

There are eleven LPG importers, supplying to around 1,100 wholesalers who in turn supply around 20,000 retailers.

In 2015 demand for LPG in Japan was below 16mMT, a fall of 6% from the previous year.

This demand was met with 80% of the product being imported 20% mainly from domestic refinery production. The supply is secured against a 50-day equivalent compulsory stock by the private sectors and 1,500,000MT from the national stockpile.

Demand has gradually fallen off during the last decade and the market is described as '...matured...'

5.2 Control of Assets

Asset controls in Japan are generally undertaken by the asset owners although some can be outsourced provided they meet the safe and quality criteria.

The distribution of LPG by road is commonly outsourced by the LPG companies, again under strict controls.

LPG cylinders are owned by the LPG companies. Some LPG cylinder filling plants are jointly managed by two or three LPG distributors.

Where an LPG plant is owned by an LPG distributor the distributor can fill the LPG cylinders owned by other LPG distributors through a contractual arrangement.

The control of assets in Japan is described as '...very good and organized...'

5.3 Regulatory Framework

There is a good balance between the self-regulation of the LPG industry and the regulations imposed by the Japanese government to ensure a

safe LPG industry. Beyond that the LPG industry operates in a free and competitive market economy.

The main piece of legislation controlling the LPG industry is the *High-Pressure Gas law, LP Gas Act*.

The enforcement measures used to regulate the industry are supported by education and penalties for non-compliance.

The application of "Heinrich's law" in Japan is encouraged through education. (Heinrich's Law: that in a workplace, for every accident that causes a major injury, there are 29 accidents that cause minor injuries and 300 accidents that cause no injuries.[3] Because many accidents share common root causes, addressing more commonplace accidents that cause no injuries can prevent accidents that cause injuries).

The Japanese government's position with LPG in the energy policy is described as:

(i) Re-positioning

Historically, Japan used to have a strong dependence on LPG supplies from the Middle East but cheaper shale-associated LPG from the USA has opened new opportunities to spread the geopolitical risks. Amongst fossil fuels, LPG is relatively clean, and a low producer of greenhouse gas emissions. This is supported by well-developed stockpiling facilities and a comprehensive and efficient supply system for end-users. LPG has many advantages over competing fuels that make it a popular option for use in emergencies and day to day life. The government recognises this.

(ii) Policy direction

In emergencies LPG can be relied on as the "last stronghold" to provide an energy supply. The Japanese government therefore continues to consolidate the LPG supply system, e.g. steady stockpiling and facility enhancement at core LPG filling stations. It also streamlines the supply structure to reduce costs and promote the diversification of LPG use.

At the same time, LPG continues to fulfil its role in the transportation sector as Autogas.

From the LPG distributors position, there is a need for:

- (i) Diversified procurement sources and a reform of the LPG supply structure. Apart from the continued diversification of LPG procurement there is a need to improve the supply structure by rationalising filling stations and introducing a centralized monitoring system
- (ii) Creation of new business operations. Possible new opportunities including entering other energy businesses

such as power/city gas retailing and exporting safety devices for LPG to Asian countries

- (iii) Promotion of efficient LPG appliances that contribute to the diversification of energy use. For example, LPG cogeneration systems using user-end reserves (stock in circulation)

5.4 Government Incentive Policies

Imported LPG attracts a petroleum and coal tax which amounts to 1,600 yen (US\$14.5)/MT. Refinery produced LPG attracts fiscal levies. Importers pay a crude oil tax of 2,540 yen (US\$23)/kL. Autogas attracts a tax of 9.8 (US\$0.09) yen/L. All fuels attract an 8% consumption tax.

There are no differential tax regimes or tax credits or grants for LPG.

It is a free market and consumers can select an LPG distributor of their choice. On behalf of the Japanese government the Japanese LPG Center holds local LPG summits at several locations every year to educate LPG consumers about supply and purchase contracts between LPG distributors and LPG sellers. The government seeks to secure fair transactions between LPG distributors and consumers (household users).

