MALAYSIAN Gas ASSOCIATION

Malaysia: Natural Gas Industry Annual Review

2016 Edition

Cover photo

PFLNG SATU, the world's first floating LNG liquefaction plant.
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 4th edition of the "Malaysia: Natural Gas Industry Annual Review" publication. I am pleased to note that this publication has attracted interest among professionals and students and I hope that it will continue to be a comprehensive and authoritative reference of the Malaysian natural gas industry.

Firstly and on behalf of MGA, I would like to record my appreciation to my predecessor, Ir Pramod Kumar Karunakaran for the impeccable service and leadership as MGA President for the past 3 years. I look forward to working with the MGA Council and members to continue with the efforts to make MGA as the platform for members and other stakeholders to strive towards a vibrant and sustainable gas industry in Malaysia. We will continue to advocate gas as an integral part of sustainable energy system in Malaysia.

The past 2 years has been a very challenging time for the oil and gas industry in Malaysia and globally. The benchmark Brent crude averaged USD52/bbl in 2015, and even dropped to USD30/bbl in early 2016. Since then, it has recovered to average USD42/bbl in the first 9-months of 2016.

The low oil price has had an adverse impact on Malaysia's LNG exports as the LNG prices are indexed to oil price. The value of our LNG export dropped to RM47 billion in 2015 compared to RM64 billion in 2014. The low LNG price is expected to persist in the next few years, compounded by the oversupply of LNG from several new projects notably in Australia which came on stream in 2015 and 2016.

Despite the low price environment, Malaysia recorded several positive developments in the gas industry.

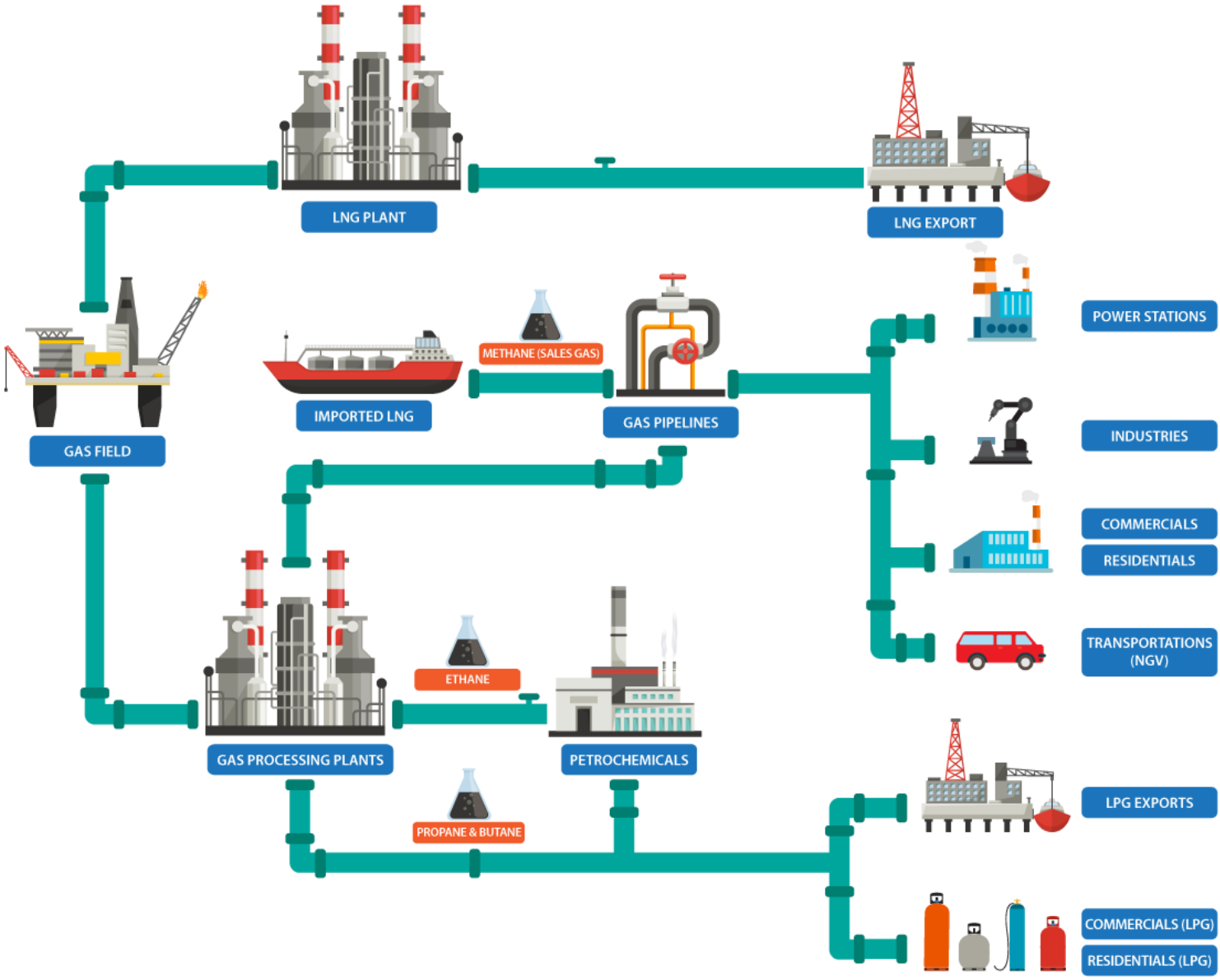
- The amended Gas Supply Act 1993 has been passed by the Parliament and was gazetted in September 2016. The amended GSA paved the way for Third Party Access (TPA) and liberalization of Malaysian gas market.
- The world's first floating LNG facility, PFLNG SATU which is owned by PETRONAS set sail from Okpo, South Korea on 14 May 2016 to Kanowit gas field, offshore Sarawak. It was indeed a proud achievement for the country. PFLNG SATU which has a capacity of 1.2 MTPA went on to achieve first gas from Kanowit on 14 November 2016.
- 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.
- First commercial production of bio-CNG from Palm Oil Mill Effluent (POME) by a Gas Malaysia-Sime Darby joint venture which began production in 2016.
- The Government of Malaysia remains committed to the gas subsidy rationalization with 2 revisions of regulated gas prices with the latest in July 2016.

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

CONTENT

Diagram of Natural Gas Industry in Malaysia



EXECUTIVE SUMMARY

- The Malaysian economy grew by 5.0% in 2015, compared to 6.0% in 2014.
- The Malaysian population increased to 31.0 million in 2015, compared to 30.6 million in 2014 and 30.2 million in 2013.
- The aggressive effort to reverse the decline in domestic production has boosted the country's total natural gas resources to 100 tscf.
- Gas production in first half of 2016 was 1,074 kboe/d.
- The first commercial biogas plant began production in 2016. The plant which is located in Selangor produces gas from Palm Oil Mill Effleuent (POME) is a joint venture between Gas Malaysia and Sime Darby.
- In 2015, Malaysia's domestic gas consumption was 2.6 bscfd. Approximately 82% of the domestic demand was accounted by Peninsular Malaysia, followed by Sabah & Labuan at 10% and Sarawak at 8%.
- The amended Gas Supply Act 1993 has been passed by the Parliament, at the Lower House on 23 May 2016 and as well as the Upper House in 14 Jun 2016. The amended Act was gazetted on 9 September 2016. The amended GSA paved the way for Third Party Access (TPA) and liberalization of Malaysian gas market.
- In 2015, Malaysia LNG export decreased to 25.1 MTPA from 25.8 MTPA in 2014.
    - LNG export in 2015 was valued at RM47 billion, lower than RM64 billion in 2014 due to lower volume and lower prices as LNG prices were indexed to crude prices.
- More than 9,000 LNG cargoes have been exported to buyers across the globe.
- Malaysia's first floating LNG facility, PFLNG SATU which is owned by PETRONAS, is the first FLNG project in the world. PFLNG SATU is now being commissioned and has achieved its first gas milestone on 14 Nov 2016 from the Kanowit gas field, 180 km offshore Sarawak. PFLNG SATU has a production capacity of 1.2 MTPA.
- Train 9 LNG project, which is a part of the PETRONAS LNG Complex in Bintulu delivered its first cargo in September 2016. Train 9 has a capacity of 3.6 MTPA.
- A total of 24 LNG cargoes were imported into Peninsular Malaysia through the LNG RGT1 in Melaka in 2015.
- The number of NGV vehicles in Malaysia was approximately 77,000 while the number of NGV refueling stations was 178.

- In 2015, the total revenue foregone by selling gas to the domestic market at regulated prices was RM10.9 billion, of which RM5.5 billion or 50.5% was accounted by the power sector and RM5.4 billion to the non-power sectors - which included industrial, commercial and residential users, and NGV. Cumulative amount since May 1997 has reached RM238.3 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

PETRONAS

Pushing the boundaries of technology. Changing the landscape of the LNG industry.

The PFLNG SATU. A first of its kind.

Today, a new era begins. One that will change the oil and gas industry forever. As we pioneer the technology to process natural gas hundreds of kilometres away at sea, we will soon be able to tap into the stranded gas fields once considered uneconomical to explore.

