

Malaysia: Natural Gas Industry Annual Review

2017 Edition



Cover photo

RGT1, Malaysia's first regasification terminal in Sungai Udang, Melaka

Photo courtesy of PETRONAS



VISION

PROMOTING A VIBRANT AND SUSTAINABLE MALAYSIAN GAS INDUSTRY.

MISSION

TO PROMOTE THE ADVANCEMENT OF A SUSTAINABLE MALAYSIAN GAS INDUSTRY THROUGH ADVOCACY, COMMUNICATION AND EDUCATION ON BEHALF OF ITS MEMBERS AND THE NATION.

OBJECTIVES

ADVOCATE FOR GAS-RELATED ISSUES

TO BE THE ADVOCATE FOR GAS-RELATED ISSUES THAT ARE THE PRIORITIES OF MEMBERS AND THE GAS INDUSTRY AND TO CONTRIBUTE TO THE DEVELOPMENT OF THE ASSOCIATED LEGISLATION, POLICIES, AND/OR STANDARDS

ADVANCE KNOWLEDGE AND LEARNING

TO ADVANCE KNOWLEDGE AND LEARNING ACROSS THE GAS VALUE CHAIN ON THE SAFE, EFFICIENT AND SUSTAINABLE USE OF GAS AMONG MEMBERS, GAS PROFESSIONALS AND STUDENTS

DISSEMINATE INDUSTRY INFORMATION AND INSIGHTS

TO PROVIDE A PLATFORM FOR THOUGHT LEADERSHIP AND TO PRODUCE AND MAINTAIN GAS RELATED INFORMATION, INSIGHTS AND STATISTICS ON THE GAS INDUSTRY

ENHANCE PUBLIC'S UNDERSTANDING ON GAS

TO ENHANCE UNDERSTANDING OF THE GENERAL PUBLIC ON THE ROLE AND USES OF GAS AS A CLEAN, SAFE, AND EFFICIENT ENERGY

PROMOTE BUSINESS NETWORKING AND COLLABORATION

TO ORGANIZE ACTIVITIES THAT FACILITATE NETWORKING AMONG MEMBERS AND STAKEHOLDERS INVOLVED IN GAS RELATED ACTIVITIES



MESSAGE FROM THE PRESIDENT OF MGA

It gives me great pleasure to present the 5th edition of the “Malaysia: Natural Gas Industry Annual Review” publication. I am delighted to note that this publication has attracted interest among industry professionals and students and I hope that it will continue to be a comprehensive and authoritative reference on the Malaysian natural gas industry.

2016 continued to be a very challenging time for the oil and gas industry in Malaysia and globally. The industry has responded accordingly with companies instituting various measures to improve cost efficiency and protect their cash positions. I am confident that the industry will emerge from this crisis stronger and more resilient.

On a more positive note, the passing of the Gas Supply (Amendment) Act 2016 is a significant milestone for the industry. The act introduces the Third Party Access (TPA) framework, whereby third parties will be allowed to bring in gas into the country and sell gas directly to consumers.

During the second-half of the year, market gas prices in Peninsular Malaysia reached their lowest point since the introduction of LNG-based pricing in 2013, reaffirming the view that now is the most opportune moment to implement price deregulation. At RM3.076 billion, gas subsidy in 2016 was at its lowest since 1999. This was due to a large part to gas market reforms undertaken by the Government towards reducing the gas subsidy burden, which has accumulated to over RM 241.4 billion.

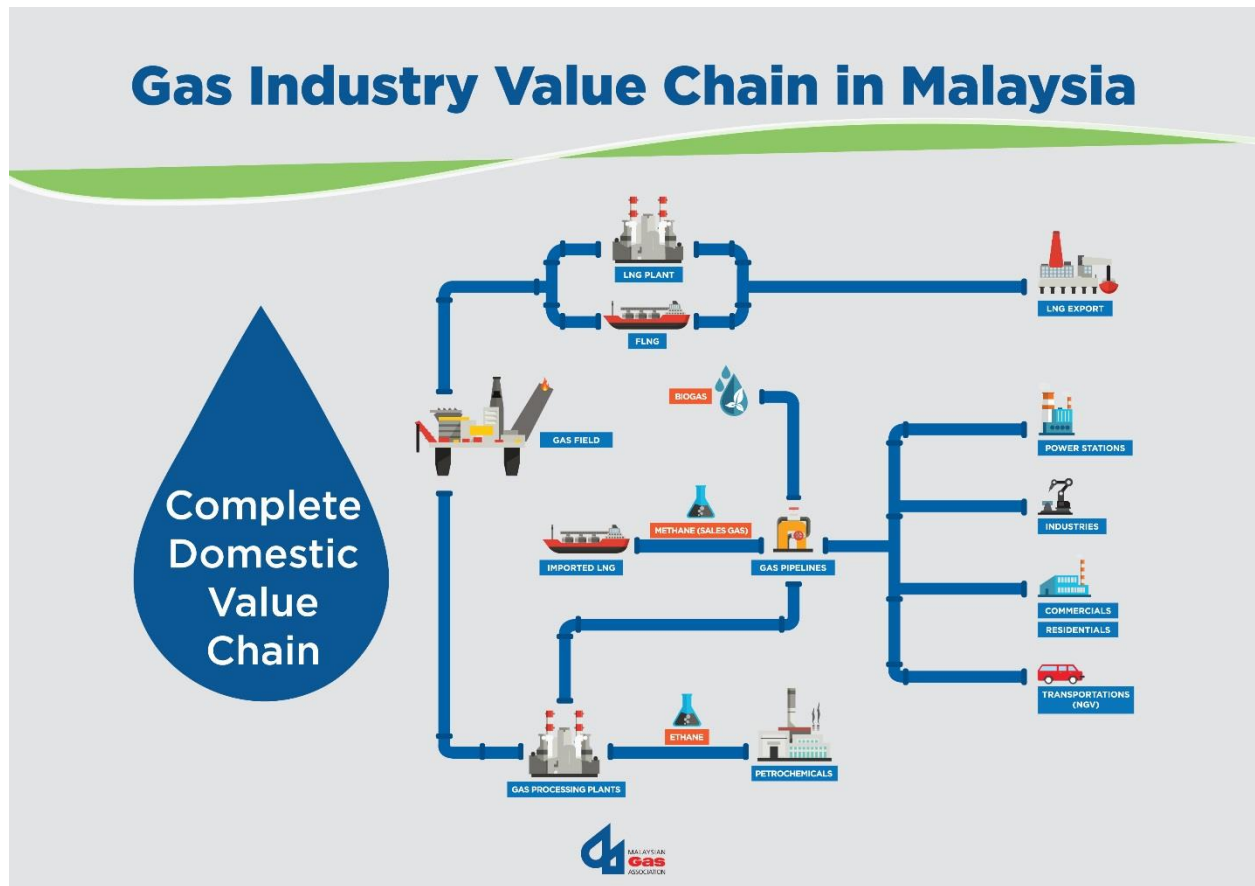
During the year, several other encouraging developments have taken place in the domestic gas industry:

- The world’s first floating LNG facility; PFLNG Satu, achieved an industry breakthrough with the successful production of its first drop of LNG from the Kanowit gas field, offshore Sarawak. This operational milestone is expected to boost Malaysia’s total LNG production capacity to 32 MTPA and alter the landscape of the global LNG industry
- The Train 9 LNG project in Bintulu delivered its first cargo in September 2016. Train 9 will boost Malaysia’s LNG production capacity by another 3.6 MTPA, further cementing Malaysia’s position as a major LNG player in the world
- The first commercial production of bio-CNG from Palm Oil Mill Effluent (POME) by a Gas Malaysia-Sime Darby joint venture in 2016
- The Government of Malaysia remains committed to the gas subsidy rationalization

Finally, I wish to record my sincere gratitude to PETRONAS Group of Companies and Gas Malaysia Berhad for their contribution and involvement in making this publication possible, and to Suruhanjaya Tenaga, Bank Negara Malaysia, the Department of Statistics and other organizations whose information, data and publications had been referred to in this publication.

Hazli Sham Kassim
President
Malaysian Gas Association

Diagram of Natural Gas Industry in Malaysia



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EXECUTIVE SUMMARY

- The Malaysian economy grew by 4.2% in 2016, compared to 5.0% in 2015.
- The Malaysian population increased by 1.3% to 32.0 million in 2017 from 31.6 mil in 2016.
- The total natural gas resources as of 1 January 2015 stood at 100.4 TSCF.
- Malaysia's gas intensity or the volume of natural gas consumed to generate one percent of GDP growth for the year was 17.9 BCM. This represents a 17.6% increase in gas intensity per GDP over the previous year and a 29.6% increase over that of the preceding 5 years.
- The amended Gas Supply Act 1993 has been passed by the Parliament, in the Dewan Rakyat on 23 May 2016 and the Dewan Negara on 14 Jun 2016. The amended Act was gazetted on 9 September 2016 and came into force on 16 January 2017. The amended GSA paves the way for Third Party Access (TPA) and the liberalization of Malaysian gas market.
- The world's first floating LNG facility; PFLNG Satu, achieved an industry breakthrough with the successful production of its first drop of LNG from the Kanowit gas field, offshore Sarawak. This operational milestone is expected to boost Malaysia's total LNG production capacity to 32 MTPA and alter the landscape of the global LNG industry.
- The Train 9 LNG project in Bintulu delivered its first cargo in September 2016. Train 9 will boost Malaysia's LNG production capacity by another 3.6 MTPA, further cementing Malaysia's position as a major LNG player in the world.
- A total of 420 LNG cargoes were exported from Bintulu in 2016.
- A total of 20 LNG cargoes were imported into Peninsular Malaysia through the LNG RGT1 in Melaka in 2016.
- On average, PETRONAS Gas' Gas Processing Plants processed 1,672 MMSCFD of sales gas in 2016. Added to this was 327 MMSCFD of sales gas from the Malaysia-Thailand Joint Development Area (MTJDA) and another 153 MMSCFD of sales gas from RGT1. Accordingly, the PGU pipeline delivered on average a total of 2,152 MMSCFD of sales gas for the year.
- The number of NGV vehicles in Malaysia in 2016 was approximately 77,000 while the number of NGV refueling stations stood at 103.
- In 2016, the total revenue foregone by selling gas to the domestic market at regulated prices was RM3.1 billion, of which RM1.9 billion or 61% was accounted by the power sector and RM1.2 billion to the non-power sectors - which included industrial, commercial and residential users, and NGV. Cumulative amount since May 1997 has reached RM241.4 billion.



Glossary:

MT = million tonnes

MTPA = million tonnes per annum

GJ = giga joule

bscf = billion standard cubic feet

mmscfd = million standard cubic feet per day

tscf = trillion standard cubic feet

mmBtu = million British thermal unit

kboe = thousand barrels of oil equivalent

bboe = billion barrels of oil equivalent

LNG = liquefied natural gas

NGV = natural gas for vehicle

FLNG = floating LNG

GWh = Giga Watt hour

FY = fiscal year

CY = calendar year

SECTION 1: UPSTREAM SECTOR

SECTION 1.1: NATURAL GAS RESOURCES

In 1980, the natural gas reserves in Malaysia stood at 41.67 TSCF. 58.03 percent or 24.18 TSCF of the reserves were located in Peninsular Malaysia, whereas Sabah and Sarawak contributed about 0.02 percent and 41.95 percent respectively. However, in 1990, the pattern underwent a reversal – the natural gas reserves in Sabah and Sarawak overtook those in Peninsular Malaysia and this trend continues to the present day.