There are no restrictions on the use of competing fuels. Some long tunnels have restrictions on LPG road tankers but there are no such restrictions for Autogas vehicles. There are no restrictions on Autogas vehicles parking underground. Autogas vehicles do not attract any benefits (e.g. congestion zone access).

The attitude from the consumer is quite neutral towards LPG.

Regarding CNG, Osaka Gas is interested in developing a refuelling station network in the Osaka area for CNG vehicles but it is at an early stage. Tokyo Gas is reluctant to develop a CNG refuelling station network in the Tokyo area. Electric vehicles are being developed by the vehicle manufactures. The government is also putting some focus on developing hydrogen vehicles. The Japanese government however understands that LPG vehicles must be retained to provide the Japanese

society with some resilience to natural disasters such as occurred in 2011.

The government understands the LPG industry reasonably well and is generally supportive of the industry.

5.5 Competitiveness of LPG against Other Fuels

The 20kg and 50kg cylinders are commonly used for household user and restaurants. Consumers also use bulk tanks with capacities of 500kg or 1 MT. LPG cylinders are owned by LPG distributors.

Unlike most countries in the world, LPG is sold by volume. Each consumer has a gas meter which is usually provided by an LPG distributor.

Japan has gas/liquid ratios (GLR). There are four regions. Each region has its own GLR. The average is 4.77m³/10kg. The average propane retail price nationwide in April 2017 was: 4,769 Yen (US\$43)/5m³; 7,598 Yen (US\$68.5)/10m³; 12,918 Yen (US\$116.5)/20m³; 27,413 Yen (US\$247)/50m³.

The prices include the basic tax rate making the average price approximately US\$2,400/MT. Bulk prices are close to the price for the 20m³ case above.

LPG competes with natural gas and oil and process are similar.

The international wholesale market is competitive but the domestic price is not.

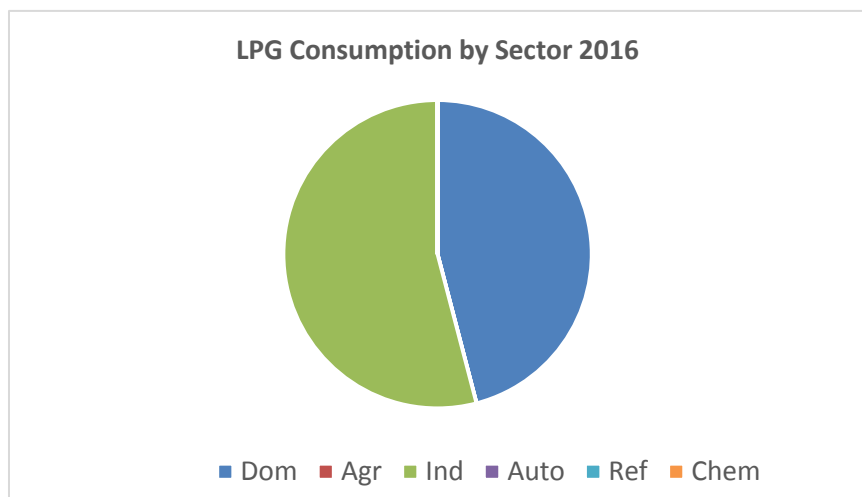
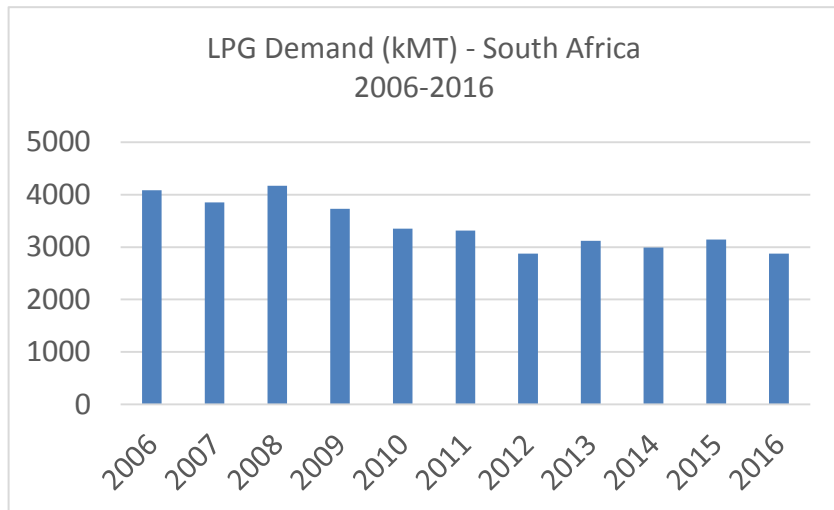
5.6 Recommendations for Improvement