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SECTION 1: UPSTREAM SECTOR

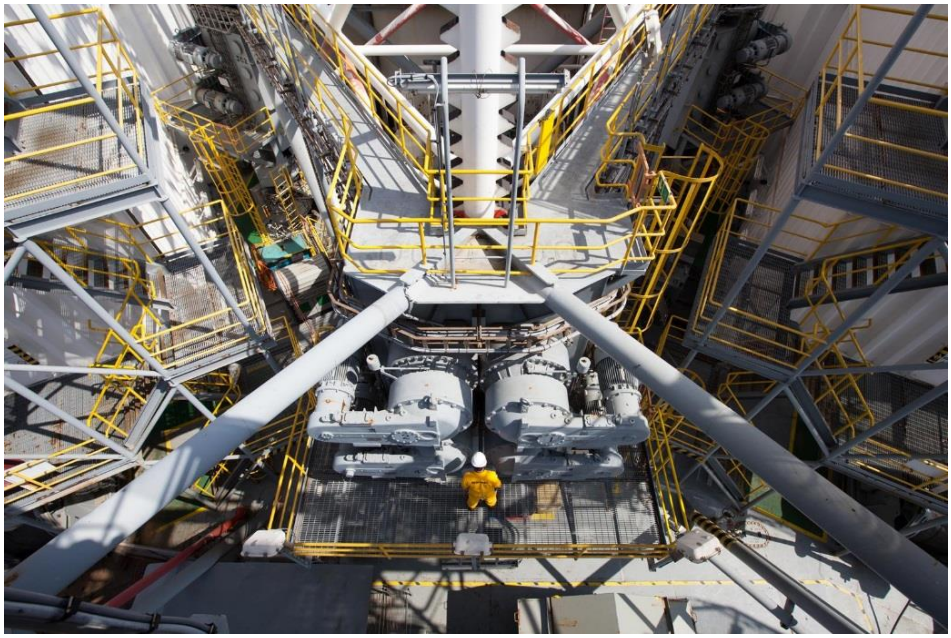
SECTION 1.1: NATURAL GAS RESOURCES

2015 was a challenging year to the upstream oil and gas sector in Malaysia due to persistent lower crude oil price.

Gas discoveries were made in Jerun-1 and Jeremin-1 wells located in Block SK408 offshore Sarawak. The discoveries add another 3 tcf of gas to the existing 3 tcf previously found in Block SK408.

Malaysia's total natural gas resources are estimated to be 100.7 tscf. Thus, based on the current production rate, Malaysia's natural gas resources should be able to last up to 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.

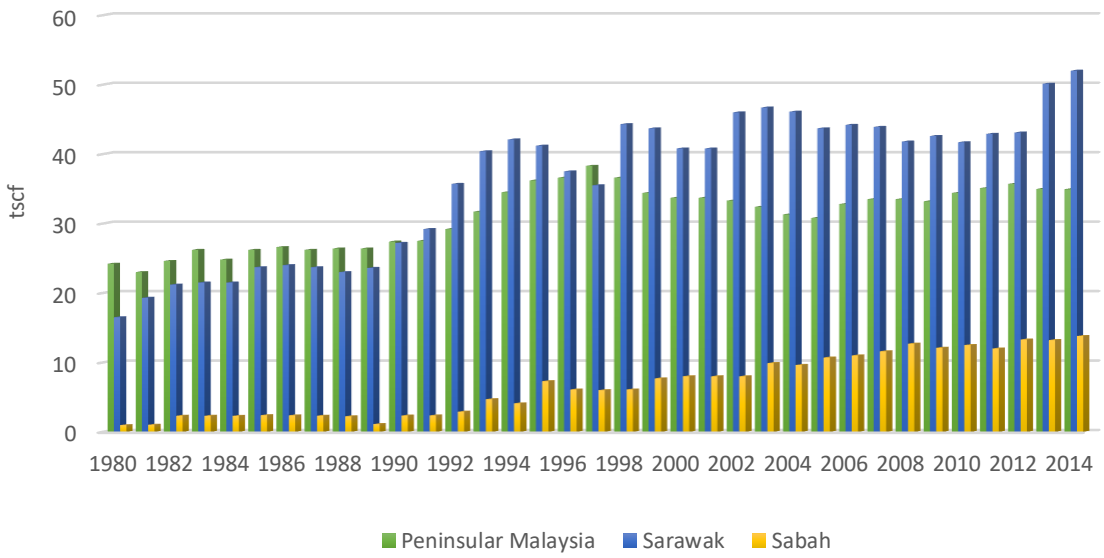
In 2015, PETRONAS recorded 101 active PSCs in Malaysia, encompassing exploration, development and production blocks.



Angsi platform. Photo courtesy of PETRONAS.

As depicted in Figure 1, Malaysia's natural gas resources as at 1 January 2014 was 100.7 tscf, rose by some 2.4 tscf from 98.3 tscf on 1 January 2013. A breakdown of the country's natural gas resources by region is provided below.

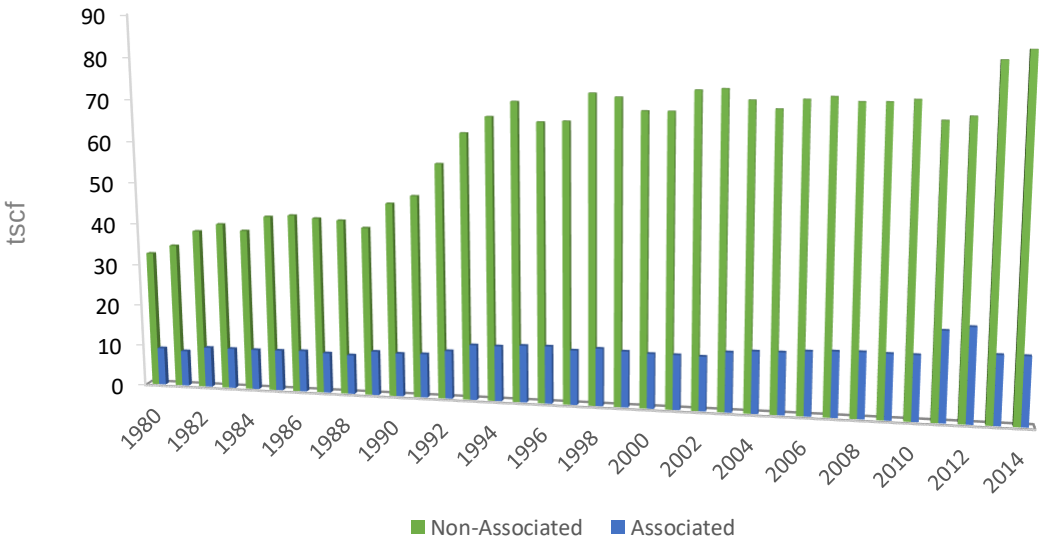
Figure 1: Natural Gas Resources by Region



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

Natural gas resources by type on 1 January of each year is shown in Figure 2. 84% of Malaysia's natural gas resources comprises of non-associated gas.

Figure 2 : Natural Gas Resources by Type



Source : MEIH, Energy Commission

According to PETRONAS' Annual Report 2014, Malaysia's natural gas reserves (2P) as of 1 January 2015 was 7.2 bboe increasing by 9.1% from 6.6 bboe on 1 January 2014, while contingent resources (2C) was 10.0 bboe as of 1 January 2015, compared to 10.2 bboe on 1 January 2014.

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.

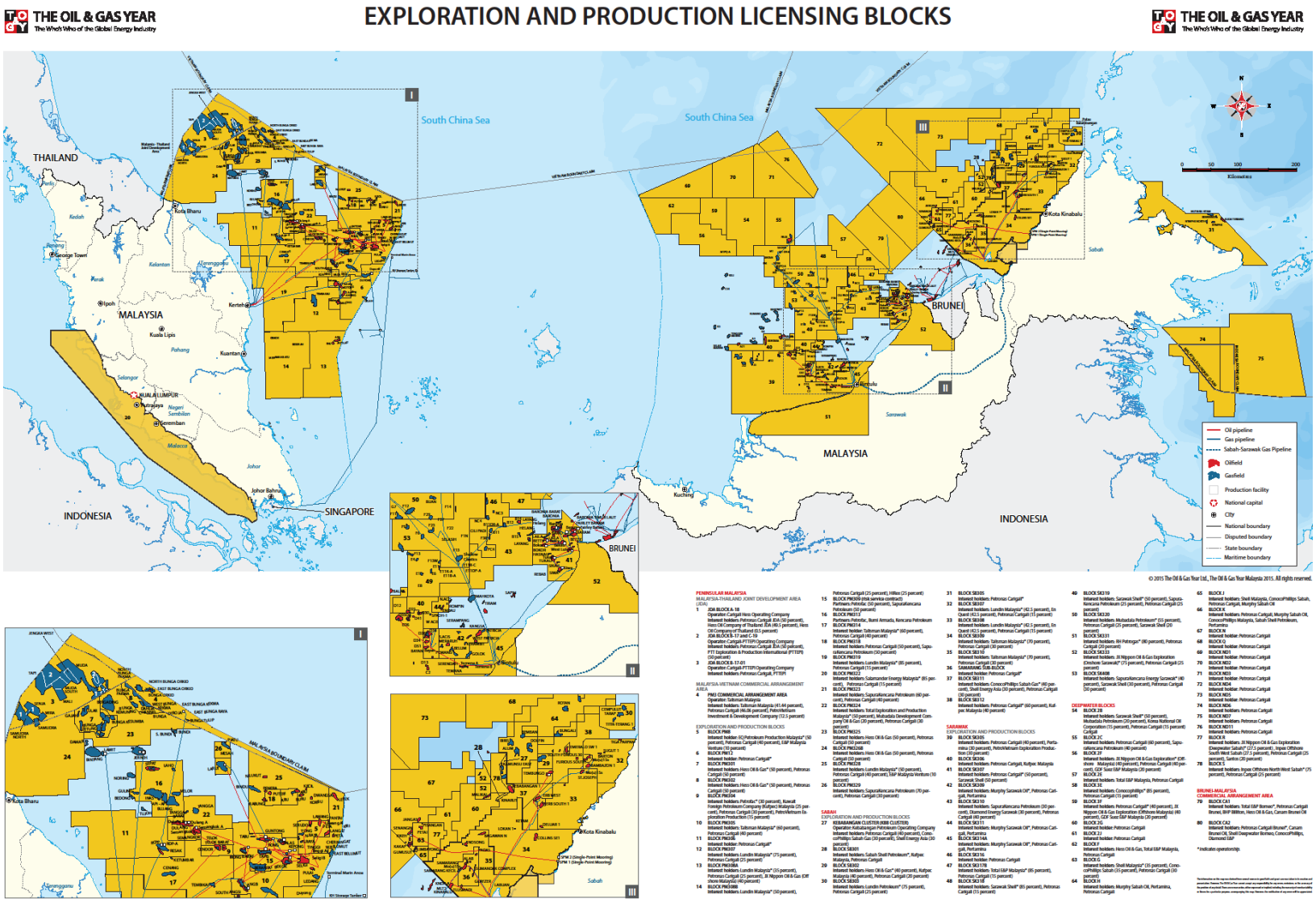
SECTION 1.2: LOCATION OF MALAYSIA'S GAS FIELDS

Almost all of the country's existing oil and gas fields are located offshore. Based on data on 1 January 2014, Sarawak accounts for approximately 52% of the country's natural gas resources, followed by Peninsular Malaysia with about 35%, and Sabah with 14%.

