Malaysia: Natural Gas Industry Annual Review 2012

August 2013

MESSAGE FROM THE PRESIDENT OF THE MGA

It gives me great pleasure to present the inaugural edition of this "Malaysia: Natural Gas Industry Annual Review 2012" publication which I hope will be the first of many future editions that both the general reader and industry specialist will come to appreciate as a comprehensive and authoritative reference on the Malaysian natural gas industry.

Natural gas has always played a fundamental role in supporting Malaysia's economic development. Nowhere is this more aptly illustrated than the fact that 60 percent of the growth in the country's energy requirements over the last 30 years was met from this clean source of energy. Today, natural gas is the country's largest source of primary energy. It provides about 40 percent of the power sector's generation fuel requirements and one-third of the industrial sector's energy needs. Gas forms the backbone of our petrochemicals industry, where it has helped extend the country's industrial capabilities further downstream in the oil and gas value-chain; and exported as LNG, it remains a major foreign exchange revenue earner for the Nation.

Going forward, I am confident that gas has tremendous potential to continue sustaining Malaysia's future economic development. As this Report highlights, the country's total gas reserves at current production rates have a comfortable lifespan of over 40 years. Other efforts such as the construction and commissioning of Malaysia's first LNG regasification terminal in Sungai Udang, Melaka in June 2013, to be followed by a planned second terminal in Pengerang, Johor, will also provide additional avenues through which this role can be further enhanced.

Of course, none of this contribution potential will be realised automatically. Gas as a safe, reliable and clean energy source that sustains the Nation's future progress needs to be sustained in its attractiveness to both suppliers and consumers alike and this requires no less than the full commitment from all stakeholders to ensure that the necessary conditions for the industry to flourish continue to remain in place. For this reason, I believe the mounting gas subsidy burden borne by the Government and PETRONAS — almost RM28.0 billion in 2012 and 18 percent higher on the year, as this Report highlights — must be regarded as a serious concern by all given that it directly undermines the future sustainability of our gas supplies.

As such, I am heartened to note that the Government of Malaysia has acknowledged this challenge and already set out clear objectives for gas price revisions in the New Energy Policy outlined in its 10th Malaysia Plan (10MP). The effective and timely implementation of these price revisions will not only place future long-term Malaysia gas supplies on a far more sustainable foundation, but would also provide the much-need catalyst to create a new competitive basis for the Malaysian economy—one driven by sustained productivity gains and innovation; and this of course is a goal the Government has also already recognised the need for in its having enunciated the country's New Economic Model (NEM).

I would like to take this opportunity to acknowledge the close co-operation demonstrated by all stakeholders in having successfully managed what proved to be a very challenging supply situation in 2012. Indeed, the robust, carefully co-ordinated response that we were able to forge, in which all stakeholders played a critical part, leaves me hopeful that the collective will to take on the country's future energy challenges remains resilient.

With government providing a conducive environment for industry to flourish, and industry playing its part to ensure adequate and timely supplies of gas, the positive economic legacy which the Malaysian gas industry has thus far been able to create for the Nation will, I am confident, continue to endure well into the future.

By way of a final note, I wish to place on record my sincere and heartfelt thanks to all Taskforce Members and to their respective organisations — in particular, the Economic Planning Unit (EPU), the Ministry of Energy, Green Technology and Water (KeTTHA), Suruhanjaya Tenaga (ST), PETRONAS and Gas Malaysia Berhad (GMB) —for all their tireless contributions which have made this Report a reality; and not least, to PFC Energy, which also played an instrumental role in its preparation. I would also like to take this opportunity to acknowledge the contributions of my predecessor, Yang Berbahagia Datuk (Dr.) Abdul Rahim Hj. Hashim, who insightfully envisioned the need for this report, as well as to thank him for his unwavering personal support.

Thank you.