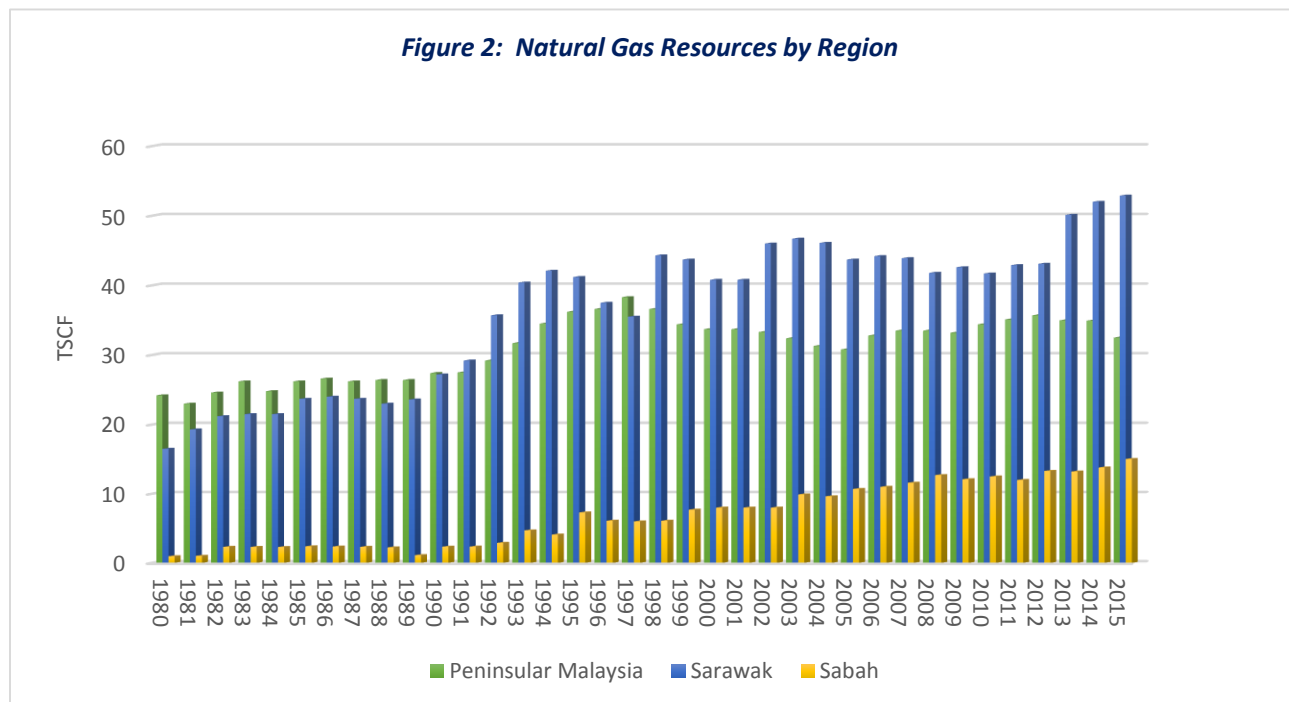
As of 1st January 2015, Malaysia's total natural gas resources are estimated to be 100.413 TSCF as can be seen in Figure 1. At the current production rate, Malaysia's natural gas resources should be able to last over 40 years. Natural gas therefore is expected to continue to play an important role in helping to power Malaysia's economy, as well as feature prominently in ensuring security of the nation's energy supply up to 2050.

Figure 1: Reserves and Production of Natural Gas as of 1st January 2015

REGION	RESERVES			PRODUCTION
	TRILLION STANDARD CUBIC FEET (TSCF)			MILLION STANDARD CUBIC FEET PER DAY (MMscf/d)
	ASSOCIATED	NON-ASSOCIATED	TOTAL	
Peninsular Malaysia	8.471	24.022	32.493	1,949.69
Sabah	3.149	11.884	15.032	376.02
Sarawak	2.853	50.034	52.888	4,147.00
TOTAL	14.473	85.940	100.413	6,472.71

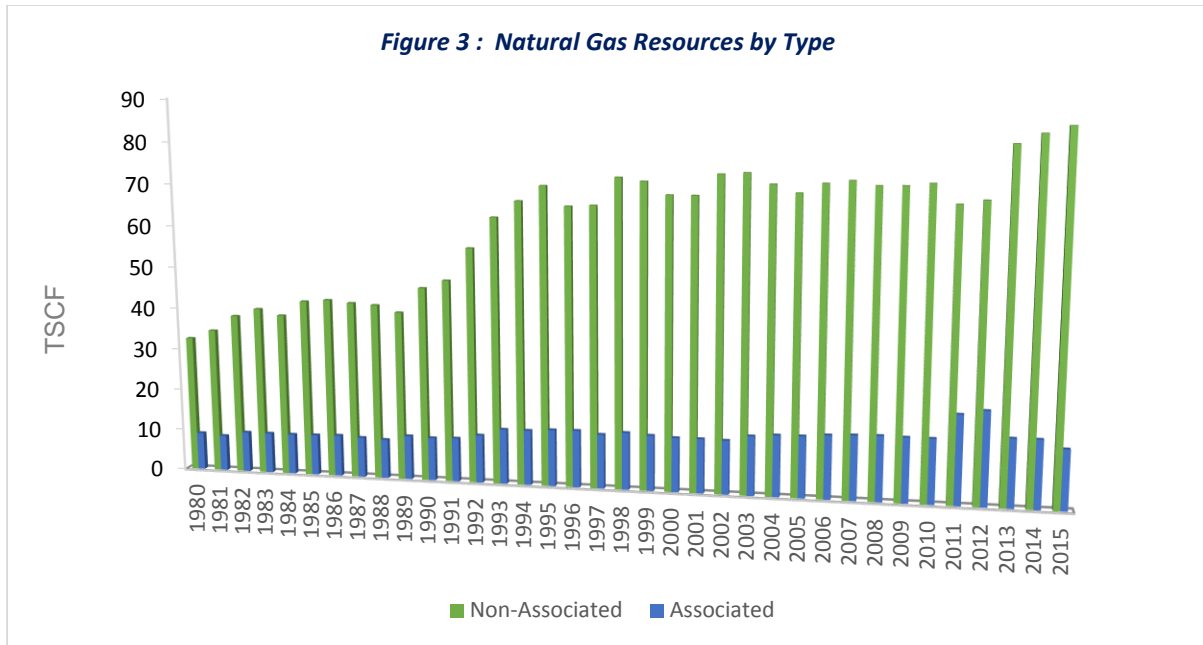
Source: National Energy Balance 2015, Energy Commission

A breakdown of the country's natural gas resources by region is provided in Figure 2 below. The largest share of Malaysia's gas resources lie in Sarawak (at 52.89 TSCF).



Source: Malaysia Energy Information Hub (MEIH), Energy Commission

Natural gas resources by type on 1 January of each year is shown in Figure 3. In 2015, 84 percent of Malaysia's natural gas resources comprises non-associated gas i.e., deposits or reservoirs of natural gas not occurring in association with oil deposits or reservoirs. The implication of this is that the price of gas need to be attractive on its own to make the development of these gas resources economically viable.

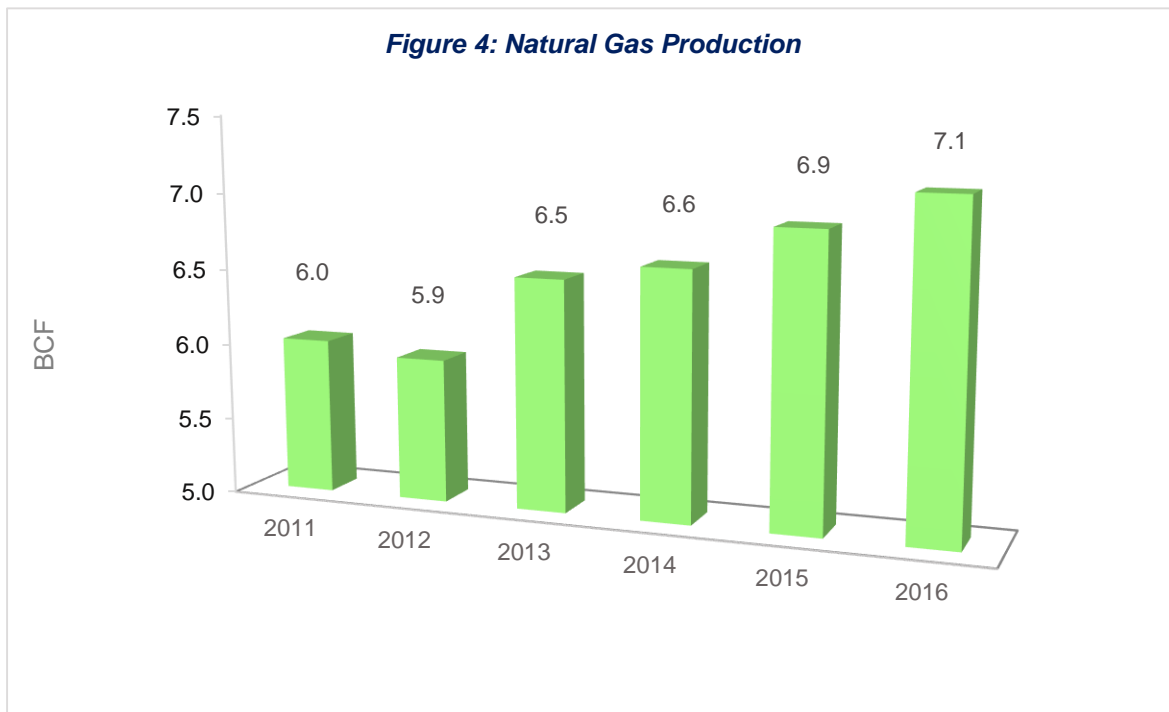


Source: MEIH, Energy Commission

In developing its gas resources, Malaysia faces various challenges in upstream gas development such as depleting resources and ageing facilities, gas fields containing high CO₂ and other contaminants, marginal fields, and rising development costs.

SECTION 1.2: NATURAL GAS PRODUCTION

According to the BP Statistical Review of World Energy 2017 publication, Malaysia's gas production in 2016 amounted to 7.13 billion cubic feet, a growth of 3.4 percent from the previous year and accounting for 2.1 percent of total global production. The Natural Gas Task Force chaired by the Energy Commission has been monitoring major upstream shutdowns since 2011. In 2015, nine major shutdowns were registered and monitored.



Source BP Statistical Review of World Energy (2017)

SECTION 2: DOWNSTREAM SECTOR

Malaysia's downstream sector of the gas industry had its beginnings Sarawak with the introduction of domestic and commercial piped gas in the early 1960s. This was followed by Peninsular Malaysia in 1984. The downstream sector of Malaysia's natural gas industry consists primarily of domestic consumption and exports. However, since about 80.3 percent of the country's natural gas demand is located in Peninsular Malaysia, domestic consumption practically refers to gas consumed in this part of the country. On the other hand, a significant portion of the natural gas produced offshore Sarawak is exported in the form of LNG; thus, Malaysia's natural gas exports primarily refer to exports of LNG via Bintulu, Sarawak.

SECTION 2.1: DEVELOPMENT OF MALAYSIA'S NATURAL GAS INDUSTRY

Malaysia's ability to harness and obtain the best value for its natural gas resource is attributed to the orderly and systematic manner in which the country's gas resources were developed and exploited. One of the success factors is the mandate given to PETRONAS by the Malaysian Government to develop the industry, from the development of the gas fields up to the processing, marketing and distribution of the resource. As a result, PETRONAS was able to develop the country's natural gas industry in a fully integrated and efficient manner, thereby obtaining the optimum returns for the resource throughout the whole value chain.

The Gas Master Plan Study commissioned by PETRONAS in 1981 set the stage and roadmap for the development of natural gas industry in Malaysia. One of the most important recommendations from the Study was the implementation of a project to put in place the transmission grid for the Peninsular Malaysia, known as the Peninsular Gas Utilization project, or PGU.

Under the PGU system, gas from the offshore fields off the east coast of Peninsular Malaysia is treated and processed at PETRONAS Gas Berhad's (PGB's) gas processing plants (GPPs). Here, the gas is separated into its main components, namely sales gas, ethane, propane, butane, and condensate. The sales gas; which comprises mostly methane, is supplied to the power and non-power sectors while ethane, butane and propane are supplied to petrochemical plants as feedstock.

The GPP complexes, located in Kertih and Santong, Terengganu have a capacity to produce a total of 2,060 MMSCFD of sales gas. In 2016, an average of 1,672 MMSCFD of sales gas was processed at the GPPs.

Figure 5: PGB's Gas Processing Plants

Complex	GPP	Capacity (MMSCFD)
GPK	1	310
GPK	2	250
GPK	3	250
GPK	4	250
GPS	5	500
GPS	6	500
Total		2,060

Source: PETRONAS Gas Berhad Annual Report 2016

The sales gas is delivered to the end users throughout Peninsular Malaysia via the PGU gas transmission network comprising more than 2,500 km of high pressure pipelines. The PGU system subsequently helped spawn petrochemical hubs on the east coast and encouraged gas-fired power plants to be built along its route, especially along the south and west coast of the peninsular. The PGU also has the historical significance of being the first Asian export pipeline as it enabled natural gas to be exported to Singapore. Equally important, the PGU is linked to a pipeline grid from Thailand, where natural gas from the Malaysia-Thai Joint Development Area (JDA) is landed at Songkhla in south Thailand, and subsequently piped into Malaysia, via Padang Besar in Perlis.