The Japanese LPG industry seeks the matching of national standards with global standards in some areas. One example is the acceptance of the toroidal fuel tank.

Current regulations restrict the sale of LPG to domestic consumers by volume with the industry purchasing by mass (MT). The industry is arguing for change.

6 South Africa

- Long history of LPG in South Africa
- Local standards (SANS) referenced with international ones
- Growth restricted by lack of infrastructure
- Lack of licencing regime
- Government support for LPG is limited but...
- South Africa seen as an LPG leader in the South



Source: Argus Media – WLPGA Statistical Review of Global LPG - 2017

6.1 Market Overview

The LP Gas Safety Association of South Africa (LPGSASA) has been in existence for thirty years. There has been little in the way of influence from neighbouring territories.

The uptake of LPG has been gradually increasing over the past five years. Most of the demand has come from the domestic market with some growth in the food and beverage industry etc.

The LPG industry in South Africa is consolidated and dominated by a few major wholesalers but there has been growth at the dealer level to service the domestic market. There has been a strong increase in sales of appliances recently which are mostly imported. There has been some interest recently in a possible cylinder manufacturing plant.

The market has been described as ‘...poised for strong growth...’

6.2 Control of Assets

There is no government requirement for requalifying cylinders although companies apply self-regulation and do this against their own internal procedures to ensure they are in a safe condition and inspect, requalify and/or scrap.

Rail tankers are limited and maintained by the state-owned enterprise. Some road tankers are owned by the major wholesalers but most are owned and operated by transport companies.

Major wholesalers purchase ex refineries and import but there is a growth of smaller companies entering this section of the market.

LPG equipment is distributed and marketed by manufacturers/importers but the majority are available via national retailers, LPG dealers and general hardware outlets.

6.3 Regulatory Framework

The market is regulated mainly through the Government Department of Labour (DoL), with most of the industry players assuming responsibility as well. Compliance is strongly encouraged via the DoL and the LPGSASA.

The DoL are the main enforcing body but the Department of Trade and Industries (DTI), Emergency Services (Fire Department), South African

Police, the National Energy Regulator (NERSA) also have some involvement.

Local Standards covering cylinders/valves, appliances and equipment exist and these often reference acceptable international standards.

The installation of LPG appliances and equipment is also covered by a suite of relevant South African National Standards (SANS)

SANS 10087 Parts 1 - 10, 1539, 1237, 1156-2, 10019, 199 are the most frequently used. Cylinders and storage tanks (pressure vessels) are covered by the Pressure Equipment Regulations (PER).

All cylinders and valves must be tested against the relevant SANS standards. This is verified through the LPGSASA which issues a verification permit for all cylinders found to be compliant. A similar process is adopted for other equipment such as appliances, hoses and regulators.

Larger storage vessels have to comply to standards and various processes involving Authorised Inspection Authorities (AIA's).

Installers are trained by the LPGSASA and registered through an independent body appointed by the DoL.

6.4 Government Incentive Policies

The Government is currently encouraging the use of LPG for domestic cooking, water and room heating applications but not to any real extent.

There are some initiatives being considered (mainly domestic) but there is no real clarity on these at present.

There are no government promotional campaigns but individual companies do undertake some campaigns from time to time.

The LPGSASA promotes the safe use and benefits of LPG via editorial content, radio programmes and, increasingly, digital media.

There are no restrictions on competing fuels such as wood and charcoal.

Provided LPG meets all the necessary safety requirements there are no restrictions on its use. There are no benefits for using LPG either.