Ir Pramod Kumar Karunakaran
President
Malaysian Gas Association

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Executive Summary

- In 2012, Malaysia's natural gas industry registered another year of respectable performance, particularly in the upstream sector.
- The robust activities in the upstream sector led to several new significant discoveries, boosting the country's total natural gas reserves at end December 2012 to about 98.3 trillion standard cubic feet (scf), an increase of some 6.7% from the level of 92.1 trillion scf at end of 2011. On the production front, PETRONAS succeeded to deliver the volume required to meet its domestic and export markets, except to the power sector in Peninsular Malaysia. Production from the 55 gas fields increased marginally over 2011 to reach about 6.0 billion scf/d. The higher production output was also partly attributed to PETRONAS bringing onstream 4 new fields, two offshore Peninsular Malaysia and the Kumang Cluster offshore Sarawak.
- For the next 5 years, Malaysia will be facing various major challenges in its effort to develop the new gas fields, such as depleting resources and ageing facilities, gas fields containing high CO_2 and other contaminants, small field sizes, and rising development costs. Innovative solutions such as integrated development, utilizing the hub concept, and implementing floating LNG, will continue to facilitate monetisation of the new gas fields.
- In 2012, Malaysia's domestic gas consumption increased by about 8% to reach 2.54 billion scf/d, from 2.35 billion scf/d in 2011. Almost 81% of the demand was accounted by Peninsular Malaysia, followed by Sarawak at 10% and Sabah at 9%. Since 2008, demand for Peninsular Malaysia has been constrained by the steady decline in production from ageing oil and gas fields offshore. The shortfall however was supplemented by sourcing of additional volume from the Malaysia-Thai Joint Development Area and the Malaysia-Vietnam Commercial Arrangement Area, as well as higher imports from Indonesia.
- The onset of gas price reform and the expectation of higher-priced LNG imports has forced Malaysia's power sector to rely more on coal. In year 2000, gas' share of power generation in Peninsular Malaysia stood at about 75% but this has since fallen to about 45% in 2012, whereas coal's share rose from 23% to 46%.
- In 2012, Malaysia exported about 3.6 billion scf/d of gas, down by some 5% from about 3.7 billion scf/d in 2011. LNG accounted for 97 percent of exports, and the remaining 3% was exported to Singapore via pipeline. Revenue wise, LNG exports in 2012 generated about RM55.5 billion, an increase of about 11% over the value in 2011, on the back of a 16.2% increase in the average price of LNG, at RM44.92/mmBtu compared to RM38.67/mmBtu obtained in 2011.

- Due to higher production achieved from gas fields offshore Peninsular Malaysia, the additional volume of natural gas sourced from the Malaysia-Thailand Joint Development Area, the Malaysia-Vietnam Commercial Arrangement Area, and Indonesia, in 2012 dropped by about 5% to 597 million scf/d from 629 million scf/d in 2011.
- In 2012, the number of NGV vehicles in Malaysia increased by 10% to almost 57,000 vehicles, compared to about 52,000 vehicles in 2011. The number of NGV refueling stations also increased marginally by 5 stations, bringing the total in 2012 to 175 stations.
- In 2012, the total subsidy for natural gas – in effect revenue foregone by selling gas to the domestic market at the price below those stipulated in the contract– reached almost RM28.0 billion, of which 56% was accounted by the power sector. Meanwhile, subsidies to the non-power sectors – which include industries, commercial users, residential users, and the NGV sector – increased to RM12.3 billion.

Glossary:

MT = million tonnes MTPA = million tonnes per annum scf/d = standard cubic feet per day

scf = standard cubic feet bcf = billion cubic feet tcf = trillion cubic feet

mmBtu = million British thermal unit LNG = liquefied natural gas FLNG = floating LNG

NGV = natural gas vehicle FY = fiscal year

Section 1: Upstream Sector

Section 1.1: Natural Gas Reserves

In 2012, the upstream sector of Malaysia's natural gas industry registered yet another year of impressive performance. The high level of exploration activities carried out by PETRONAS and its Production Sharing Contractors (PSC) during the past 3 years succeeded in making over 30 new significant discoveries. As a result, during the period, Malaysia's total natural gas reserves are estimated to have increased by over 10.0 trillion standard cubic feet (scf).