Figure 6: PGB's Gas Pipelines

PGB Total Pipeline Length	Length (km)
Main	1,690
Lateral	458
Liquid	373
Sarawak	39
RGTSU	30
Total	2,590

Source: PETRONAS Gas Berhad Annual Report 2016

The completion of all the three stages of the PGU project in the late 1990s has since propelled natural gas to become the most important source of energy for Malaysia, reshaping the country's energy and economic landscape, whilst at the same time paving the way for the nation to embark on the path towards industrialization.

In terms of national economics, natural gas helped Malaysia to generate significant valuable foreign exchange earnings, whilst at the same time help to substantially reduce the country's dependence on fuel oil, and its import. Exports of LNG and the cutback of fuel oil imports for power generation provided a very significant boost to Malaysia's economy. Natural gas' contribution to Malaysia's economy climaxed during the 1997-98 Asian Financial Crisis. With over 70% of its power needs then being generated by natural gas, Malaysia was able to avoid the full brunt of the Ringgit's devaluation, which depreciated to almost RM 5 to the US dollar. Thanks to its relatively low domestic electricity tariffs, the country was amongst the earliest in the region to recover from one of the worst ever economic recession to hit the Asian region.

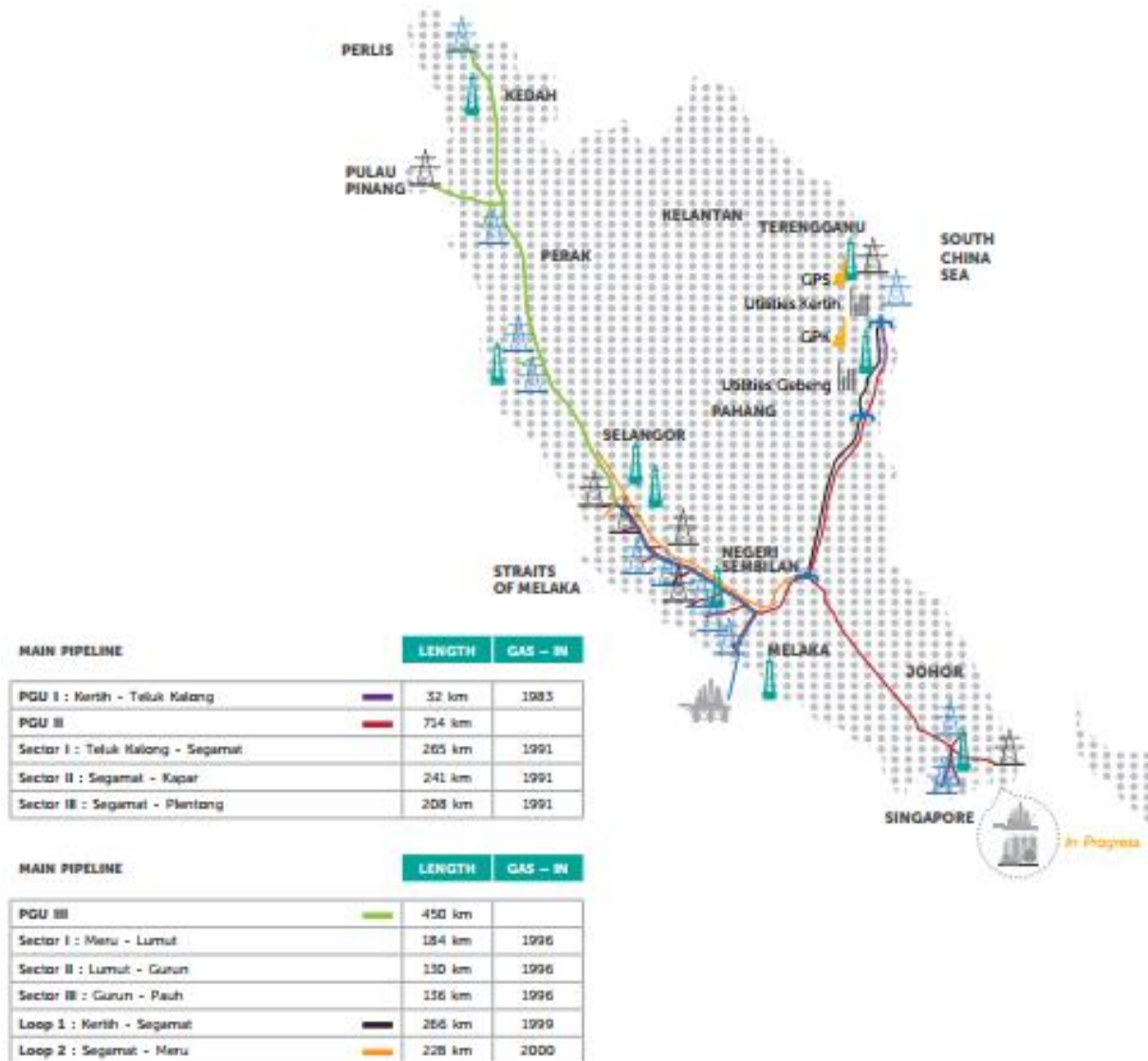
More recently, the domestic gas supply has helped mitigate the effects of the depreciating ringgit on the country's balance of payments and foreign exchange reserves positions. In 2016 alone, with 88.8 percent of the sales gas being piped gas – most of which are from domestic sources, at

the minimum, it saved RM 7.8 billion of the country's precious foreign exchange reserves from being depleted to finance fuel imports.

In April 2014, PETRONAS announced the Final Investment Decision of Pengerang Integrated Complex (PIC) in southern Peninsular Malaysia. This massive development is part of the larger Pengerang Integrated Petroleum Complex (PIPC) being promoted by the Johor State Government. PIC development will include, amongst others, a second LNG RGT and a co-generation plant which are targeted for completion in 2017, in time to support the commissioning of RAPID (Refinery and Petrochemical Integrated Development) in 2019.

The gas-fired Pengerang Cogeneration Plant (PCP) will generate 1,220 MW of electricity and up to 1,480 tonnes per hour of steam. PCP will also supply 400 MW of electricity to the national grid.

Figure 7: Map of Peninsular Gas Utilization (PGU) Pipeline Network



Source: PETRONAS Gas Berhad Annual Report 2016

The Sabah-Sarawak Integrated Oil and Gas Project harnesses the oil and gas resources in the offshore area of Sabah in East Malaysia. Besides the development of the new oil and gas fields off the coast of Sabah, namely Gumusut/Kakap, Kinabalu Deep and East, Keabangan and Malikai, the project consists of two onshore developments:

1. Sabah Oil and Gas Terminal (SOGT)

The SOGT receives, stores and exports crude oil as well as receives, processes, compresses and transports the gas produced from the fields located offshore Sabah. Covering an area of about 250 acres, the SOGT has the capacity to handle up to 300,000 barrels of crude oil per day and 1.0 billion standard cubic feet of gas per day. The crude oil and condensate received and stored at the terminal can be loaded into vessels for export through single point moorings located about 10km offshore Kimanis.

The new terminal complements the operations of the existing Sabah Gas Terminal, the Labuan Crude Oil Terminal and the Labuan Gas Terminal which will continue to handle the oil and gas produced from other offshore Sabah fields.

2. Sabah-Sarawak Gas Pipeline (SSGP)

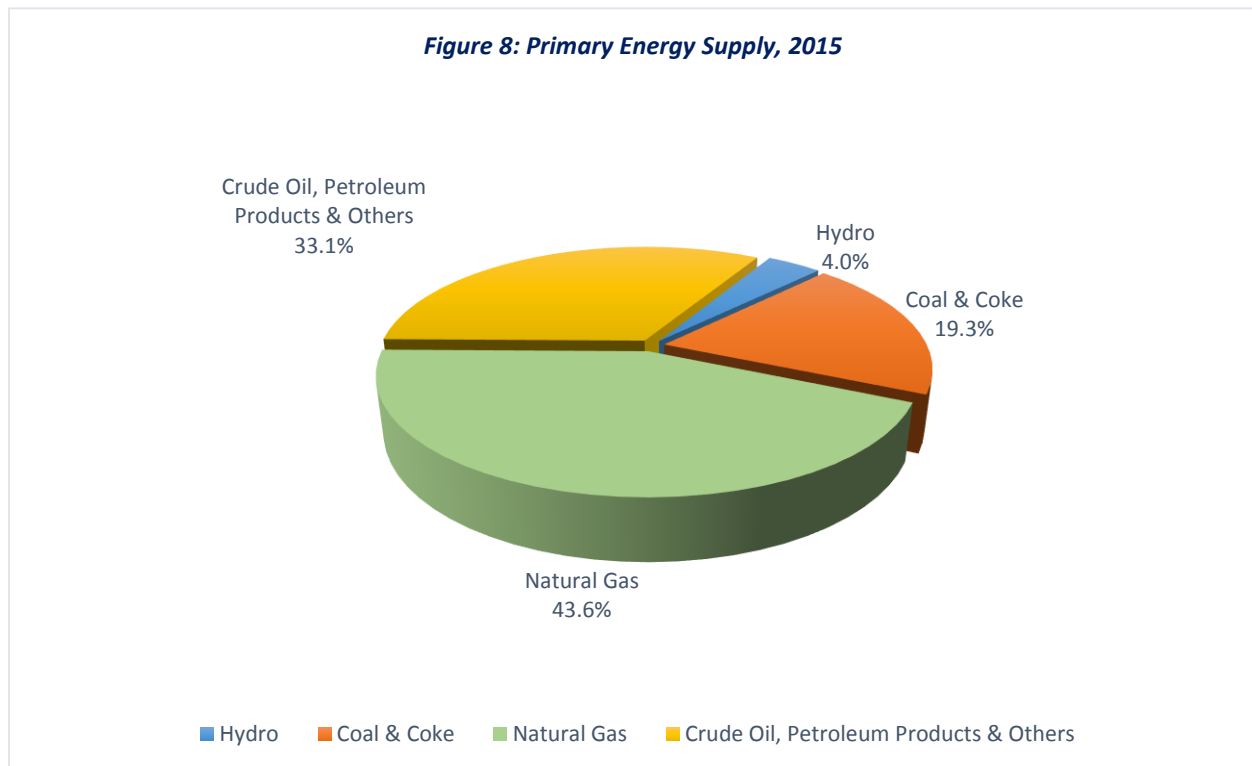
The 500-km SSGP transports gas from the SOGT in Kimanis to domestic users and for processing into liquefied natural gas (LNG) at the PETRONAS LNG Complex for export. The operations of the pipeline was suspended due to an incident in 2014 but was resumed in Q3, 2016.

Gas from the SOGT will also be delivered to industrial and petrochemical users in Kimanis and Sipitang. At Sipitang, PETRONAS Chemicals Group has undertaken the Sabah Ammonia Urea (SAMUR) project, using gas feedstock to produce ammonia and urea. The plant was progressively commissioned in 2016.

SECTION 2.2: DOMESTIC NATURAL GAS CONSUMPTION

Since 1991, when Phase Two of the PGU was commissioned, natural gas has become an important source of energy for Malaysia. At its peak in 2006, natural gas accounted for almost 53 percent of Malaysia's primary energy supply. However, due to the decline in production from some of the fields offshore Peninsular Malaysia, the share of natural gas in Malaysia's primary energy mix has since dropped to 43.6 percent in 2015, with coal meeting the country's incremental energy demand.

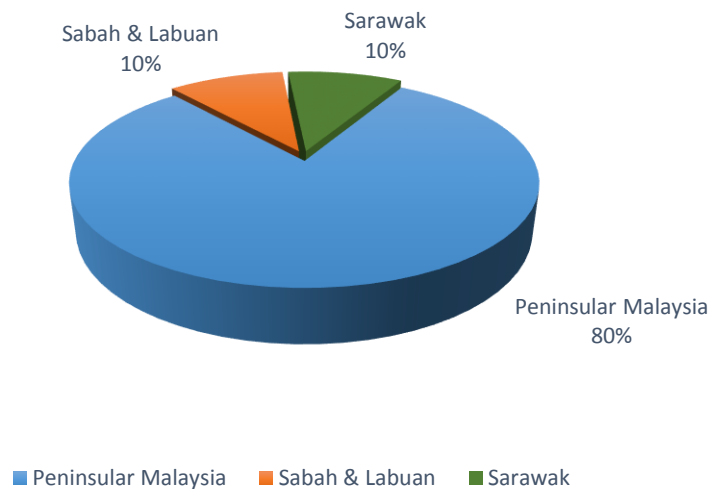
A chart showing natural gas' share of Malaysia's primary energy supply in 2015 is provided in Figure 8.