Public attitude is still fairly sceptical towards LPG. There is still a fear of using LPG, mainly in the lower income households. This has improved over the past decade and confidence is increasing.

South Africa has lacked sustainable supplies of LPG which has impacted the demand. This has caused problems in promoting the benefits of LPG

with erratic supplies especially safety, cleanliness and reliability. This situation is worse in the winter months.

There are no fiscal advantages applying to LPG. Kerosene enjoys VAT exemption which effectively gives it a subsidy.

Government attitude is slowly improving towards LPG but the main focus is on electricity, nuclear, natural gas and renewables.

6.5 Competitiveness of LPG against Other Fuels

LPG cylinders range in size from 3kg to 48 kg. Cylinders less than 9kg are privately owned. The majority of 9kg cylinders are commercially branded/owned (some 9kgs are now privately purchased/owned). Larger sizes are commercially branded/owned

Privately owned cylinders are purchased and owned by the individual. Commercially branded/owned cylinders are made available to the consumer via a deposit scheme.

Currently the price of LPG in South Africa is R22.21/kg (approx. US\$1.69/kg). Prices change/fluctuate monthly with CP. The price per kg is constant irrespective of cylinder size unless there is some special arrangement with the consumer.

LPG is sold in bulk but pricing is negotiated per project/contract. Some tanks are leased but they are generally 'free on loan' linked to a supply contract.

The price of traditional fuels is revised monthly. Electricity is priced on an increasing sliding scale, depending on usage – the average domestic charge would be approximately R1.40 per kilowatt hour (kwh) (USD\$ 0.11/kwh).

6.6 Recommendations for Improvement

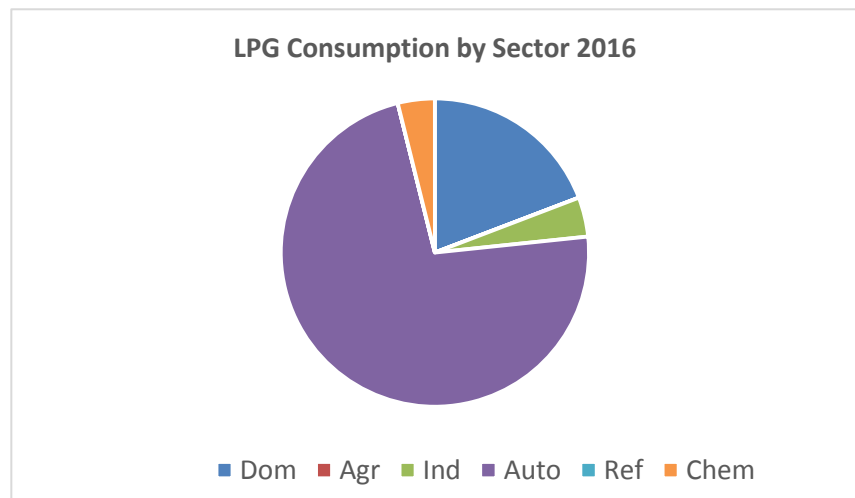
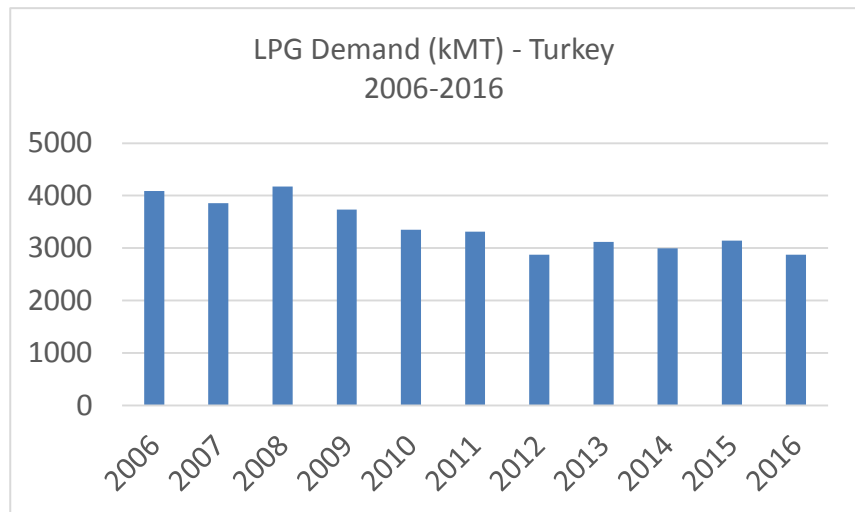
One recommendation to improve matters would be to institute a licensing regime throughout the distribution network to control cylinder filling and ongoing compliance.