Some of the major discoveries made are listed in the table below:

Figure 1: Recent Gas Discoveries Since 2010

Well	Date	Block	Operator	Estimated Resource
B-15	2H2010	SK310	Newfield	0.27 tcf of recoverable reserves
NC3	Feb-11	SK316	PETRONAS	2.15 tcf of gas in place
Tarap-1	Jul-11	SB303	Lundin	N/A
Cempulut-1	Aug-11	SB303	Lundin	N/A
NC8	Sep-11	SK316	PETRONAS	0.45 tcf of gas in palce
Kasawari	Nov-11	SK316	PETRONAS	3.0 tcf of recoverable gas resource
Kuang North-2	Oct-12	SK316	PETRONAS	2.3 tcf of gas in place
Tukau Timur Deep-1	Nov-12	SK307	PETRONAS	2.1 tcf of gas in place
Kelidang NE-1	Mar-13	CA-2	Murphy Oil	0.4-0.9 tcf of gas resource
B-14	Apr-13	SK310	Newfield	1.5-3.0 tcf of gas in place

Source: PFC Energy

Taking into account the additional volume from these new discoveries, Malaysia's total natural gas reserves today is estimated to have exceeded 100.0 trillion scf. Thus, based on the current average daily production rate of some 6.0 billion scf, Malaysia's natural gas reserves should be able to last at least another 40 years. Natural gas therefore is expected to continue to play a very important role in helping to power Malaysia's economy, as well as feature prominently in ensuring security of the nation's energy supply, at least up to 2050.

Equally important, the recent discoveries of significant reserves in the supposedly matured acreage of Malaysia's offshore areas will very likely attract renewed interest from multinational oil companies to invest in new rounds of exploration campaigns to explore for oil and gas in the country; thereby further increasing the possibility of finding more oil and gas reserves. This favourable sentiment is being supported by Malaysia's

upstream exploration discoveries being recognised recently as "stand-out performer" in the Southeast Asian region.

Section 1.2: Location of Malaysia's Gas Fields

Although Malaysia's first oil field was discovered onshore in Miri, Sarawak, almost all of the country's existing oil and gas fields are located offshore (see map on next page). Sarawak, being the cradle of Malaysia's oil and gas industry, today accounts for half of the country's natural gas reserves, followed by Peninsular Malaysia with about 40%, and Sabah accounting for the balance of some 10%. However, with the recent spate of new large discoveries offshore Sarawak and Sabah, Peninsular Malaysia's share of total reserves is expected to drop to about 35%.

Considering that the large natural gas deposits offshore Sabah are located far away from the primary demand centre in Peninsular Malaysia, it is very likely that these reserves would be developed and marketed as liquefied natural gas, or LNG. PETRONAS is also currently constructing a 500 km pipeline which would bring the natural gas offshore Sabah to Bintulu, Sarawak, where the gas would be liquefied in the PETRONAS LNG Complex, and subsequently exported as LNG.

Since a large proportion of the new discoveries are located in the deepwater areas offshore Sabah, to monetize some of the stranded fields, PETRONAS is also currently evaluating the option to construct a second floating LNG plant (FLNG). Final investment decision, or FID, on this project is expected to be reached sometime in late 2013.

The maps in the following pages showing the location of the gas fields in Malaysia are for illustration purposes only.

PENINSULAR MALAYSIA

MALAYSIA THAILAND JOINT DEVELOPMENT AREA
JDA block A-18
Operator: Carigali Hess Operating Company
Interest holders: Hess, Petronas Carigali

JDA block B-17 and C-19
Operator: Carigali – PTTEPI Operating Company (CPOC)
Interest holders: Petronas Carigali, PTT Exploration & Production International (PTTEPI)

JDA block B-17-01
Operator: CPOC
Interest Holders: Petronas Carigali, PTTEPI

KEBABANGAN CLUSTER (KBB)
Interest holders: Kebangan Petroleum Operating Company, ConocoPhillips Sabah Gas, Shell Energy Asia