Source: *National Energy Balance 2015, Energy Commission*

The gas demand in Malaysia in 2015 was 943,154 MMSCF. Out of this, the largest users are the power sector at 54.3 percent, industry at 19.4 percent, non-energy at 18.1 percent and co-generation at 7.1 percent. Peninsular Malaysia accounts for the lion's share of demand at 80.3 percent of Malaysia's total natural gas consumption. A snapshot of the country's natural gas demand by region is provided in Figure 9.

Figure 9: Domestic Gas Consumption by Region, 2015



Source: National Energy Balance 2015, Energy Commission

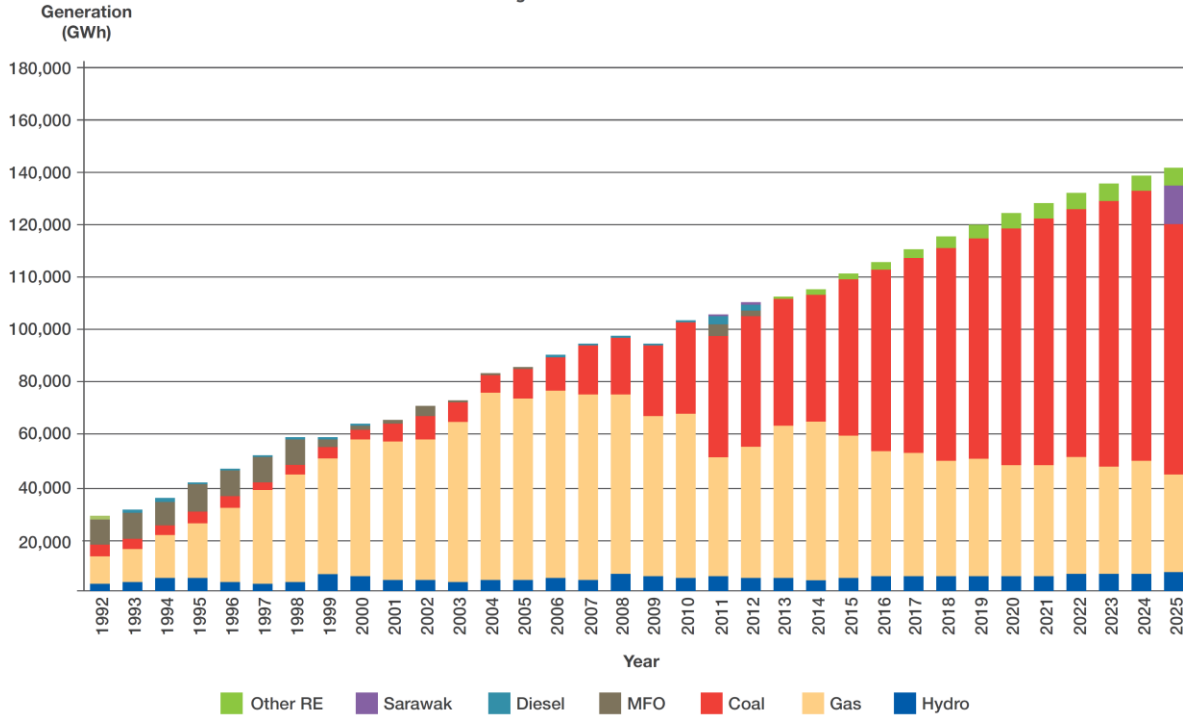
Ever since it was introduced to the country's power sector in the late 1980s, natural gas has continued to be the preferred fuel for power generation. Together, power stations and co-generation plants accounted for 61.4 percent of total gas consumption in Malaysia in 2015.

The Malaysian Government's decision to regulate the gas price to the power sector in Peninsular Malaysia and Sabah has succeeded in keeping the country's electricity tariff to be amongst the lowest in the region. Demand for natural gas in the power sector grew and reached a peak in 2000 when it accounted for 78 percent of electricity generation mix for the country.

The completion of the LNG RGT1 in May 2013 contributed significantly towards enhanced gas supply and energy security in Peninsular Malaysia. Reliable gas supply ensured that the share of gas in Peninsular Malaysia's power generation mix stood at approximately 41 percent in 2016.

As of December 2016, the total installed capacity of power generation plants stood at 22,919 MW. Out of this, Combined Cycle Gas Turbines accounted for 41 percent of the capacity whilst Open Cycle Gas Turbines accounted for an additional 6 percent.

Figure 10: Peninsular Malaysia's Power Generation Mix (1992-2030)



Source: Peninsular Malaysia Electricity Supply Industry Outlook 2016, Energy Commission

Additional capacity of 9,171 MW from 12 committed generation projects will be commissioned in 2017-2023 against plant retirements amounting to 6,256 MW. The new projects consist of 5,282MW capacity from gas, 3,000 MW from coal and 889 MW from hydro. The committed gas-fired generation projects are listed in Table 10. As a signatory to the COP21 Paris Agreement, direction of future generation planting-up will be influenced by the commitment to reduce GHG emissions.

Figure 11: New Committed Gas-fired Power Plants

No	Projects	Capacity (MW)	Commercial Operation Date
1	Pengerang Cogeneration	400	June 2017
2	Additional Pengerang Cogeneration	200	January 2019
3	SIPP P. Gudang (Track 4A)	1,440	January 2020
4	Edra Energy	2,242	January 2021
5	Tadmax Resources	1,000	January 2023

Source: Peninsular Malaysia Electricity Supply Industry Outlook 2017, Energy Commission

In addition to new gas-fired power plants, due to delays in the completion of some committed projects and transmission lines, a few of the existing ones have been granted operational extensions to supply power to the grid through 2019 on a competitive bid basis. These power plants are listed in Figure 12.

Figure 12: Short Term Extension of Existing Gas-fired Power Plants

No	Projects	Capacity (MW)	Expiry Date
1	YTL Power Generation	585	30 June 2021
2	Port Dickson Power	436	31 March 2019
3	Powertek	434	31 December 2019
4	SJ Sultan Ismail, Paka (GF4)	257	Pending finalization of agreement

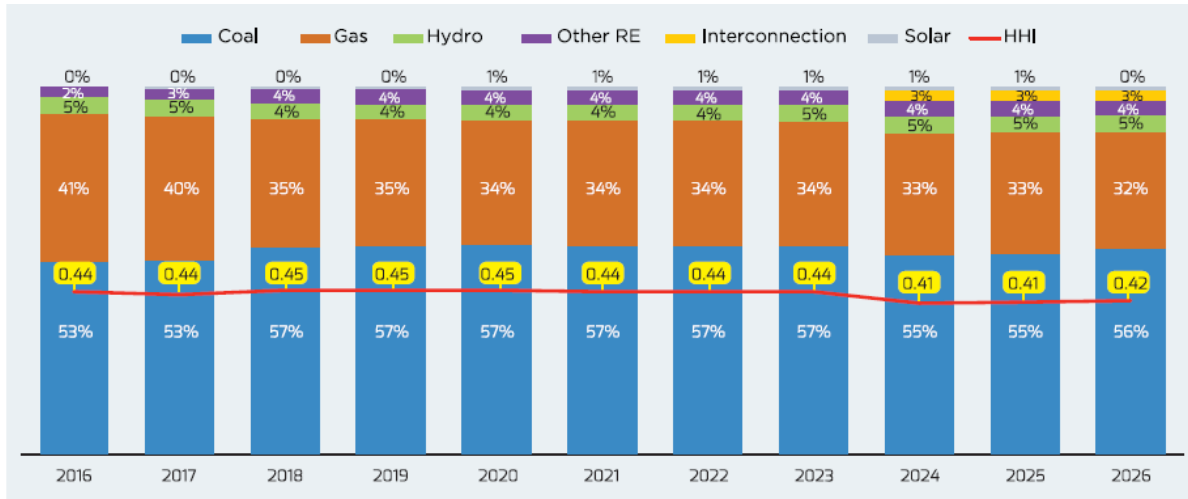
Source: Peninsular Malaysia Electricity Supply Industry Outlook 2017, Energy Commission

The COP21 Paris Agreement on climate change, which entered into force in November 2016, is expected to influence the direction of future planting-up of generation capacity, especially in Peninsular Malaysia. As a party to the agreement, Malaysia has to find ways to mitigate its GHG emissions. In preparation for the Third National Communication to the United Nation Framework Convention on Climate Change (UNFCCC), the forms of mitigation measures need to be identified and agreed upon by the stakeholders.

The Malaysia Government has taken steps to increase shares of renewables in the overall fuel mix through programs such as Feed-in-Tariff (FiT), Large Scale Solar (LSS), Net Energy Metering (NEM) and the development of new hydroelectric stations. Though some reduction of emissions can be achieved through these measures, the technology limitations of renewables and their intermittency suggest that gas will have a key role to play in the power generation mix of the future.

Nonetheless, the revised generation mix released by the Energy Commission mix shows a reduced dependency on natural gas, primarily due to the retirement of gas turbines and new coal-fired plants coming onstream. By 2026, gas-fired power will only make up 32 percent of total dispatched power compared to 41 percent in 2016.

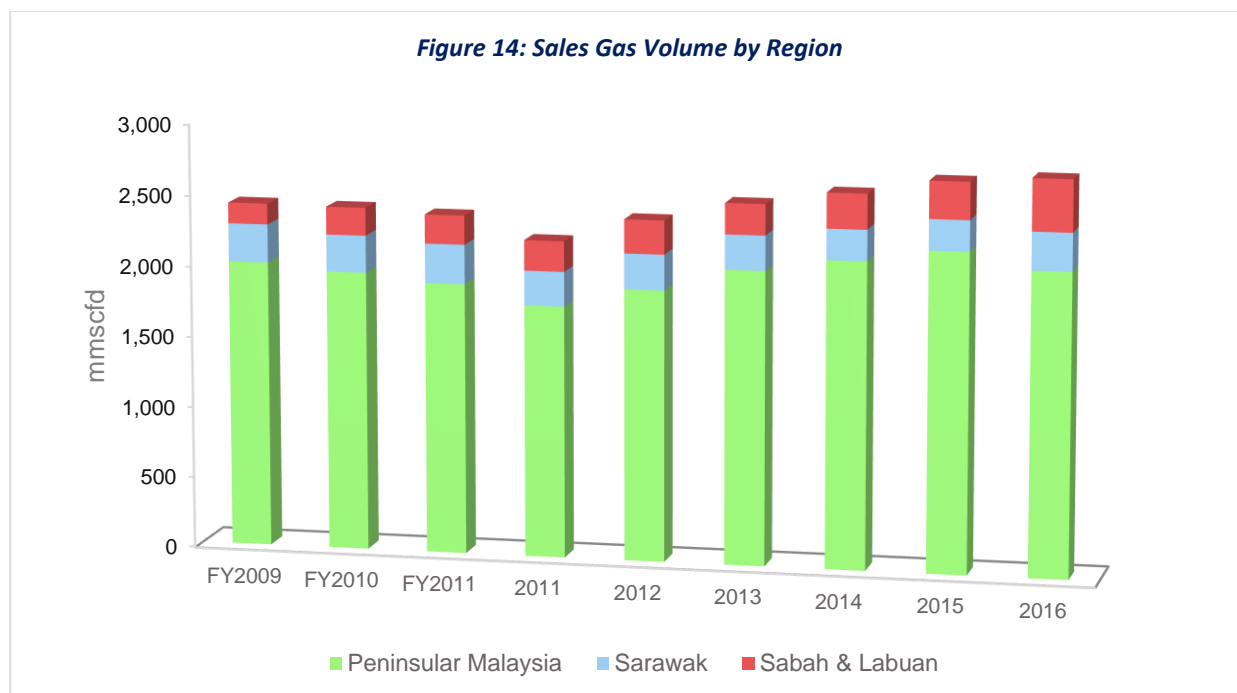
Figure 13: Generation Mix in Peninsular Malaysia



Source: Peninsular Malaysia Electricity Supply Industry Outlook 2017, Energy Commission

The largest share of gas demand growth in 2016 came from Sabah. For the year, gas consumption in the state increased to 367 MMSCFD in 2016 from 265 MMSCFD in 2015, amounting to an increase of 38.5 percent. This followed the commencement of operations at the Sabah Ammonia Urea (SAMUR) plant in Sipitang, the commissioning of the Dalak pipeline tie-in to PETRONAS Chemicals Methanol plant in Labuan, and additional gas demand from the two gas-fired power plants in Kimanis. The 300 MW gas-fired Kimanis Power Plant achieved full commercial operations in November 2014 while SPR Energy's 100 MW gas-fired power plant, also located in Kimanis achieved commercial operations in August 2014. These gas-fired power plants has and will continue to strengthen the reliability of power supply in Sabah, enhancing the state's socio-economic development and industrialization in the process.