South Africa has announced some initiatives recently to install sea fed storage facilities and it is hoped this will instil confidence for government to reinforce the benefits of using LPG.

An expansion of the industry will create employment opportunities - especially for women in the industry

7 Turkey

- Long history of LPG in Turkey
- Autogas champions (second in the world behind South Korea)
- Government policy not clear for LPG but...
- Strong control from EMRA on standards
- Natural gas has price advantage through taxation
- LPG industry seeking fiscal equality with NG



Source: Argus Media – WLPGA Statistical Review of Global LPG - 2017

7.1 Market Overview

LPG was introduced into Turkey in late 1950's and developed following the formation of three founder companies in the early 1960's. There have been various multinational joint-ventures in the LPG industry since then.

The Turkish LPG market is now well developed and mature with a strong supply and distribution network supported by strict standard compliance.

The Turkish LPG market has passed through various stages in its nearly 60 years of history. Although the main driver of the market initially was the residential sector the last 10 - 15 years of the growth has come from the transport sector with the introduction of Autogas.

Throughout the history of the market there have been several eras of strict pricing and subsidy programs. Currently the market is best defined as mature and liberal with the oversight of the National Energy Market Regulatory Authority (EMRA) regarding issues of standards and licencing.

Around 25% of the LPG supply is supplied from local refinery production and the rest is imported. There are three refineries in Turkey that produce LPG; Izmit, Izmir and Kırıkkale with a total production of approximately 900kMT/year.

Imports are sourced mainly from North Africa, The Black Sea, The North Sea and the US. There are five main terminal zones operating in The Black Sea and The Mediterranean. Total storage capacity is approximately 300kMT.

Being a mature LPG market, Turkey has developed a comprehensive LPG equipment industry to support the local LPG business. These products are also exported to various regions around the world including Europe, The Far East, North Africa and The Middle East.

7.2 Control of Assets

All assets (cylinders and tanks) are owned by the LPG company except for a small number of bulk LPG tanks that are sold to the customers. Cross-filling is strictly banned.

The requalification period for all LPG pressure vessel equipment is ten years. Most of the requalification is done by the asset owner but there are a few cases that it is outsourced.

Any movement of LPG between terminals and storage facilities is typically managed by the LPG companies. Transportation through the distribution channel can be contracted out but it is strictly monitored by the LPG companies.

Typically, distribution is made through brand exclusive dealers, both in the residential and Autogas sectors. Industrial consumers are supplied

directly. All related LPG equipment is both available in the LPG channel and non-LPG outlets.

7.3 Regulatory Framework

The regulatory framework in Turkey is well established and clear.

All the energy markets, including LPG, are regulated by the National Energy Market Regulatory Authority. This covers both standards and licencing.

There is a free market policy in place covering pricing which is in full compliance with competition laws.

The main standards are EN 589 for Autogas and EN TS 2178 for the traditional cylinder market.

There are various enforcement measures in place which are applied by Energy Market Regulatory Authority, different ministries and government agencies as well as local governments and municipalities. They cover a large area from licencing to facilities.

The government's attitude towards LPG is '...non-committal...'. There is currently neither a positive nor a negative policy towards LPG.

7.4 Government Incentive Policies

With the government's attitude towards LPG being non-committal there is a neutral policy towards LPG in the current mature stage of the market.

There is only a 0.7% (<99% propane) or 8% (>99% propane) customs tax on propane imports as customs tax. Customs tax applies only when EUR1 and/or ATR is not present.