The map in the following page showing the location of the exploration and licensing blocks in Malaysia is for illustration purposes only.

Figure 3: Oil & Gas Upstream Map

Map courtesy of The Oil & Gas Year (TOGY), www.theoilandgasyear.com

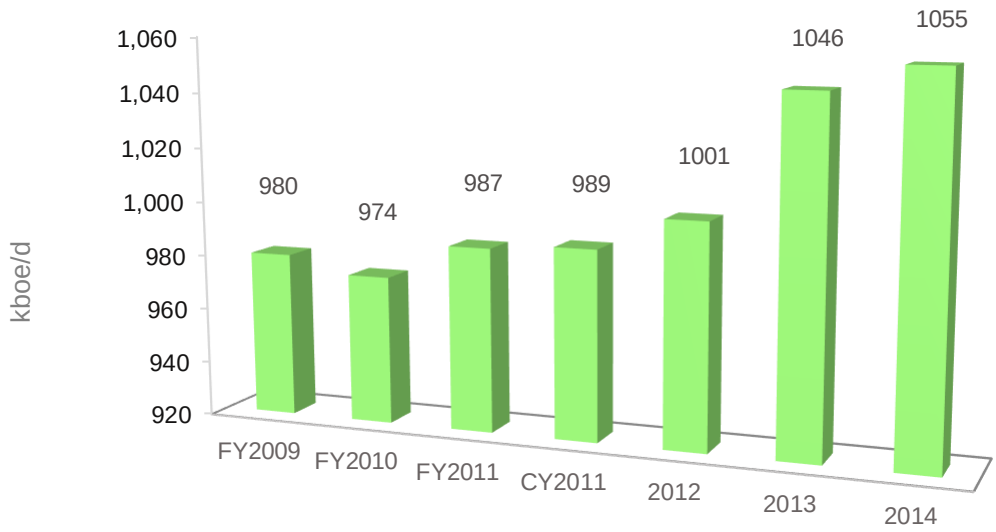


SECTION 1.3: NATURAL GAS PRODUCTION

Gas production in the first half of 2016 was 1,074 kboe/d increasing from 1,044 kboe/d in same period of 2015. Production in Peninsular Malaysia within the period was higher to support shortfall in imported gas from West Natuna B, Indonesia.

In May 2015, ExxonMobil announced its plan to kick-start gas production from the second phase of the Telok gas development project, located off the east coast of Peninsular Malaysia. The project comprises of two satellite platforms, Telok A and Telok B, which together are able to produce more than 450 mmscfd of gas. *(ExxonMobil starts production from Telok B platform, The Star, 7 May 2015)*

Figure 4: Natural Gas Production



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

Since 2005, Sarawak has been the largest producing state in Malaysia, with production at almost 4.0 bscfd, most of which went to LNG production in Bintulu. The recent discoveries of several new significant fields offshore Sarawak is expected to enable the state to maintain its dominance as the country's largest producer of natural gas for the foreseeable future.

Over 65 years, our commitment to national development has rewarded one and all. Small, medium and large-scale industries have emerged and grown. Malaysians nationwide are now accustomed to the comforts that electricity can provide. We do all this to better lives for a brighter tomorrow.

TENAGA NASIONAL
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SECTION 2: DOWNSTREAM SECTOR

The downstream sector of Malaysia's natural gas industry consists primarily of domestic consumption and exports. However, since about 81% 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 1.2: 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 Masterplan 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 Utilisation 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 methane (or sales gas), ethane, propane, butane, and condensate. The sales gas (mostly methane) is supplied to 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 2,060 mmscfd of sales gas. In 2015, an average of 1,682 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 2015

The sales gas is distributed 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	429
Liquid	373
Sarawak	39
RGTSU	30
Total	2,561

Source : PETRONAS Gas Berhad Annual Report 2015

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 went down to almost RM5.00 to one US Dollar. Because Malaysia was able to maintain domestic electricity tariff at a fairly low rate, the country was amongst the earliest in the region to recover from one of the worst ever economic recession to hit the Asian region.

Figure 7: Map of Peninsular Gas Utilization (PGU)

Source : PETRONAS Gas Berhad Annual Report 2015

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, Kebabangan 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 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 fields offshore Sabah.

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.

In addition to the above, PETRONAS Chemicals Group is undertaking the Sabah Ammonia Urea (SAMUR) project, in Sipitang, Sabah which is expected to achieve full commercial operation by the end of 2016. The plant uses natural gas as feedstock.

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.

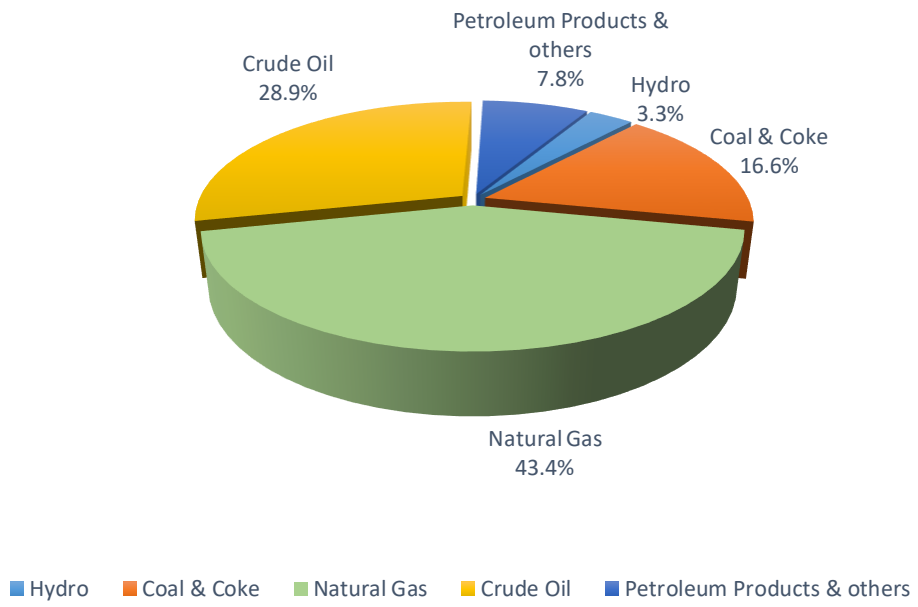
The gas-fired Pengerang Cogeneration Plant (PCP) will generate 1,220 MW of electricity and up to 1,480 tonnes per hour of steam. PCP will also supply 400 MW of electricity to the national grid.

SECTION 2.2: DOMESTIC NATURAL GAS CONSUMPTION

Since 1991, when Phase Two of the PGU was commissioned, natural gas has become a very important source of energy for Malaysia. At its peak in 2006, natural gas accounted for almost 53% 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 about 43% in 2014, with coal meeting the country's incremental energy demand.

A chart showing natural gas' share of Malaysia's primary energy supply in 2014 is provided in Figure 8.

Figure 8: Primary Energy Supply, 2014



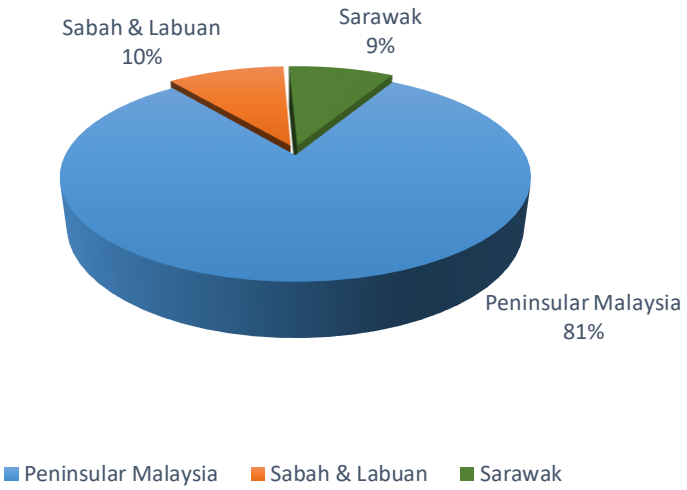
Source : National Energy Balance 2014, Energy Commission

The gas demand in Malaysia in 2015 was 2.6 bscfd. Out of this, 54% is from the power sector, and 45% from the industrial sector. The balance of 1% is from other sectors such as commercial, residential and transportation.

Peninsular Malaysia accounts about 82% 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: PETRONAS

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. Power stations and co-generation plants accounted for 62% of total gas consumption in Malaysia in 2014.

The Malaysian Government's decision to regulate the gas price to the power sector 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 continued to grow and reached a peak in 2000 when it accounted for 78% of electricity generation mix for the country.