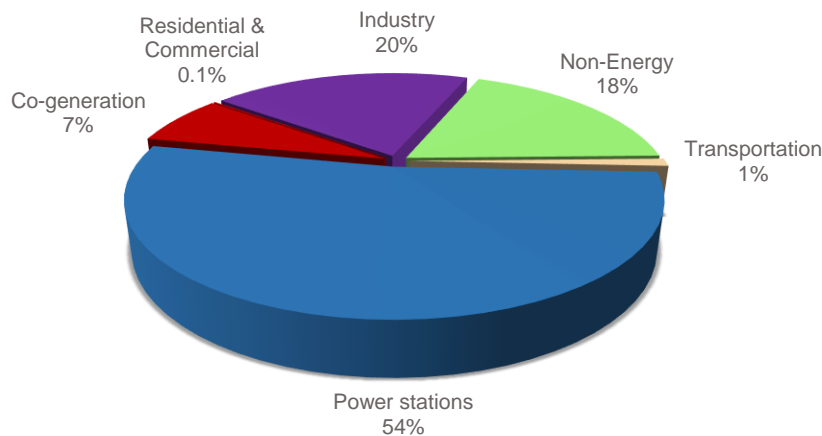
Similarly, gas consumption in Sarawak rose to 269 MMSCFD in 2016 from 218 MMSCFD in the previous year on the back of increased demand from the power and industrial sectors. The demand for gas in the state is expected to grow further in the coming years owing to demand from these two sectors. In November 2016, PETRONAS signed a Heads of Agreement (HOA) with Huchems Fine Chemical Malaysia Sdn Bhd for the supply of 58 MMSCFD of natural gas to Huchem's proposed petrochemical plant at the Samalaju Industrial Park, 65 kilometers from Bintulu for a period of 20 years to produce ammonia and ammonia derivatives.



Sources: PETRONAS Annual Reports and Financial Results announcements. (Note: FY2009, FY2010 and FY2011 ends on 31 March of the corresponding financial year.)

In terms of demand by sector, the industrial sector has always been the second largest consumer of gas after the power sector. In the 1990s, Malaysia's economy underwent a transformation from an agrarian economy to one which is more industrial-based. In line with this development, the Malaysian Government had encouraged the establishment of integrated industrial and petrochemical complexes. Subsequently, PETRONAS built the Kertih Integrated Petrochemical Complex in Terengganu and Gebeng Integrated Petrochemical Complex in Pahang. The design of these complexes include a centralized utility facility which provides power, steam, and demineralized water to the tenants, thereby significantly reducing the owner's capital investment to setup their plants.

Figure 15 : Gas Consumption by Sector, 2015



Source: National Energy Balance 2015, Energy Commission

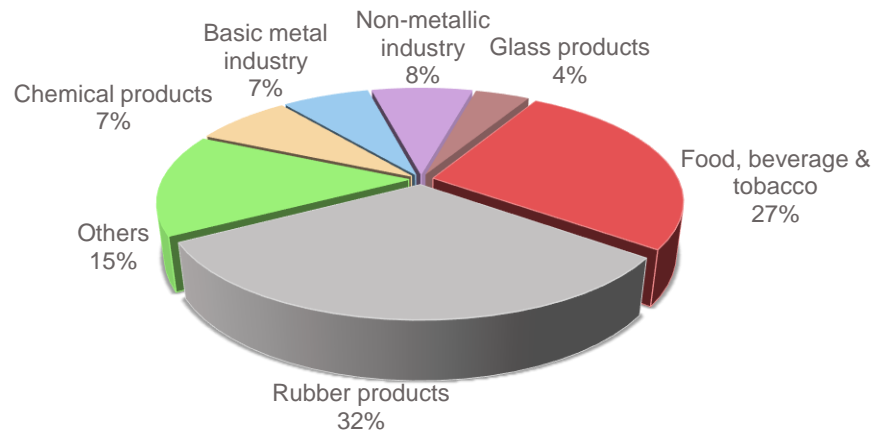
Further downstream, gas is made available to industries, commercial and residential customers in Peninsular Malaysia by Gas Malaysia Berhad (GMB) which owns and operates a 2,186-kilometer gas distribution pipeline network.

In 2016, GMB supplied natural gas to 819 industrial, 935 commercial and 12,339 residential customers. 99.1 percent of the volume of gas delivered was to industrial customers. GMB secured 45 new industrial customers while ceasing gas supply to 21 customers in 2016. Customers were mainly from the rubber products, food, beverage and tobacco and the fabricated and basic metals segments which collectively consumed 70 percent of the total gas supplied by GMB.

In addition; during the same year, GMB also supplied Liquefied Petroleum Gas (LPG) to 1,325 commercial and 22,959 residential customers in 2016 compared to 1,287 commercial and 23,175 residential customers the year before.

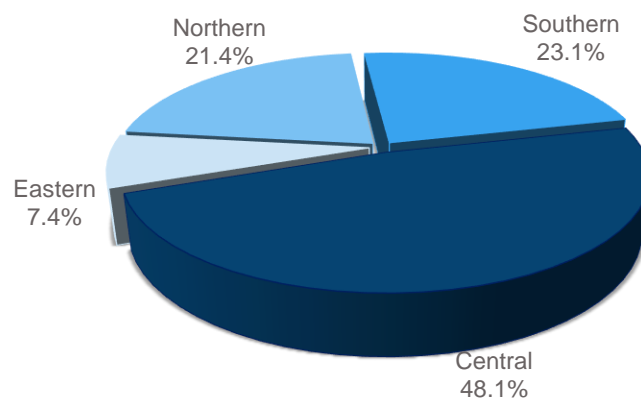
GMB saw its sales increase from only 0.7 million MMBTU in 1993, to 164.26 million MMBTU in 2016.

Figure 16: Breakdown of Gas Malaysia's Sales Volume by Industry (2016)



Source: GMB Annual Report 2016

Figure 17: Breakdown of gas supplied by Gas Malaysia by Region (2016)



Source: GMB Annual Report 2016

GMB has taken the initiative to introduce and promote the Combined Heat and Power (CHP) system since 2014, in a joint venture with TGES. Due to its high thermal efficiency of up to 90 percent, the system enables customers to utilize more energy from the same volume of gas, thus significantly reducing the total energy costs. GMB's inaugural CHP plant; with a capacity of 333 MW and which is able to generate 128 tonnes per hour of steam recovery, has been completed for a major manufacturing company located in Prai, Penang.

Gas Malaysia and IEV Energy explore other avenues to create new demand for gas by introducing "virtual pipeline" to the customers – the supply of compressed natural gas via land transportation to areas beyond the reach of its existing gas pipelines. This initiative makes natural gas accessible to a wider base of consumers who would otherwise not have any access to this energy resource. A Compressed Natural Gas (CNG) mother station has commenced operations in Gebeng, Pahang, with an initial consumption of 19,000 MMBTU per year.

Gas Malaysia has also teamed up with Sime Darby to pioneer the commercial production of BioCNG from Palm Oil Mill Effluent (POME) with a construction of a plant in Sungai Tinggi, Kuala Kubu Baru, Selangor. Commencing operations in July 2016, the plant has started supplying 15,000 MMBTU per annum of BioCNG to its first customer.

To improve operational performance through efficient allocation and use of resources; GMB, as the main supplier of piped natural gas in Peninsular Malaysia, has been subjected to the Incentive Based Regulation (IBR) which has been implemented on 1 January 2016 for a trial run for one year, followed by the first regulatory period from 2017 to 2019. The introduction of the IBR will support the liberalization of the natural gas industry, which is to gradually align gas prices towards market prices. The IBR framework is expected to provide earnings clarity to GMB. In addition, the IBR will also provide financial neutrality to the company with respect with any gas costs fluctuations.

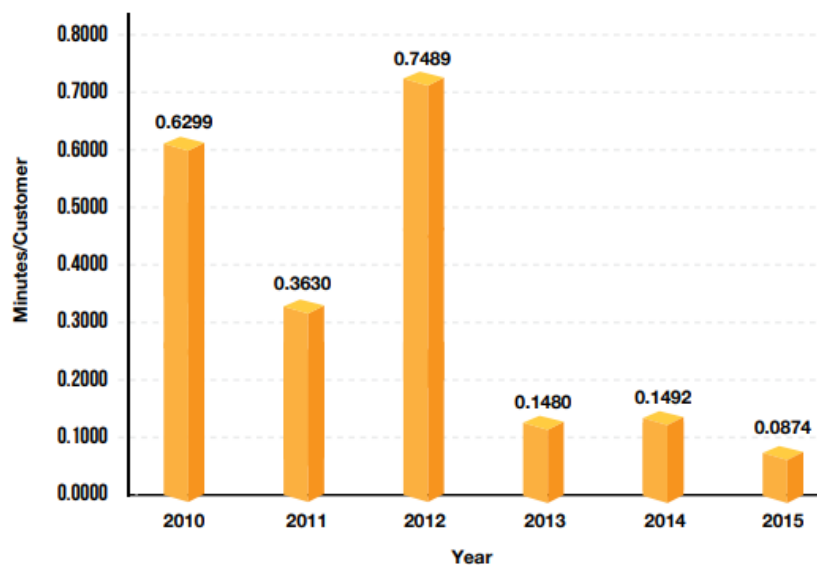
In Sarawak, PETRONAS Gas Berhad operates a 39-km gas pipeline network in Bintulu and Miri where gas is delivered to gas-fired power plants and industrial users. Further gas distribution to residential and commercial users is managed by Sarawak Gas Distribution Sdn Bhd (SGDSB). SGDSB supplies gas to over 20,000 residential, commercial and industrial customers.

In November 2016, the Sarawak State Assembly passed a new law on the distribution and reticulation of gas in Sarawak. Activities such as import of LNG, regasification, treatment, separation, processing, transport, supply and retail of gas, construction, management and maintenance of gas pipelines, terminals, plants and facilities will be licensed by the state government.

Gas distribution in Kota Kinabalu, Sabah and Labuan is managed by Sabah Energy Corporation (SEC). In 2015, SEC supplied 294,387 MMBTU of natural gas to 22 industrial customers, increasing sharply from only 93,582 MMBTU in 2013. Gas was supplied using 8 kilometers of steel and polyethylene pipelines as well using “virtual pipelines” whereby the gas is compressed into specially-built containers and transported to customers’ premises.

In terms of gas supply performance, the gas transmission and distribution network in Peninsular Malaysia continued to show improvement. The System Average Interruption Duration Index (SAIDI) is the duration of interruptions in minute that every registered customer experiences in a particular year. Lower figures of SAIDI represents better performance of the gas supply distribution. In 2015, the SAIDI for the network chalked an impressive 41.42 percent improvement from the previous year, as shown in Figure 18 below.