Cylinder LPG is over taxed in Turkey compared to natural gas and electricity. For example, in calorific terms LPG is taxed 46 times more than natural gas. This is one issue that the LPG industry would like addressing.

Two of the main awareness and education campaigns includes 'Fuel of the Future; LPG' and "Drive for Tomorrow" (<http://www.drivefortomorrow.com/>). The 'Fuel of the Future; LPG' campaign emphasises the benefits, versatility, eco-friendly, safe, economical and high performance of LPG. Drive for Tomorrow focuses on the environmentally friendly aspects of Autogas.

One important restriction for Autogas cars in Turkey is that they are prohibited from entering underground car parks and some ferry services.

The perception of cylinder LPG has been positive with the well-established structure of the market. For Autogas, which is a relatively new segment compared to 60 years history of cylinder LPG, the public

perception has increased dramatically recently in the areas of safety, environment and performance.

7.5 Competitiveness of LPG against Other Fuels

LPG is a competitive fuel in the Autogas segment and the most widely used one in personal road transportation. However, in the other segments, it is heavily taxed in comparison to its alternatives, mainly natural gas.

There are five cylinder sizes currently in use in Turkey (2kg, 12kg, 16kg, 24kg and 45kg). The 12kg cylinders constitutes 80% of the market.

Cylinders are leased to consumers for a moderate deposit and the ownership remains with the LPG company. All universally accepted payment methods can be used to purchase the LPG.

There is no single pricing policy and prices are determined in compliance with the free market. The average price in the market is around US\$1.5 – 2.0/kg.

Typically, bulk LPG tanks are leased to consumers for a moderate deposit for the term of the supply contract. Only a small number of tanks are sold to the customers who commit to ensuring compliance of maintenance needs.

As with residential cylinder consumers there is no single pricing policy and prices are determined in compliance with the free market. The average price in the bulk market is around US\$1.5 – 1.7/kg.

Compared to LPG, natural gas for residential use is priced at US\$0.3/m³, coal is US\$0.2/kg, fuel-oil is US\$0.7/kg, electricity US\$0.1/kWh, diesel US\$1.2/litre and gasoline US\$1.5/litre.

7.6 Recommendations for Improvement

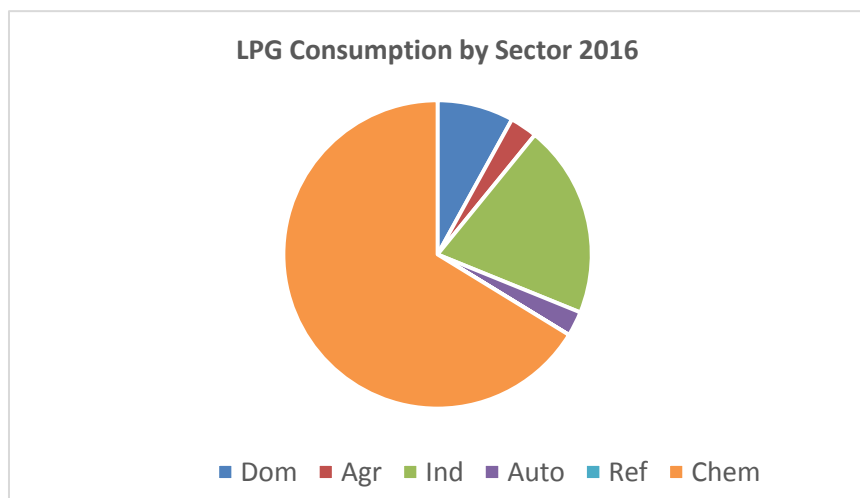
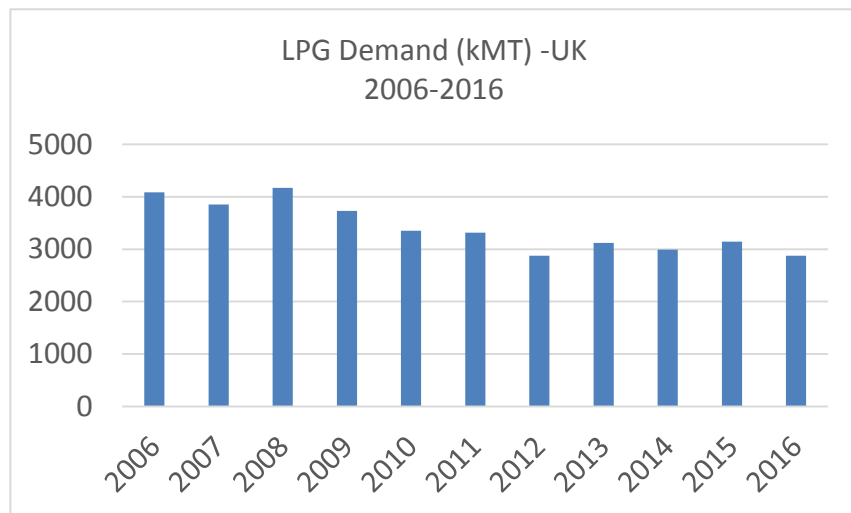
The differential taxation between natural gas and LPG makes it a challenge for LPG to compete and this is an important area for the industry to change with government.