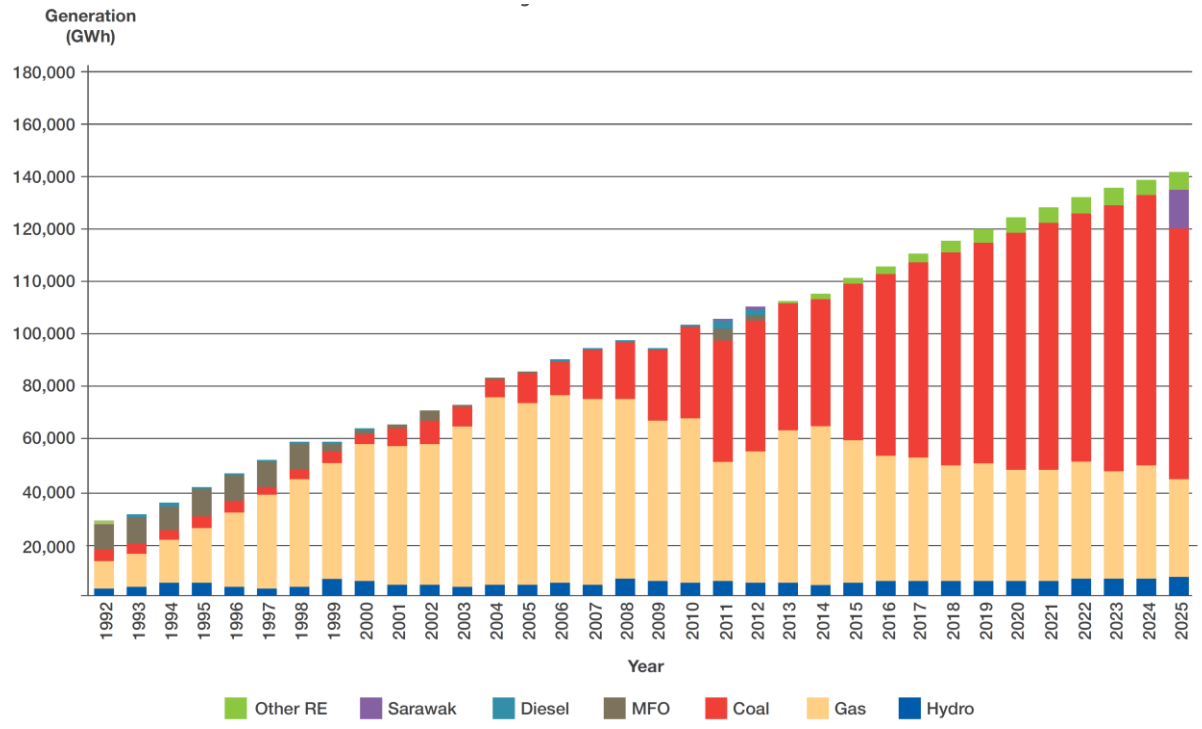
The completion of the LNG RGT1 in May 2013 contributed significantly towards enhanced gas supply and energy security in Peninsular Malaysia. Reliable gas supply ensured that the share of gas in Peninsular Malaysia's electricity generation mix continued to be approximately 45%.

Figure 10: New 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)	1,400	April 2019
4	Edra Global Energy	2,400	January 2021

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

Figure 11: Peninsular Malaysia' Power Generation Mix (1992-2030)

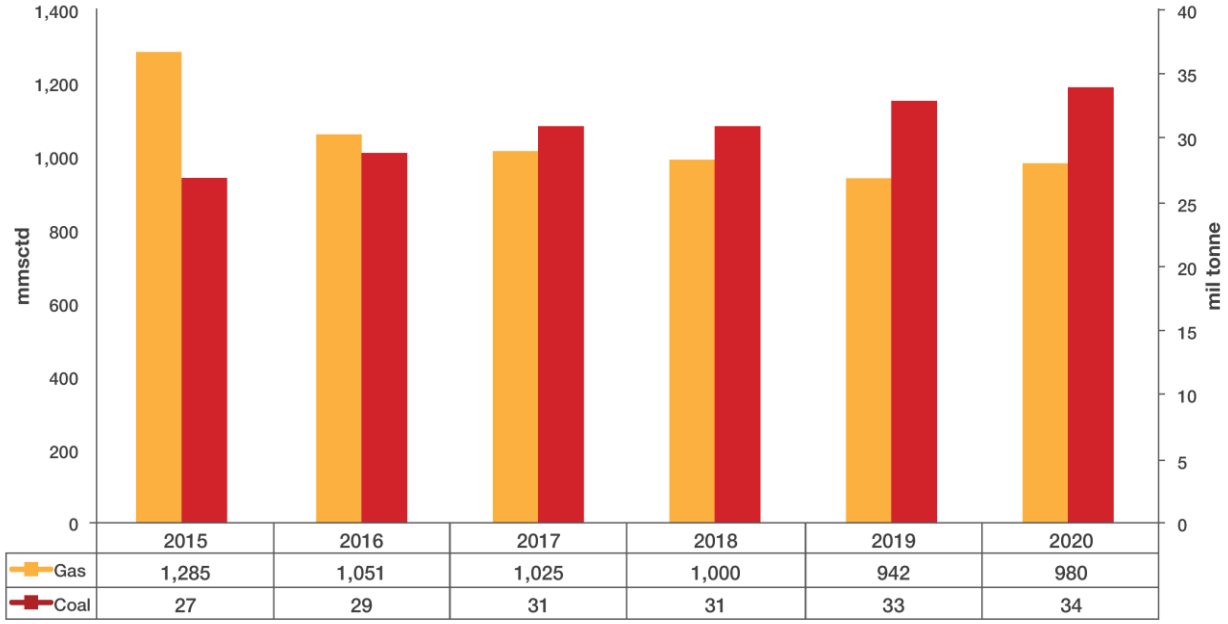


Source: Peninsular Malaysia Electricity Supply Industry Outlook 2016, Energy Commission

Nonetheless, gas usage as fuel in power generation in Malaysia will decrease due to retirement of gas-fired plants, shift from gas to coal and admission of Sarawak Interconnection with electricity generated from hydro that is expected to materialize by 2025.

Coal consumption is projected to steadily increase due to introduction of new coal-fired generating units with a combined capacity of 5,010 MW. By 2020, coal-fired power plants will make up 65% of total installed capacity compared to 45% in 2014.

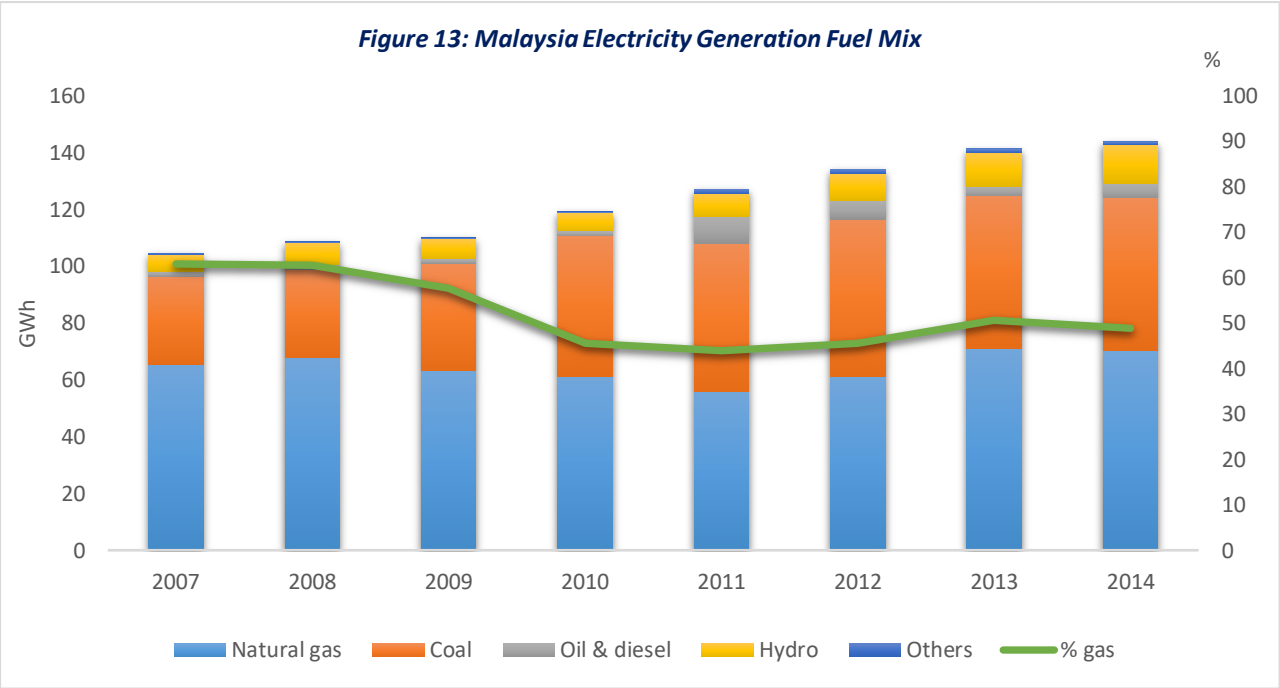
Figure 12: Projected Coal and Gas Consumption in Power Sector, Peninsular Malaysia



	2015	2016	2017	2018	2019	2020
Gas	1,285	1,051	1,025	1,000	942	980
Coal	27	29	31	31	33	34

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

Even though share of coal in power generation fuel mix is expected to increase, natural gas will still continue to contribute significantly due to its clean burning property and hence, lower Green House Gas (GHG) emissions. The government has set a target to achieve reduction in GHG emission intensity of GDP by up to 45% compared to 2005 levels by the year 2030 as committed during COP21.