Figure 18: : SAIDI for the Peninsular Malaysia gas transmission and distribution network



Source: Peninsular Malaysia Piped Gas Industry Outlook 2016, Energy Commission

Figure 19: GMB's Supply Areas

NORTHERN REGION	CENTRAL REGION	SOUTHERN REGION	EASTERN REGION
PERLIS Arau Chuping Kangar	SELANGOR Ampang Balakong Bandar Sultan Sulaiman Bangi Batu Caves Banting Beranang Bestari Jaya Cyberjaya Damansara Dengkil Ijok Jeram Kajang Kelana Jaya Klang KLIA Kundang North Port Pandamaran Petaling Jaya Puchong Pulau Indah Rawang Salak Tinggi Selayang Semenyih Sepang Serdang Seri Kembangan Shah Alam Sungai Buloh Teluk Panglima Garang	NEGERI SEMBILAN Nilai Senawang Sendayan Seremban Seremban 2	PAHANG Gambang Gebeng Kuantan Kuantan Port
KEDAH Kuala Ketil Kulim Mergong Padang Terap Simpang Ampat Sungai Petani		MELAKA Alor Gajah Ayer Keroh Bandar Melaka Batu Berendam Bachang Bukit Rambai Cheng Lipat Kajang Tangga Batu	TERENGGANU Kerteh Teluk Kalong
PENANG Bayan Lepas Bukit Mertajam Georgetown Jelutong Mak Mandin Nibong Tebal Prai Sungai Dua Tanjung Pinang		JOHOR Air Hitam Gelang Patah Johor Bahru Kluang Kulai Larkin Nusajaya Pasir Gudang Plentong Senai Tampoi Tanjung Langsat Tebrau Yong Peng	
PERAK Bercham Ipoh Kampar Kamunting Lumut Parit Buntar Seri Iskandar Seri Manjung Sitiawan Taiping Tambun Teluk Intan Tronoh	FEDERAL TERRITORY OF KUALA LUMPUR FEDERAL TERRITORY OF PUTRAJAYA		

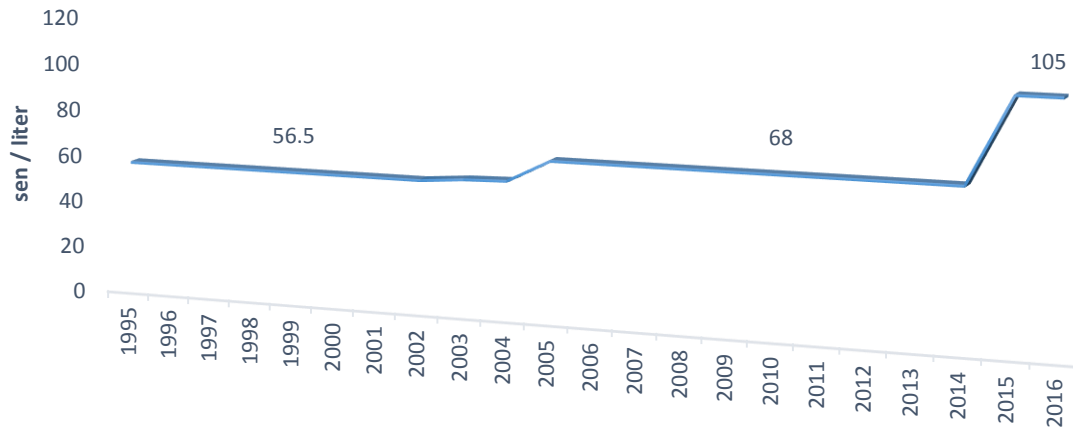
Source: Gas Malaysia Berhad Annual Report 2016

The PGU pipeline system has made it possible to supply compressed natural gas as transportation fuel throughout Peninsular Malaysia. Known as NGV, the availability of natural gas in major cities in Peninsular Malaysia has enabled PETRONAS to promote the use of natural gas as the cleaner fuel for the transportation sector. This program has received strong support from the Malaysian Government since it would also steer the transportation sector away from its dependence on oil products.

Currently, 103 NGV refueling stations are in operation serving approximately 77,000 natural gas vehicles on the road. The demand for NGV is on a decreasing trend as the largest share of demand comes from taxis, which are experiencing a reduction in total distance traveled due to improvements in public transportation such as the introduction of the Mass Rapid Transit (MRT) in the Klang Valley and increasing popularity of ride hailing services such as UBER and Grab, whose vehicles do not generally run on NGV. In addition, the all-NGV city bus fleet in Putrajaya is gradually being phased out in favor of electric buses.

The Government has maintained the natural gas pump price for NGV at 68 sen per liter of petrol equivalent since 2005 until September 2015 as shown in Figure 20. This price is approximately one-third of the price for RON 95 unleaded petrol, and only one-fourth of RON 97 unleaded petrol during that period. On 20 September 2015, after a period of 10 years, the regulated NGV pump price was increased to RM1.05 per liter of petrol equivalent. Despite the increase, the retail price of NGV is only about 50 percent of the price of RON 95 unleaded petrol.

Figure 20 : Regulated NGV pump price



Currently, PETRONAS NGV Sdn Bhd (PNGV) is the sole supplier of NGV in the country. The negative margin incurred due to low regulated NGV pump price has had the effect of disincentivizing other downstream players from entering the market. PETRONAS has incurred significant actual losses arising from the situation but is continuing the program as part of its contributions and obligations towards improve the quality of life and the environment in Malaysia.

Most of the gas delivery to the NGV refueling stations is by pipeline. A small amount of NGV is also delivered by trucks to refueling stations that do not have access to the gas pipeline, in an arrangement known as “mother-daughter supply”.

Figure 21: Number of NGV Stations by State



Source: PETRONAS NGV Sdn. Bhd.

SECTION 2.4: GAS EXPORTS

About 95 percent of the gas exports was in the form of LNG, whilst the balance was in the form of piped gas to Singapore. The volume exported represents approximately 60 percent of the total volume of natural gas produced by the country.

Ever since the country started exporting LNG in January 1983, natural gas exports have since emerged as a major contributor of Malaysia's export earnings. According to data published by Department of Statistics, Malaysia exported RM 32.1 billion worth of LNG in 2016, decreasing from RM 44.6 billion in 2015. The decrease was primarily due to lower LNG prices following lower oil-indexed JCC benchmark price and the lower number of LNG cargoes delivered during the year. For the year, 420 LNG cargoes were exported from Malaysia.

The PETRONAS LNG Complex, located in Bintulu, Sarawak has a capacity to produce 25.7 million tonnes per annum (MTPA) and this capacity increased by 3.6 MTPA with the addition of Train 9 in 2016. Train 9 delivered its first LNG cargo in September 2016.

In addition, PETRONAS Floating LNG Satu (PFLNG Satu) project added another 1.2 MTPA of capacity. PFLNG Satu is the first floating LNG liquefaction facility in the world when it became operational by end of 2016. Designed to last up to 20 years without dry-docking, PFLNG Satu has the flexibility to be redeployed to multiple locations to better access marginal and stranded gas fields of Malaysia. The project achieved first gas milestone from the Kanowit gas field in November 2016 and exported its first cargo to a South Asian destination

With maturing gas fields and dwindling production, FLNG provides Malaysia with the key to unlock its stranded gas resources which were previously considered uneconomical to develop and evacuate. FLNG is expected to change the landscape of the LNG business where the liquefaction, production and offloading of LNG, previously only possible at onshore plants, will be carried out hundreds of kilometers away from land and closer to the location of the offshore gas resources.

In February 2014, PETRONAS announced the Final Investment Decision (FID) of another floating LNG project, PFLNG2, which will add another 1.5 MTPA to Malaysia's LNG production capacity and was expected to become operational in 2018. The hull of PFLNG2 was officially launched in April 2016. Once completed, PFLNG2 will be located in the Rotan field, 240 km offshore Sabah.

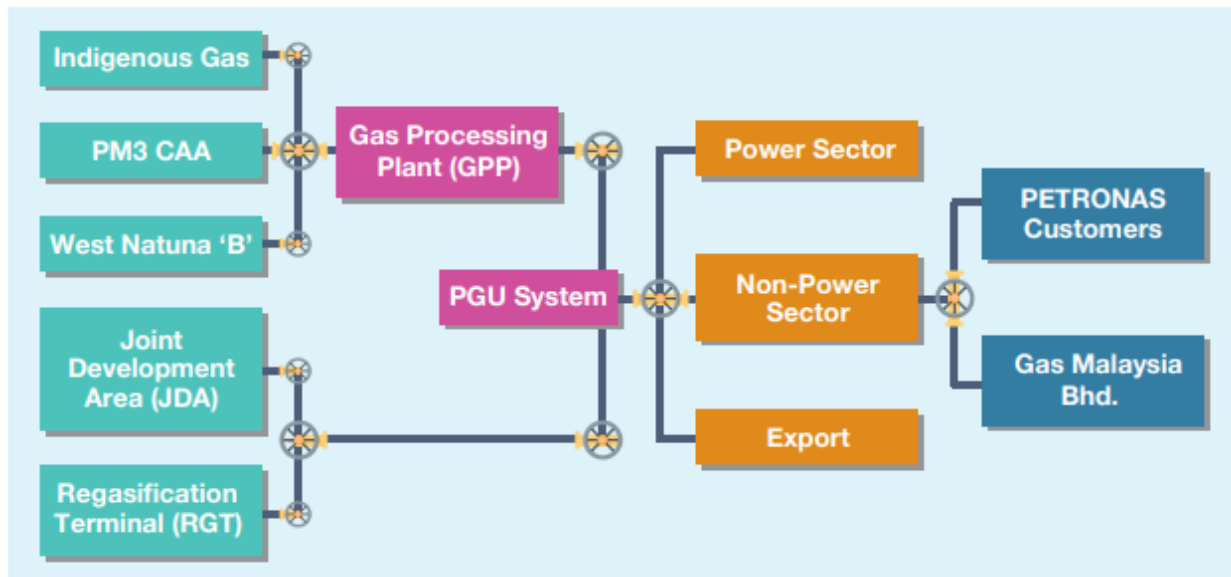
Altogether, Train 9, PFLNG Satu and PFLNG2 will add a total of 6.3 MTPA to Malaysia's LNG production capacity and will help Malaysia to maintain its position as the world's third largest LNG exporter after Qatar and Australia.

Malaysia has historically been an important supplier of LNG for Japan, South Korea, Taiwan and China (which are collectively known as the “JKTC market”). Malaysia LNG (MLNG) has had over 30 years of experience as an established and reliable supplier in delivering LNG to these major markets.

Piped gas exports to Singapore make up a small component of Malaysia’s total natural gas exports. Singapore has been importing gas from Malaysia since January 1992 mainly as fuel to its gas-fired power plants. The supplies of piped gas to Singapore were delivered under two separate contracts to Senoko Power and Keppel Gas. About 90 percent of Singapore’s electricity is generated using imported natural gas. However, gas import from Malaysia represents only a small portion of Singapore’s total gas imports as the country also relies on imports of piped gas from Indonesia as well as LNG.

SECTION 3: OTHER GAS SOURCES

Figure 22: Sources Gas in Peninsular Malaysia



Source: Peninsular Malaysia Piped Gas Industry Outlook 2016, Energy Commission

Figure 22 shows the various sources of gas into Peninsular Malaysia.

PETRONAS has been sourcing gas from the Malaysia-Vietnam Commercial Arrangement Area (CAA) since 2003 and the Malaysia-Thailand Joint Development Area (JDA) since 2005.

PETRONAS has also been importing gas from Indonesia since 2002, where it currently has a contract to purchase 1.6 TSCF over 20 years from the Block B development in Indonesia's West Natuna field.

The additional volume sourced from the JDA, CAA and imports from Indonesia are needed to meet increased domestic demand and supplement the shortfall due to declining production from the maturing gas fields located offshore Peninsular Malaysia.

Piped gas from CAA and imports from Indonesia's Natuna was processed at the PETRONAS Gas Berhad's gas processing plants (GPPs) together with domestic gas produced offshore Peninsular Malaysia.

To enhance the national security of gas supply, an additional 50 MMSCFD was secured from JDA Block A18 and the first gas flowed on 4 December 2013.