For LPG to penetrate the rural populations the industry would support the use of some form of government backed incentive. Similarly, for power generation.

The industry would also support some form of grants or tax credits for the conversion of cars to LPG and the enabling of the OEM industry to develop dedicated LPG cars off the manufacturing line.

8 United Kingdom

- LPG industry 70+ years old and well matured
- Chemical sector demand dominates
- Well established UKLPG codes driving good practices
- LPG asset control mixed
- Autogas has come and gone
- Government lethargic towards LPG
- Industry needs focused government support



Source: Argus Media – WLPGA Statistical Review of Global LPG - 2017

8.1 Market Overview

LPG market in the UK started in 1947 and has now matured. The Irish LPG industry developed closely with the UK's and today larger corporations urge cross border practices.

The commercial sector has grown. The residential sector is now stable with unit demand declining. The Autogas sector in the UK has seen growth and then decline due to several factors including a lack of long term support from the government and available Autogas vehicles.

The market has consolidated to a point where further consolidation may invite competition investigation or even regulation. The largest companies are foreign owned

Supplies are dominated by local refineries. There are two main import jetties and large storage facilities. A third is being developed. North Sea production contributes, but is declining in overall volumes.

Components and pressure vessels are largely imported but refurbishment, testing and assembly of components are done locally.

8.2 Control of Assets

Asset control varies by equipment.

LPG cylinders are requalified every 15 years if they are certified, otherwise 10 years. Storage tanks 10 years, 20 years and 30 years with varying types of work depending on the company's written scheme of examination. Storage tanks on road tankers are requalified every six years. Engine, brakes, lights etc. subject to UK road transport laws.

The responsibility for these tasks are split between the asset owner and outsourcing, depending on the process. Some processes are split.

LPG is not transported by rail in the UK. Road deliveries are mostly managed by the LPG companies but some companies outsource.

Scheduling is normally done in-house but the driver trailer is owned by contractor.

LPG supply tends to be sole branded within a competitive market. Some companies sell LPG appliances, but these can all be bought in appropriate retail outlets. Storage tanks and cylinders are owned by the LPG supply companies. Appliances are owned by the user.

Control of cylinders could be tighter. Control of fixed storage tanks and associated infrastructure is very much better but there are some document gaps.

8.3 Regulatory Framework

The UK LPG industry is not regulated although the competition authorities have set certain rules regarding contract limits, consumer

information and switching between suppliers for the supply of domestic bulk LPG customers (only).

Financial services rules apply to credit agreements. Contract law applies in general, as does the law relating to dispute resolution. Gas installers are regulated by government through a nationally recognised register.

UK law transposing EU or UK agreements; Health & Safety law and regulations. UKLPG Codes; British and CEN standards; Gas safety codes, standards from other bodies apply too.

There is a list of codes available on the UKLPG website: www.uklpg.org

These codes are not law but are 'recommended good practice'. They are sometimes enforced depending on the local authorities' approach. The UKLPG codes are exported and used as a good benchmark by other countries.