Source : Malaysia Energy Statistics Handbook 2014 and Performance and Statistical Information on Electricity Supply Industry in Malaysia, 2014 (Energy Commission)

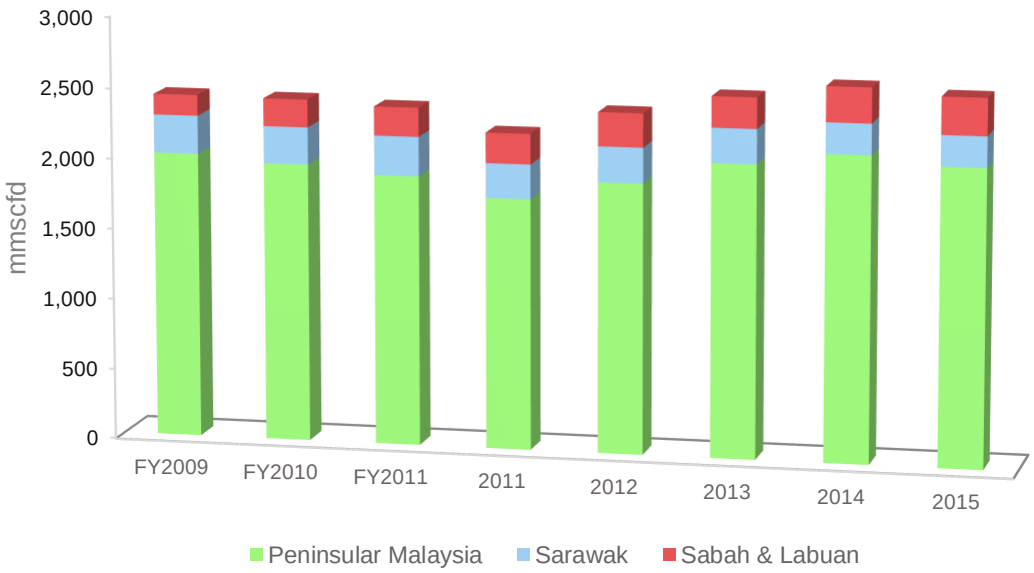
Gas-fired combined-cycle power plants in Lumut, Perak. Photo courtesy of Malakoff Corporation Berhad.

Gas consumption in Sabah increased to 265 mmscfd in 2015 from 219 mmscfd in 2013 following the completion of SOGT and two gas–fired power plants in Kimanis in 2014. The 300-MW gas-fired Kimanis power plant achieved full commercial operations in November 2014. SPR Energy's 100 MW gas-fired power plant, also located in Kimanis achieved commercial operations in August 2014. These gas-fired power plants will strengthen the

reliability of electricity supply in Sabah, enhancing socio-economic development and industrialization process. The gas consumption will further increase when the SAMUR project in Sipitang is completed in 2016. The SAMUR plant uses natural gas as feedstock.

Similarly, the gas consumption in Sarawak is also expected to increase in the future due to increasing demand from both power and industrial 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 Indutrial Park, 65 kilometers from Bintulu for a period of 20 years to produce ammonia and ammonia derivatives.

Figure 14: Sales Gas Volume by Region



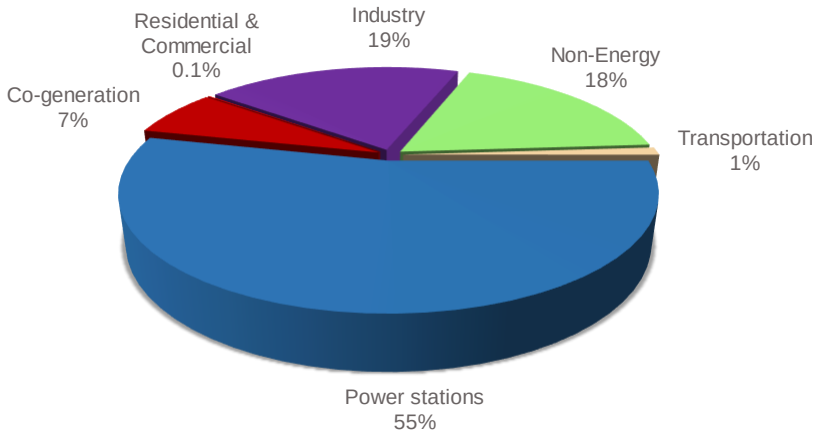
Source : PETRONAS Annual Report and Financial Results announcement. (Note : FY2009, FY2010 and FY2011 ends on 31 March of the corresponding financial year.)

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 economic landscape experienced a transformation from an agricultural-based 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 centralised utility facility which provides power, steam, and demineralized water to the tenants, thereby significantly reducing the owner's capital investment to setup their plants.

The ethylene plant in Kertih Integrated Petrochemical Complex, Terengganu uses ethane which is extracted from natural gas as feedstock. Photo courtesy of PETRONAS.

Within the Malaysian manufacturing sector, rubber products industry is the biggest user of gas followed by food, beverages & tobacco.

Figure 15 : Gas Consumption by Sector, 2014



Source : National Energy Balance 2014, Energy Commission

Natural gas is used in the production of rubber gloves. Photo courtesy of Top Glove Corporation Bhd.

Further downstream, gas is made available to industries, commercial and residential customers in Peninsular Malaysia by Gas Malaysia Berhad (GMB) which owns and operates 2,139 km of gas distribution pipeline network, with 74 km of new pipelines added in 2015.

GMB supplied natural gas to 795 industrial, 862 commercial and 12,571 residential customers. 99% of the volume of gas delivered was to industrial customers. The main customers were from the rubber products, food, beverage and tobacco sectors which collectively consumed 59% of total gas supplied by GMB.

In addition, GMB also supplied Liquefied Petroleum Gas (LPG) to 1,287 commercial and 23,175 residential customers.

GMB has seen its sales increase from only 0.7 million mmBtu in 1993, to 159.1 million mmBtu in 2015.

Figure 16: Breakdown of Gas Malaysia's Sales Volume by Industry (2015)

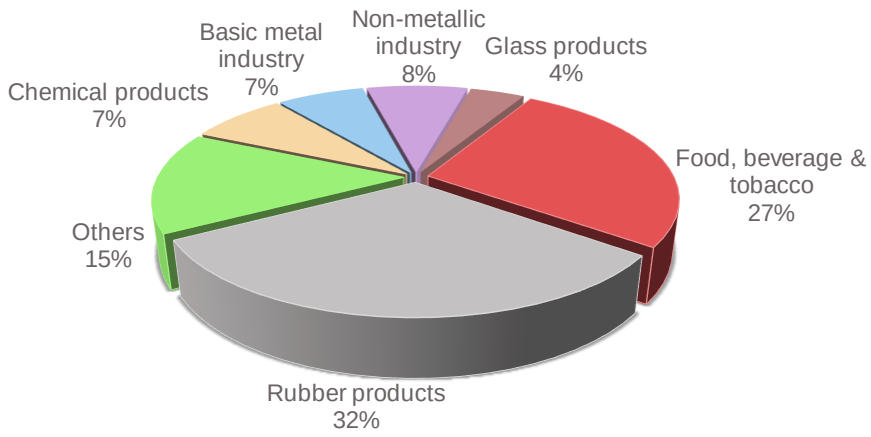
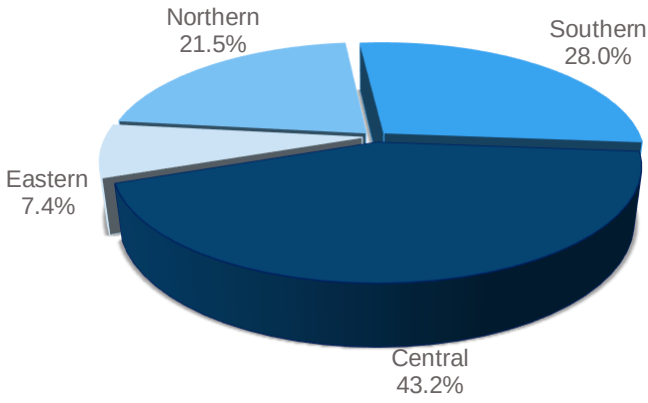


Figure 17: Breakdown of gas supplied by Gas Malaysia's by Region (2015)



Source : Piped Gas Distribution Industry Statistics 2015, Energy Commission

GMB has taken the initiative to introduce and promote the Combined Heat and Power (CHP) system since 2014 , with a joint venture with TGES . Due to its high efficiency of up to 90%, the system enables customers to utilize more energy from the same volume of gas, thus significantly reducing their total energy cost. A CHP plant is being constructed in Prai, Penang with expected completion in 2016.

Gas Malaysia and IEV Energy explore other avenues to create new demand for gas by introducing "virtual pipeline" to the customers – to supply compressed natural gas via land transportation to areas beyond the reach of its existing gas pipelines. This initiative would make natural gas accessible to wider consumers who would otherwise not have any access to this energy resource. A Compressed Natural Gas (CNG) mother stations is being constructed in Pahang, with potential volume consumption of 420,000 mmBtu per year.

Gas Malaysia and Sime Darby are also pioneering the commercial production of BioCNG from Palm Oil Mill Effluent (POME) with a construction of a plant in Selangor with initial gas delivery of 25,000 mmBtu per year.