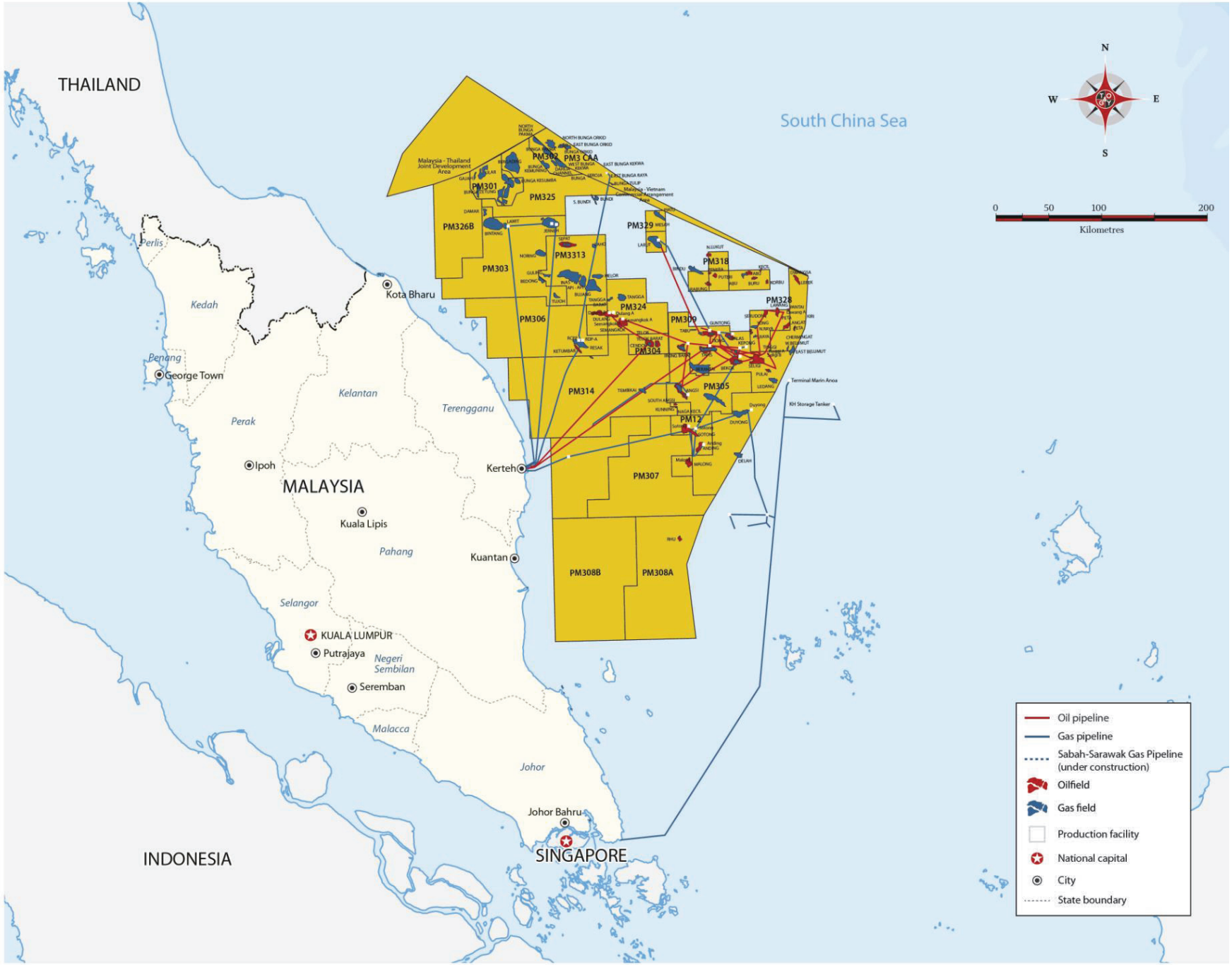
MALAYSIA VIETNAM COMMERCIAL ARRANGEMENT AREA (CAA)
PM-3 CAA
Operator: Talisman Malaysia
Interest holders: Talisman Malaysia, Petronas Carigali Overseas, PetroVietnam Investment & Development