If a major member of the UKLPG breaches the codes they are at risk of forfeiture of their UKLPG membership. Standards can be referenced in law, or would be expected to be adhered to prove compliance.

The UK government is non-committal towards LPG. They are not unsupportive but equally they are not full of enthusiasm.

The regulatory framework is described as tight with a moderate financial burden.

8.4 Government Incentive Policies

There are no incentives to use LPG in the UK apart from a favourable differential on Autogas (15.805ppl) versus diesel and petrol both 57.95ppl).

There is funding available for taxi conversions in Birmingham and further funding opportunities for vehicles in cities with Clean Air Zones (CAZ's) are currently being consulted on.

The UK government is drafting an 'Air Quality Plan' aimed at transport which will be released in 2017. Following a consultation earlier in 2017, the UK government is also currently considering how to best reduce the use of coal and oil in off-grid domestic and non-domestic buildings.

There has been no public awareness campaigns for LPG in the UK to date.

There are no restrictions on the use of LPG other than LPG road tankers are not allowed to go through city centres, and certain tunnels have

designated codes that prohibits dangerous goods vehicles. This is regulated through the European ADR Agreement.

LPG converted vehicles will meet the emissions standard for toll free access to Clean Air Zones and Low Emission Zones and so they are exempt from those charges (US\$15/day in London).

The government attitude towards LPG as an automotive fuel is 'fair to positive'. It is much better than the public attitude towards diesel, but perhaps no different to the attitude to unleaded fuel.

There are biofuels incentives under the renewable transport fuel obligation (RTFO).

Car dealerships and manufacturers can get grants to reduce the price consumers pay for brand new electric and hybrid vehicles.

The dealer includes the value of the grant in the vehicle's price. Electric vehicles are covered by this (<https://www.gov.uk/plug-in-car-van-grants/what-youll-get>).

The general government attitude towards LPG is '...non-committal...'. It is not unsupportive but equally not full of enthusiasm to the extent of giving incentives for uptake.

8.5 Competitiveness of LPG against Other Fuels

LPG cylinders in the UK come in a number of sizes including 3.9kg, 6kg, 13kg, 19kg and 47kg.

The price of the LPG in a residential cylinder varies and is determined by each supplier.

LPG is available in bulk and the consumer storage tanks attract an annual rental charge which covers testing and maintenance. The monthly weighted average bulk price for LPG in bulk is around 46ppl (US\$0.60/l) including VAT. Comparative data is available at <http://www.sutherlandtables.co.uk/>

The LPG market in the UK is highly competitive, however LPG is a more expensive fuel than other off-grid fuels.

8.6 Recommendations for Improvement

Decisive action from government, supporting LPG, is needed regarding diesel for vehicles and coal and oil for off-grid energy.

The LPG industry would like a signal from government to customers to transition from oil powered domestic and commercial appliances.

Annex 1: References

OECD (Organisation for Economic Co-operation and Development) (2013), *Taxing Energy Use: A Graphical Analysis*, OECD, Paris.

Petroleum Argus, *LPG World* (twice-monthly newsletter, various issues).

World LPG Association (2009), *LPG: Healthy Energy for a Changing World*, WLPGA, Paris.

World LPG Association/Argus Media (2017), *Statistical Review of Global LPG 2016*, WLPGA/Argus Media, Paris/London.

Global LPG Partnership (US)

International Energy Agency (IEA)

World Health Organisation (WHO)



Copyright

© 2017 World LPG Association.

All rights reserved. Neither this publication nor any part of it may be reproduced, stored in any retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the publishers.

All information in this report is verified to the best of the authors' and publishers' ability. They do not guarantee the accuracy of the data contained in the report and accept no responsibility for any consequence of their use.






182 avenue Charles de Gaulle, 92200 Neuilly-sur-Seine, France

Tel: +33 1 78 99 13 30

association@wlpga.org

www.wlpga.org

 [@ExceptionalNRG](https://twitter.com/ExceptionalNRG)