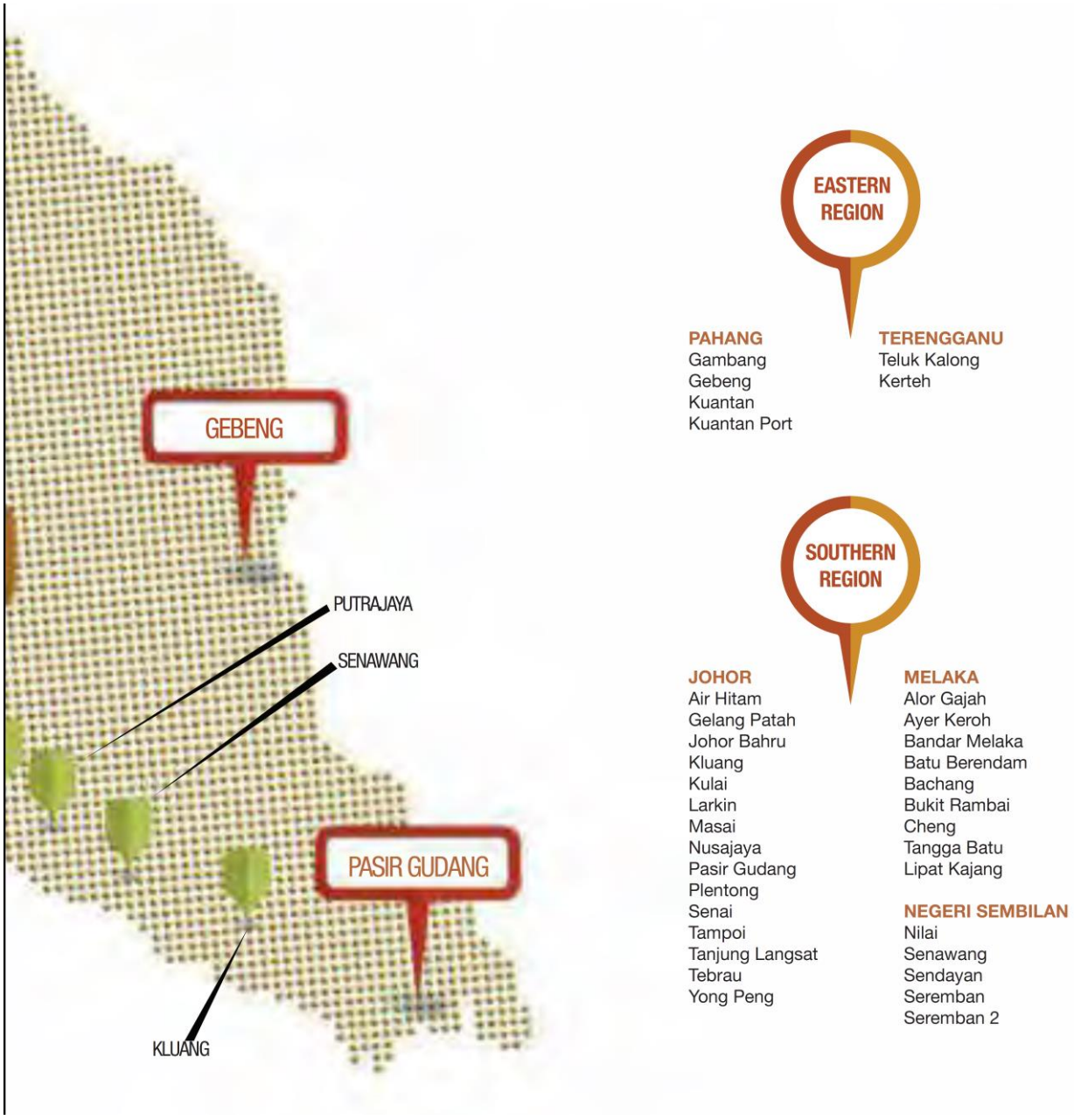
Gas Malaysia Berhad's control room.
Photo courtesy of Gas Malaysia Berhad.

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 km of steel and polyethylene pipelines as well using 'virtual pipeline' where the gas was compressed into special purpose built containers and transported to customers' premises.

Figure 18: GMB's Supply Area



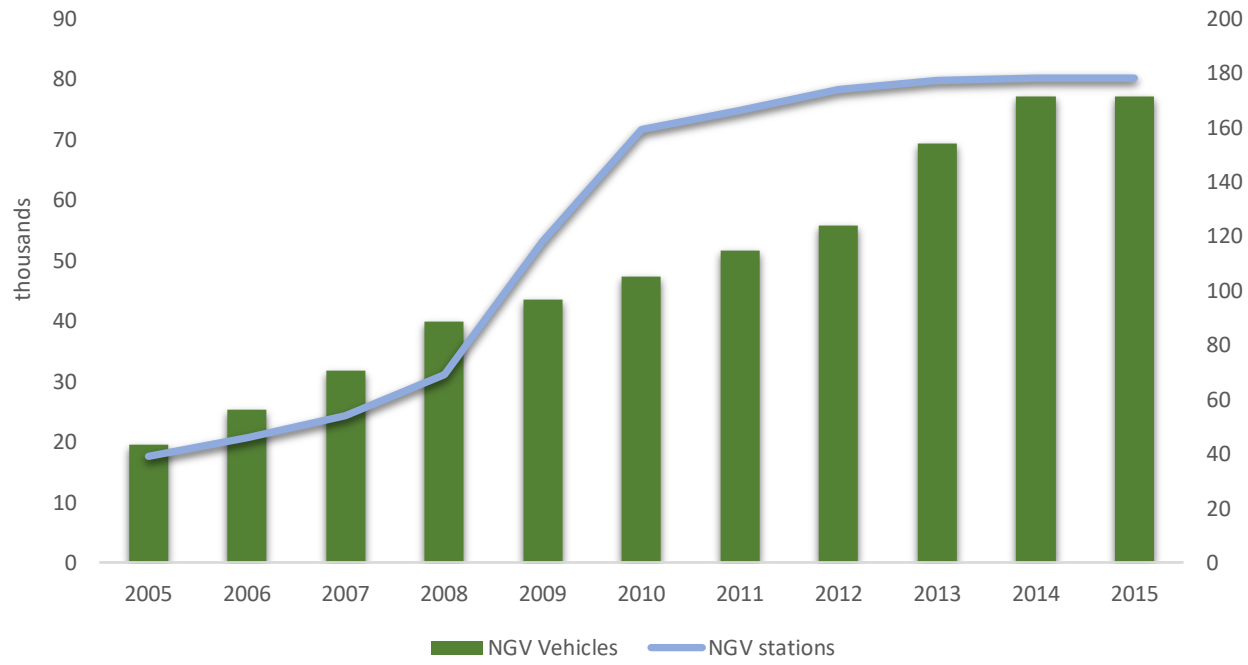
Source : Gas Malaysia Berhad Annual Report 2015

SECTION 2.3: NATURAL GAS FOR VEHICLE

An equally important development made possible by the PGU system is the natural gas for vehicle programme or NGV. The availability of natural gas in major cities on the west coast of Peninsular Malaysia has enabled PETRONAS to promote the use of natural gas as a cleaner fuel for the transportation sector. This programme has received strong support from the Malaysian Government since it would also steer the transportation sector away from its dependence on oil products.

Currently, Malaysia has about 77,000 natural gas vehicles on the road, with 178 NGV refueling stations in operation. Most of the NGV users are taxis. The public bus system in Putrajaya also runs on NGV.

Figure 19 : Number of NGV Vehicles and Refueling Stations



Source : PETRONAS NGV Sdn. Bhd.

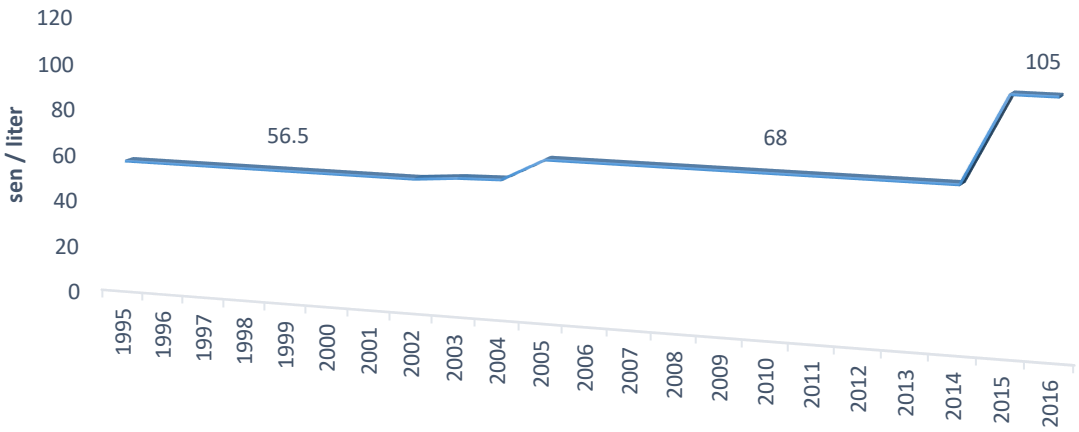
The lower than targeted number of NGV vehicle population is due to the lower number of NGV refueling stations in operation. More than half of the refueling stations are located in the Klang Valley, with only 7 stations located throughout the east coast of the Peninsular Malaysia.

Increased use of natural gas in the transportation sector would help reduce environmental pollution and greenhouse gas emissions; hence, enhancing the quality of living and supporting sustainable development.

To ensure success of the NGV programme, the Government has mantained the natural gas pump price for NGV at 68 sen/litre of petrol equivalent since 2005 until September 2015 as

shown in Figure 13. This price is approximately one-third of the price for RON 95 unleaded petrol, and only one-fourth of RON 97 unleaded petrol. After 10 years, the regulated NGV pump price was increased to RM1.05/liter of petrol equivalent effective 20 September 2015.

Figure 21 : Regulated NGV pump price



Currently, PETRONAS NGV Sdn. Bhd. (PNGV) is the only supplier of NGV in the country. The negative margin due to low regulated NGV pump price has not encouraged the sales of NGV by other suppliers. PETRONAS also incurs significant losses in this business, but is continuing the programme as part of its contribution and obligation to 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 NGV trucks to the refueling stations where there is no access to the gas pipeline.

NGV refuelling station.

Figure 20: Number of NGV Stations by States

Source : PETRONAS NGV Sdn. Bhd.

SECTION 2.4: GAS EXPORTS

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

Malaysia recorded lower LNG export in 2015 at 25.1 MTPA, decreased by 3% from 25.8 MTPA in 2014.

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 RM47 billion worth of LNG in 2015 decreasing from RM64 billion in 2014 due to lower volume and prices as LNG prices were indexed to oil prices.

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 will add another 1.2 MTPA. PFLNG SATU will also be the first floating LNG liquefaction facility in the world when it becomes 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.

With maturing gas fields and dwindling production, FLNG gives Malaysia the key to unlock its stranded gas resources which previously were 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 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. When 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 a major LNG player.