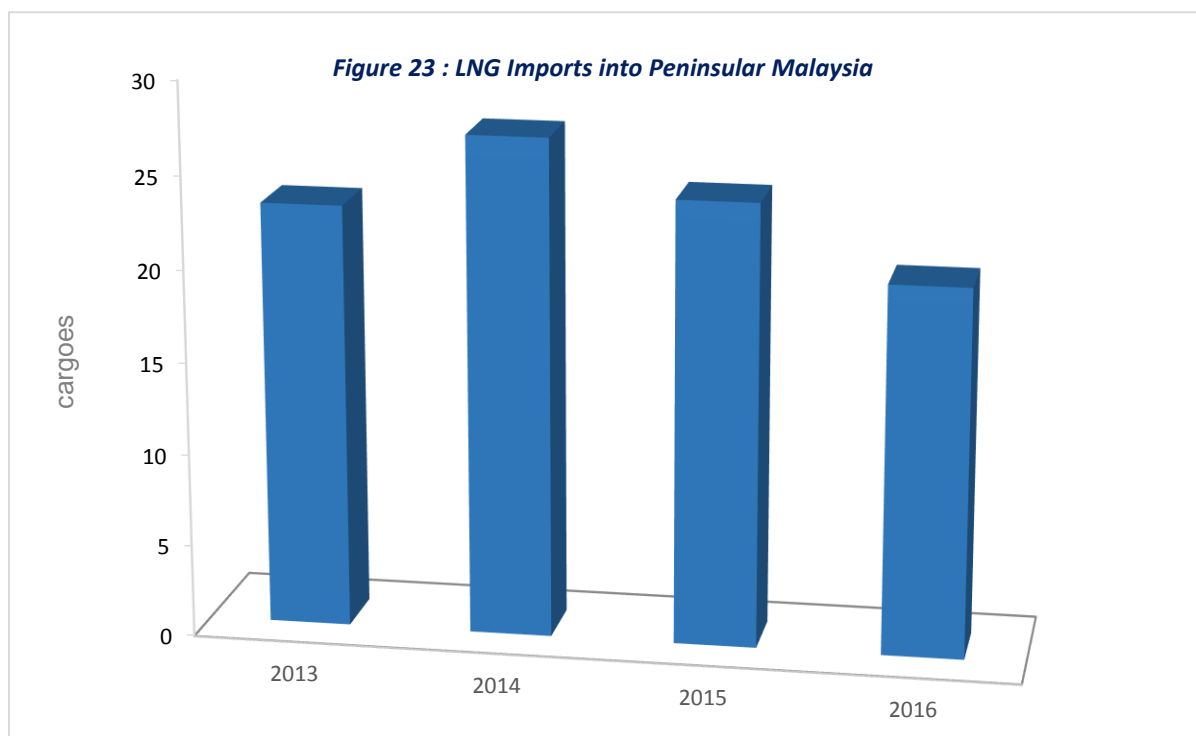
In 2016, the PGU system received 327 MMSCFD of gas from JDA through the tie-in at Padang Besar, Perlis. The gas was first processed at Songkhla before it entered the PGU system.

In addition to the onshore pipeline, a 365-km offshore pipeline from JDA to Kertih was completed at the end of April 2015 under the JDA Gas Balancing Evacuation (EVA) project. Under the EVA project, a further 214 MMSCFD of gas would be available as a long term measure.

Malaysia's first LNG Regasification Terminal (RGT1) was completed and delivered its first gas into the PGU system in May 2013. The RGT1, which has a capacity of 3.8 MTPA, is located offshore and is the first of its kind in the world. It comprises of two floating storage units and regasification facilities located on an island jetty.

The RGT1 was one of the first Entry Point Projects under the Economic Transportation Programme (ETP) Oil, Gas and Energy National Key Economic Area (NKEA). Originally planned for completion in 2015 under the 10th Malaysia Plan (2011-2015), the project was brought forward to meet the increasing gas demand and address the declining domestic production due to maturing gas fields in offshore Peninsular Malaysia. The completion of the RGT1 strengthens Peninsular Malaysia's energy security further as it enables import of LNG from any LNG source in the world. The RGT1 is also an important step towards market liberalization as it allows any gas supplier to import LNG and sells gas to domestic customers in Peninsular Malaysia.

20 LNG cargoes were imported through the RGT1 in 2016, making it 94 LNG cargoes having been imported into Peninsular Malaysia since the RGT1 became operational in May 2013.



Source: PETRONAS Gas Berhad Annual Reports. (2013 figure is from May)

Malaysia's second LNG RGT (RGT2) is being built in Pengerang, Johor. The RGT2 will consist of an LNG regasification unit and two units of 200,000 cubic meter LNG storage tanks with a send out capacity of 3.5 MTPA (490 MMSCFD of natural gas which can be expanded to 7 MTPA (900 MMSCFD). RGT2's jetty is able to accommodate LNG carriers of sizes 5,000-265,000 cubic meters and will also have a reloading export facility. RGT2 will supply gas to the RAPID petrochemical complex and Pengerang Co-generation Plant (PCP) – both located adjacent to it in Pengerang, as well as to the PGU grid system to enhance the gas supply availability in Peninsular Malaysia as a whole.

SECTION 4: THIRD PARTY ACCESS

Due to the crucial nature of natural gas to our nation as one of the main exports and also as an important feedstock for industrial use, ensuring a secure supply and distribution of gas is essential for the nation. The Malaysian Government has recognized the need to enhance the security of gas supply and this objective is captured under the National Key Economic Area (NKEA) OGE EPP5: Unlocking Premium Gas Demand in Peninsular Malaysia. One of the initiatives in connection with this is to liberalize the gas market.

Gas market liberalization requires gas facilities; such as regasification terminals and pipelines, to be made available to all market parties and the proper regulatory framework to be put in place. The completion of Regas Terminal at Sungai Udang Melaka in May 2013 and Regas Terminal at Pengerang Johor together with the amendment of the Gas Supply Act 1993 (GSA 1993) paved the way for Third Party Access (TPA) and liberalization of Malaysian gas market. The Energy Commission (ST) is entrusted to regulate the gas market.

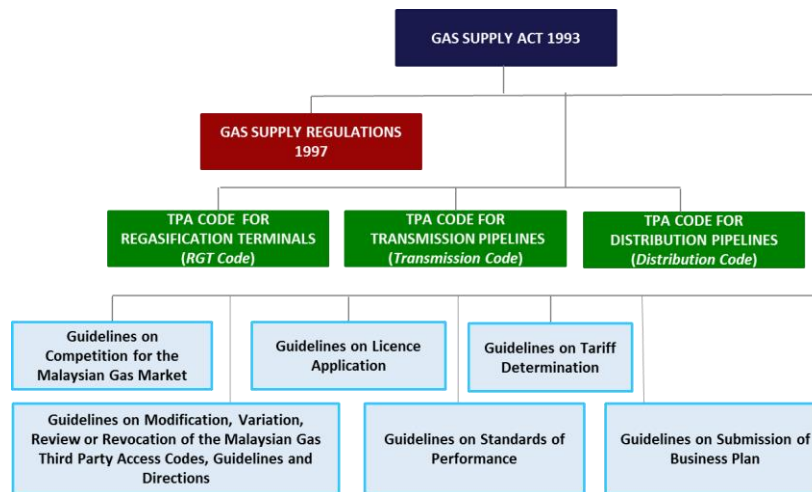
The Gas Supply (Amendment) Bill 2016, was passed by the Dewan Rakyat on 14 June 2016 and by the Dewan Negara on 14 Jun 2016. Subsequently, the Act was gazetted on 9 September 2016. The main objectives of the amendments are:

- To allow third parties to access gas infrastructure for the supply of gas to consumers,
- To promote healthy competition in the gas supply industry, and
- To enable gas consumers to benefit from competitive prices, better services and enhance sustainability and security of supply

The Act provides for the expansion of ST's regulatory scope from gas distribution and reticulation previously to also include LNG storage and regasification as well as transportation of natural gas through onshore gas transmission pipelines. Activities related to gas shipper, importer, transporter, regasification facilities, distributor and retailer will also fall under the purview of ST.

The legal framework for the TPA is shown in Figure 24.

Figure 24: The legal framework of the TPA



Source: Peninsular Malaysia Piped Gas Industry Outlook 2016, Energy Commission

Under this framework:

- Gas Supply Act 1993 amendments are enablers to implement the third party access system. Amendments are approved by Parliament
- Gas Supply Regulations 1997 amendments prescribe regulatory requirements as provided for under the Act. Amendments are approved by the Minister
- Third Party Access Codes prescribe principles of access by the owners, operators and users to gas facilities. Codes are approved by the Minister
- Guidelines are reference or explanatory documents that detail out technical, commercial or procedural requirements for the implementation of provisions under the Act and Regulations. Guidelines are approved by the Commission

The Act enhances competition in the gas market by enabling the participation of third parties in the gas supply industry via the TPA. Existing industry players were given a one-year grace period to prepare whilst all new industry participants are required to comply immediately upon enforcement of the TPA regime in January 2017.

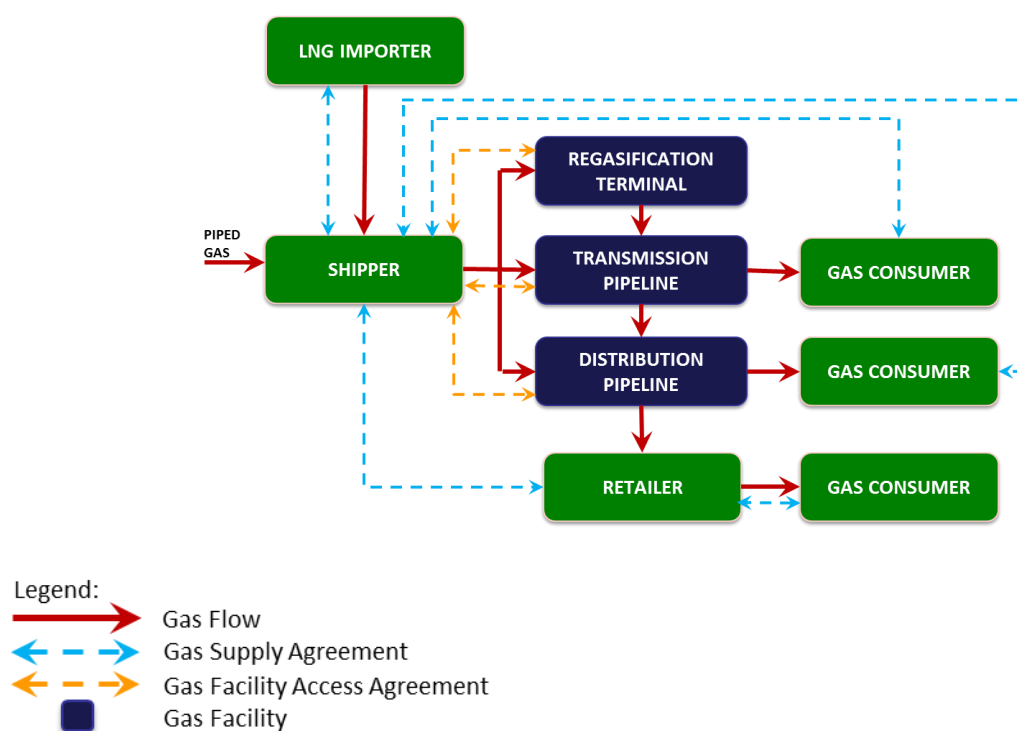
The TPA would also allow large gas users to purchase their own LNG from any source and subsequently use the regasification and pipeline facilities to bring the gas to their facilities.

Under the TPA, several new licences are created. These licences are:

- Licence to import LNG,
- Licence to ship gas via pipeline,
- Regasification licence,
- Gas transportation licence to transmit gas across Peninsular Malaysia,
- Gas distribution licence, and
- Gas retail licence

Under the TPA, new gas suppliers can bring LNG into the country via the RGT and ship their gas to their buyers using the existing PGU transmission and distribution pipelines. TPA would also allow large gas users to purchase their own LNG from any source and subsequently use the RGT and pipeline facilities to bring the gas to their facilities.

Figure 25: LNG-indexed price and Regulated Gas Prices in Peninsular Malaysia

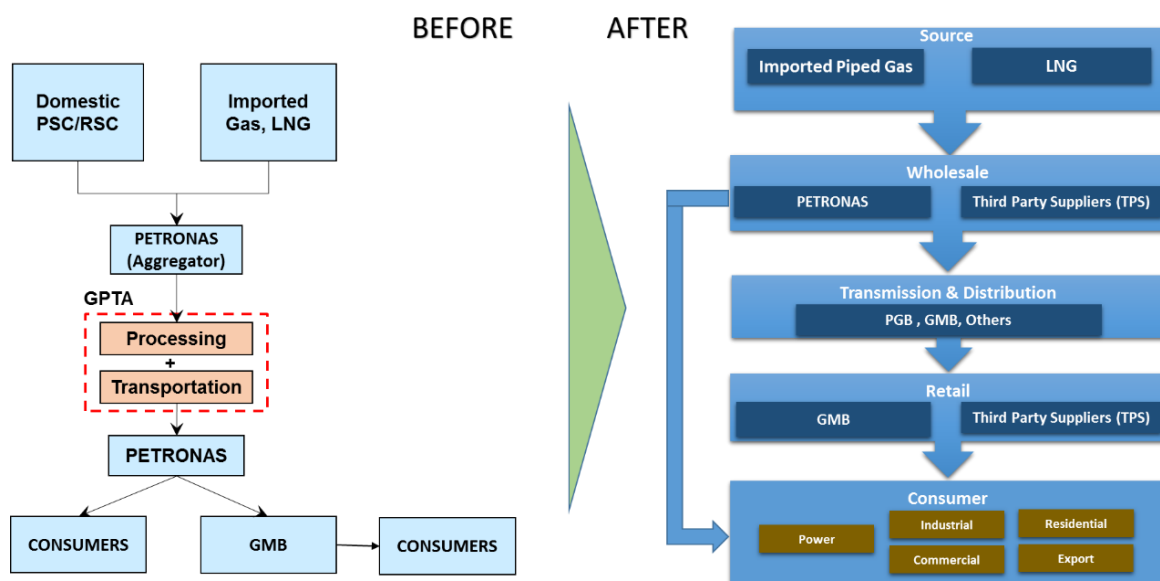


Source: Peninsular Malaysia Piped Gas Industry Outlook 2016, Energy Commission

Figure 25 illustrates the flow of gas under the TPA. An LNG importer brings in LNG cargo into Malaysia and transfers ownership of the LNG to the shipper at the regasification terminal. The LNG importer will enter into a gas supply agreement with the shipper. The shipper will then supply the LNG to consumers through gas facilities such as the transmission and distribution pipelines. To facilitate this, the shipper enters into a gas supply agreement with the gas consumers and a gas facility access arrangement with the gas facility owner. Retailers are also able to buy gas directly from the shipper via a gas supply agreement to supply gas to consumers via its own piping system. The retailer will have to enter into a gas supply agreement with the consumer.