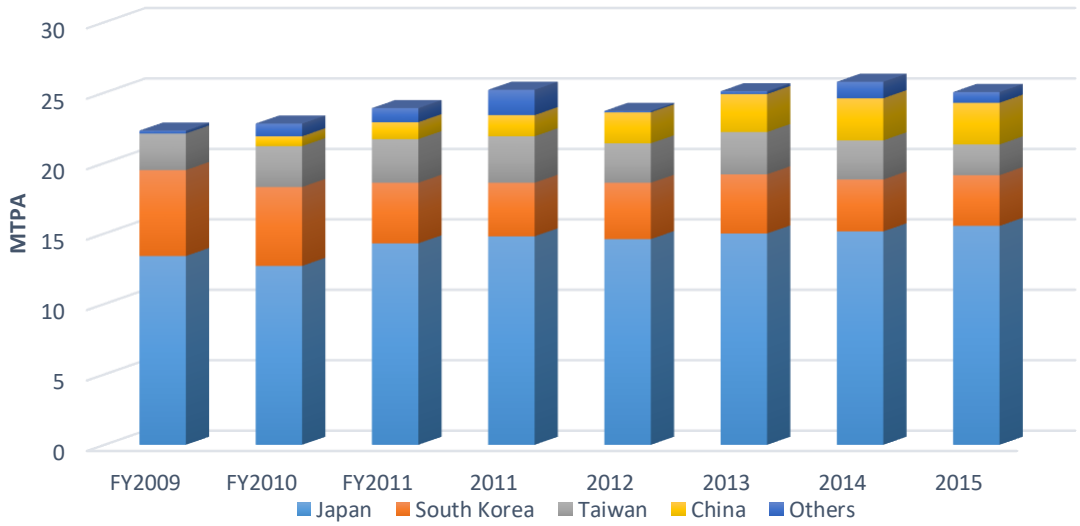
Malaysia has historically been an important supplier of LNG for Japan, South Korea, and Taiwan. Malaysia LNG has had over 30 years of experience as an established and reliable supplier in delivering LNG to these major markets.

LNG carrier Seri Anggun. Photo courtesy of PETRONAS.

Japan continues to be the main buyer of LNG from Malaysia, accounting for 62% of LNG export in 2015, followed by South Korea (14%), China (12%) and Taiwan (9%) while the balance of 3% is exported to other countries.

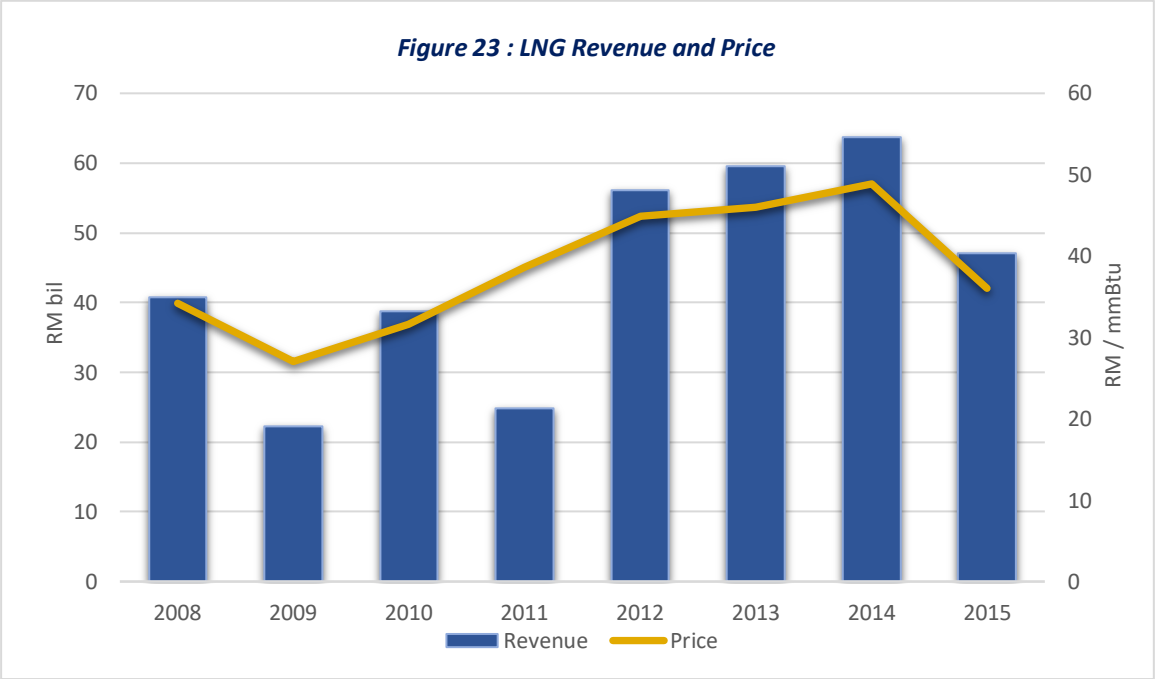
LNG export to China which began in 2009 has been increasing steadily from an initial volume of only 0.7 MTPA to 3.0 MTPA in 2015. China has surpassed Taiwan as the third largest importer of Malaysia's LNG.

Figure 22 : LNG Export by Country



Source : PETRONAS

Note : FY2009, FY2010 and FY2011 ends on 31 March of the corresponding financial year.



Source: Department of Statistics.
LNG price was calculated by MGA based on value and volume data published by the Department of Statistics

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.

About 90% of Singapore's electricity is generated using imported natural gas.

LNG storage tanks at the PETRONAS LNG Complex in Bintulu, Sarawak.
Photo courtesy of PETRONAS.

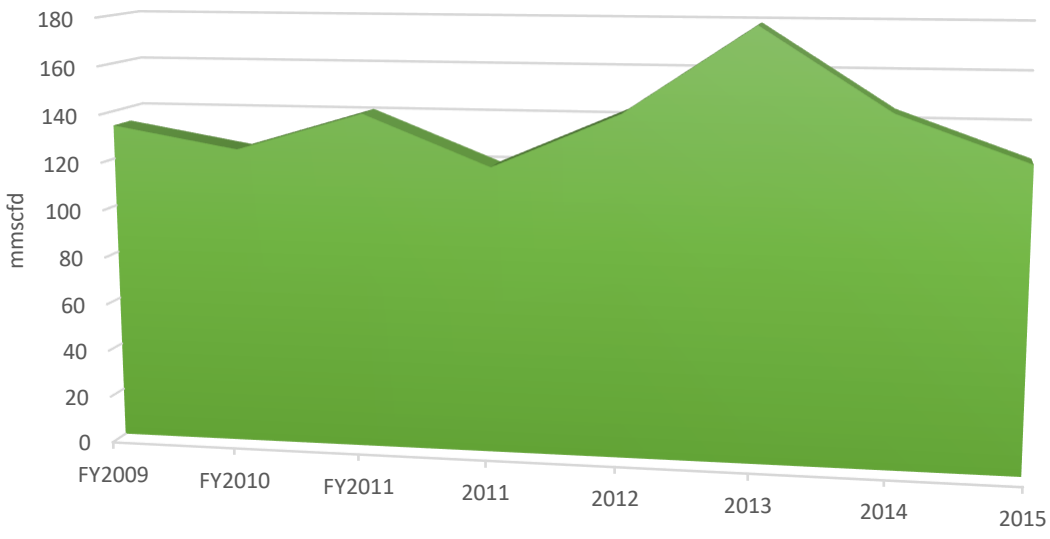
In 2015, Malaysia's piped gas export declined to 126 mmscfd from 145 mmscfd in 2014. The decrease was due to importation of LNG into Singapore which was the country's initiative to

diversify its sources of natural gas. The supplies of piped gas to Singapore were delivered under two separate contracts: Senoko Power and Keppel Gas. However, gas import from Malaysia represented a small portion of Singaporean piped gas imports as the country relied much more heavily on Indonesian volumes.

- Piped gas export to Singapore is likely to decline further in the future as Singapore uses imported LNG to diversify its gas supply sources and enhance its energy security. Singapore's first LNG import terminal became operational in May 2013. The terminal has a send-out capacity of 6 MTPA which will be increased to around 11 MTPA by 2018.

- Leveraging on its strategic geographic location, Singapore aspires to become a major player by facilitating global LNG flow and establishing itself as a LNG Trading Hub for the region.

Figure 24 : Piped Gas Export



Source : PETRONAS Annual Reports.

Note : FY2009, FY2010 and FY2011 ends on 31 March of the corresponding financial year.

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SECTION 3: OTHER GAS SOURCES

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 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 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 2015, the PGU system received 346 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.

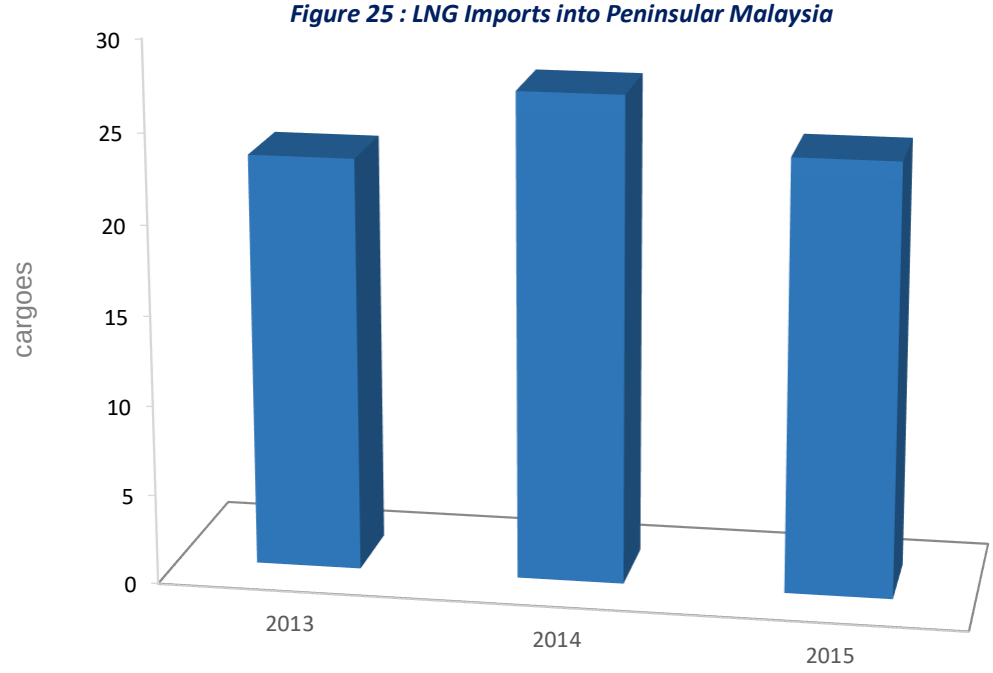
In addition to the onshore pipeline, a 365-km offshore pipeline from JDA to Kertih was completed at the end of April 2015 under the JDA Gas Balancing Evacuation (EVA) project. Under the EVA project, a further 214 mmscfd of gas would be available as a long term measure.