The main implication of the Act is that existing infrastructure operators including regasification, transmission, distribution and retail will have to ring-fence their operations and will not be allowed to compete with the gas suppliers. This will bring about a change in the structure of the gas market as shown in Figure 26. It will make it possible for gas suppliers to mix and match service offerings so that they meet the exact requirements of the buyers. Market liberalization will promote competition and efficiency and supply security, and ensure the long term security of gas supply to the nation.

Figure 26: Changes to the gas market structure as a result of the TPA



Source: Energy Commission

SECTION 5: REGULATED GAS PRICES

There are two categories of gas prices in Malaysia – regulated gas price and market-based LNG-indexed price.

Under the regulated gas price regime, the Government regulates the price of the gas supplied by PETRONAS and Gas Malaysia. Prior to drop in oil prices beginning in 2014, the gap between the regulated gas price and the market price was large, resulting in PETRONAS having to forego a substantial sum in terms of “lost” revenue, implying that optimal value is not being extracted from Malaysia’s gas resources.

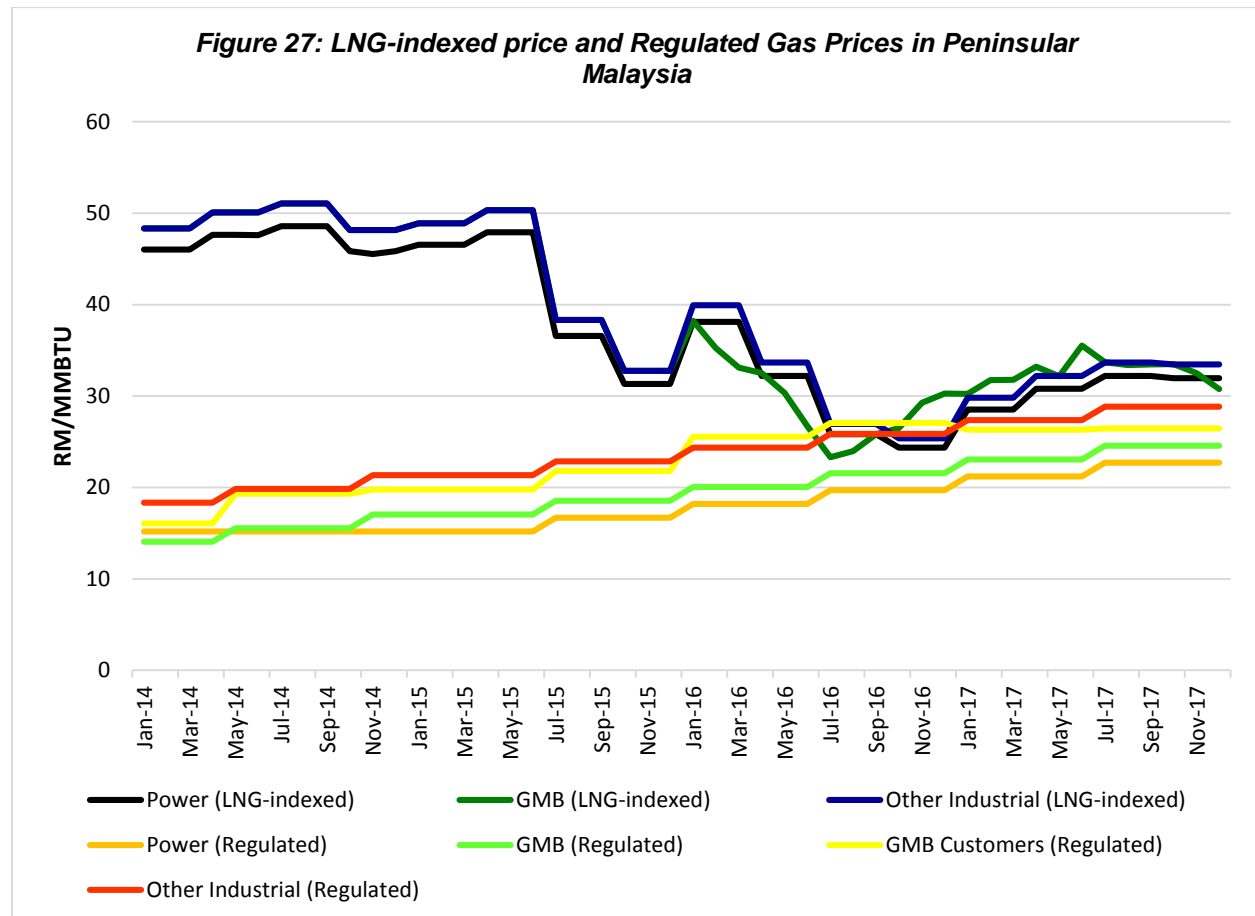
In 2012, the revenue lost by selling gas to the domestic market instead of at the stipulated contractual price was RM 27.9 billion. Due to the drop in oil price and consequently the contractual price of gas and gas subsidy rationalization by the Government, the gap between regulated and LNG-indexed prices has narrowed. Revenue forgone in respect of regulated pricing mechanism imposed on the supply of gas to Peninsular Malaysia’s power and non-power sectors narrowed to RM 3.1 billion in 2016 compared to RM 10.9 billion the previous year and the lowest since 1999. The decrease in revenue forgone was a result of lower contract prices in line with the decline in oil prices, as well as increases in regulated sales gas prices during the year for both power and non-power as part of the Government’s subsidy rationalization efforts. Under the two-tiered pricing mechanism,

- LNG-indexed market price applies to all new volumes, including additional volumes from existing customers,
- Existing volumes to remain on regulated pricing, and
- Regulated prices to be periodically increased until market parity is reached

For the purposes of the policy, the reference market price is taken to be Malaysia’s LNG unit export price (i.e., LNG FOB WAP) as declared by the Department of Statistics Malaysia (DOSM) that is discounted to ensure appropriate price level which supports economic activity and is priced on a “as delivered” basis, which incorporates all associated delivery costs. This reference market price is fixed every three months.

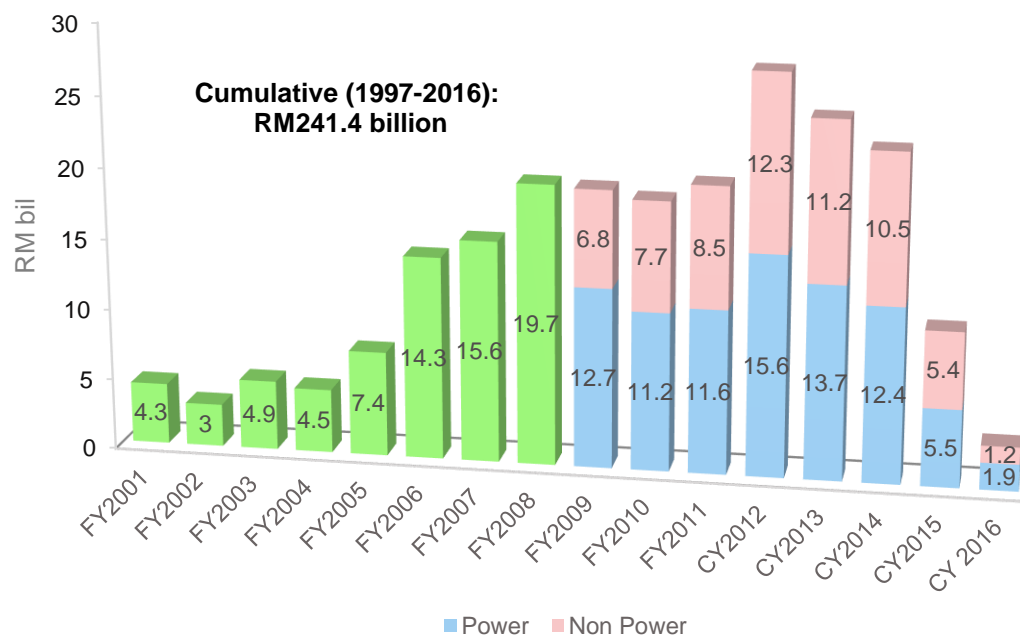
The total revenue forgone has amounted to RM241.4 billion since regulated gas prices took effect in 1997. However, at RM3.076 billion, gas subsidy in 2016 was at its lowest since 1999 due to the narrowing of the price differential between regulated and contractual prices. As a matter of fact, due to movements in global gas prices arising from the drop in oil prices, the regulated price paid by industrial consumers was actually higher than the market-based contract pricing for a

sustained 7-month period between July 2016 and January 2017. This underlines the wisdom of moving towards fully market-based LNG-indexed pricing.



Source: Energy Commission

Figure 28 : Revenue Foregone by Sector



The Government's Economic Transformation Program (ETP) has identified natural gas subsidy as one of the major issues which needs to be addressed. As part of the on-going subsidy rationalization effort, the government has decided to move away from regulated pricing to market-based pricing. This done by linking regulated prices to the market price via a discount factor. This discount factor will be periodically and gradually decreased according to a specified schedule. Malaysia has been decreasing this discount factor (or increasing the price of gas) by RM1.50 per MMBTU every six months until it reaches the market price.

For the purposes of the policy, the reference market price is taken to be Malaysia's LNG unit export price (i.e., LNG FOB WAP) as declared by the Department of Statistics Malaysia (DOSM) that is discounted to ensure appropriate price level which supports economic activity and is priced on a "as delivered" basis, which incorporates all associated delivery costs. This reference market price is fixed every three months.

The Government has increased the regulated gas price twice in 2016. The most recent gas tariff revision took effect on 1 July 2018. The revision was approved by the government through a letter from the Energy Commission dated 12 June 2018. The average price of gas supplied by Gas Malaysia has increased to RM 32.69/MMBTU.

The government has prescribed the Incentive Based Regulation (IBR) framework which sets the base tariff for a regulatory period of three years from January 2017 and allows changes in the gas costs to be passed through via the Gas Cost Pass Through (GCPT) mechanism every six months. Under the IBR framework, the base tariff will be set for a regulatory period of three years since January 2017 which will allow changes in the gas costs to be passed through using the GCPT mechanism every six months.

The regulated tariffs for gas supplied by Gas Malaysia effective from 1 July 2018 are as shown in Figure 29.

Figure 29: Tariff for Gas Supplied by Gas Malaysia Berhad in Peninsular Malaysia

Category	Gas Consumption/Month (MMBTU)	Tariff (RM/MMBTU) (Effective 1 July 2018)
A	Residential	23.80
B	0 – 600	30.50
C	601 – 5,000	30.65
D	5,001 – 50,000	30.96
E	50,001 – 200,000	32.26
F	200,001 – 750,000	32.26
L	Above 750,000	33.32
Average		32.69

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4. Bank Negara Malaysia (BNM)
5. Jabatan Statistik Malaysia (*Department of Statistics, Malaysia*)
6. International Gas Union (IGU)
7. BP Statistical Review of World Energy

Disclaimer:

The views expressed in this report do not necessarily reflect the views of the various organizations whose data was sourced from.



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Twitter : MGA_Official1