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.

24 LNG cargoes were imported through the RGT1 in 2015, making 74 LNG cargoes imported into Peninsular Malaysia since the RGT1 became operational in May 2013.

Figure 25 : LNG Imports into Peninsular Malaysia



Source : PETRONAS Gas Bergad 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 m^3 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 can accommodate LNG carrier of size 5,000-265,000 m^3 and will also have a reloading export facility. RGT2 will supply gas to RAPID, PCP and the PGU system to enhance the gas supply availability in Peninsular Malaysia.

SECTION 4: THIRD PARTY ACCESS

The completion of LNG RGT1 in Melaka in May 2013 and the amendment of the Gas Supply Act 1993 (GSA 1993) paved the way for Third Party Access (TPA) and liberalization of Malaysian gas market, with the Energy Commission as the regulator.

The amended Gas Supply Act 1993 has been passed by the Parliament, at the Lower House on 23 May 2016 and as well as the Upper House in 14 Jun 2016. The amended Act was gazetted on 9 September 2016.

The scope for the Energy Commission's regulatory areas is expanded from gas distribution and reticulation to also include LNG storage & regasification, and transportation of natural gas through onshore gas transmission pipelines. Activities related to gas shipper, importer, transporter, regasification facilities, distributor and retailer will be licensed by the Energy Commission.

Existing industry players will be given a one year grace period to prepare whilst all new industry participants are required to comply immediately upon enforcement of the Third Party Access regime in January 2017.

With 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 pipeline. TPA would also allow big gas users to purchase their own gas from any LNG source, use the RGT and pipeline facilities to bring the gas to their plants.

Market liberalization will promote competition and efficiency and supply security, and ensure long term security of gas supply to the nation.

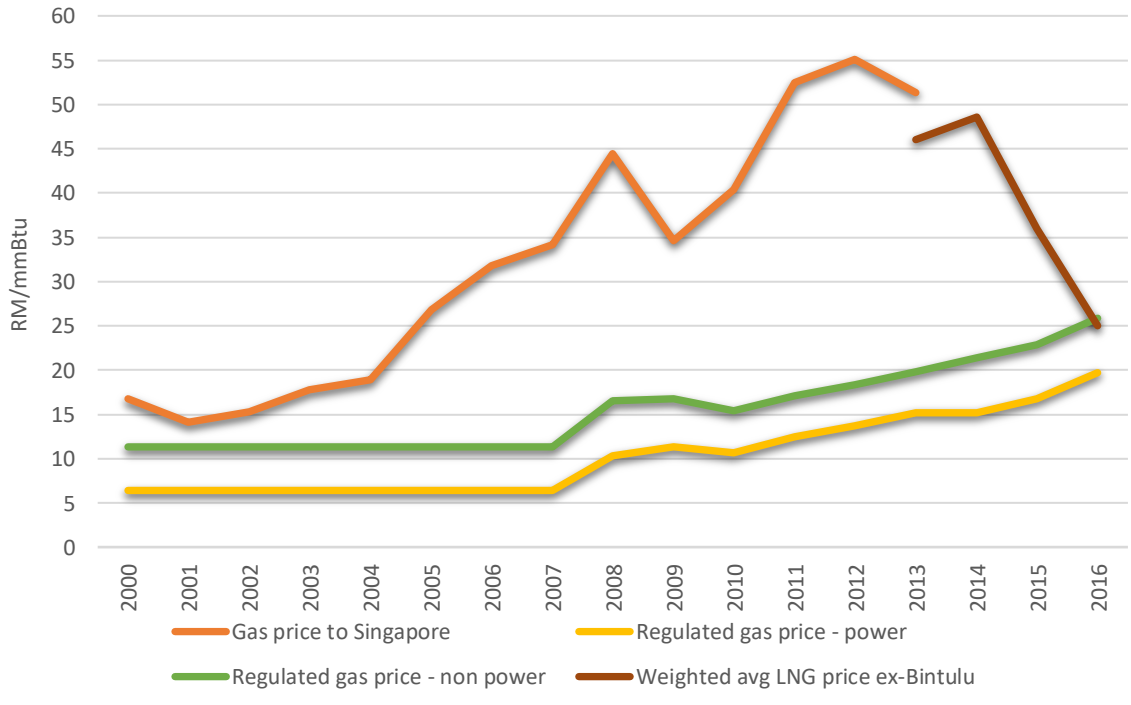
SECTION 5: REGULATED GAS PRICES

There are two categories of gas prices in Malaysia – regulated gas price and contractual price.

In the regulated gas price regime, the Government regulates the price of the gas supplied by PETRONAS and Gas Malaysia. Prior to oil price drop in middle of 2014, the gap between the regulated gas price and the market price was big, resulting in PETRONAS having to forego a substantial sum in terms of "lost" revenue, in turn 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 RM27.9 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 price and contractual price has narrowed. In 2015, the revenue foregone amount was RM10.9 billion. The decrease was also due to introduction of LNG-based market pricing mechanism for gas consumption above 1,000 mmscfd for power sector and for all new volumes for non-power sector after the commencement of LNG import when the RGT1 was completed in 2013.

Figure 26 : LNG price and Regulated Gas Prices in Peninsular Malaysia



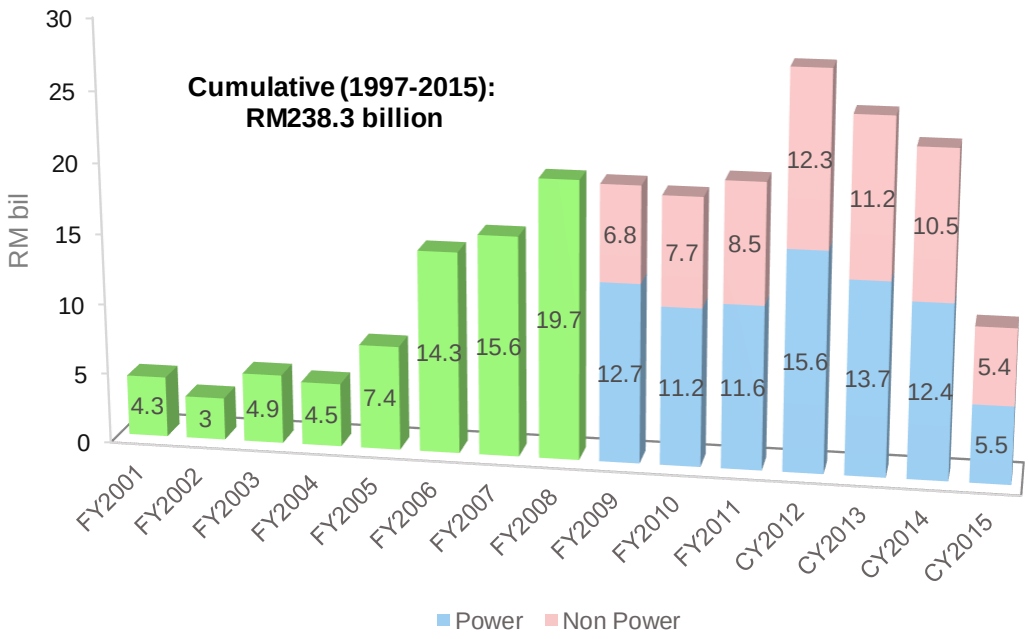
Source: 2000–2013 figures from Malaysia Energy Statistics Handbook 2015, Suruhanjaya Tenaga.

LNG weighted average price ex-Bintulu was calculated by MGA based on value and volume published by Department of Statistics. 2016 figure was based on data from Jan-Sep only.

Out of the RM10.9 billion, RM5.5 billion went to the power sector, with the balance going to the non-power sector – which includes industrial, commercial, residential and the transportation.

The cumulative total amount since May 1997 to December 2015 was RM238.3 billion.

Figure 27 : Revenue Foregone by Sector



The Government's ongoing Economic Transformation Programme, or 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 increased the regulated gas price twice in 2016.

The regulated price to power sector in Peninsular Malaysia was increased to RM19.70/mmBtu for volume up to 1,000 mmscfd effective from 1 July 2016.

For non-power sector, the regulated gas price supplied by PETRONAS in Peninsular Malaysia was increased to RM25.85/mmBtu while gas supplied by PETRONAS to Gas Malaysia was increased to RM21.55/mmBtu. The average price of gas supplied by Gas Malaysia was increased to RM27.05/mmBtu. All the price increase was effective from 15 July 2016.

The regulated tariffs for gas supplied by Gas Malaysia effective from 15 July 2016 are as shown in Figure 28.

Figure 28: Tariff for Gas Supplied by Gas Malaysia Berhad in Peninsular Malaysia

Category	Annual Gas Consumption (mmBtu)	Tariff (RM/mmBtu) (Effective 15 July 2016)
A	Residential	19.52
B	0 – 600	25.20
C	601 – 5,000	25.33
D	5,001 – 50,000	25.58
E	50,001 – 200,000	26.69
F	200,001 – 750,000	26.69
L	Above 750,000	27.58
Average		27.05

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