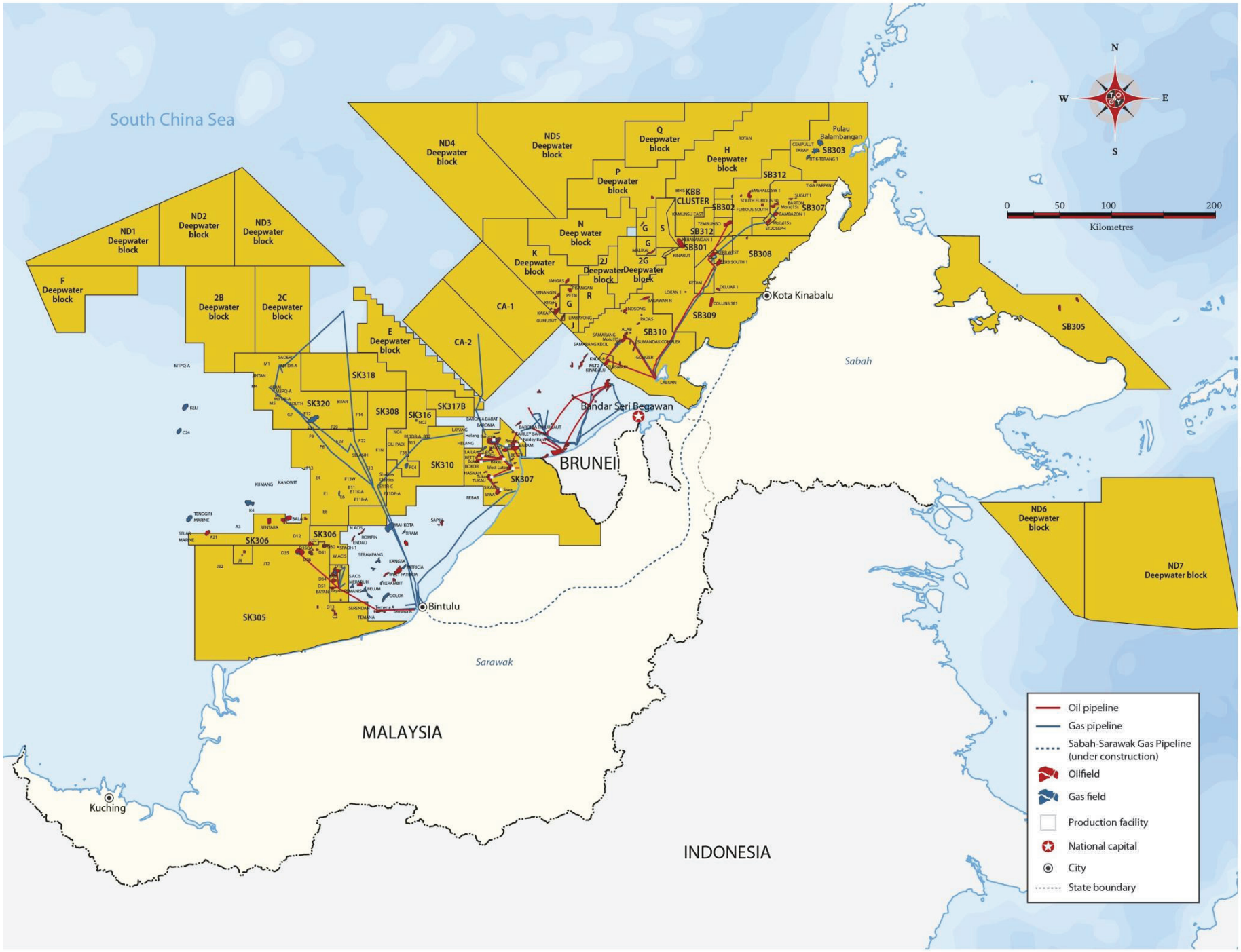
EXPLORATION AREAS

PM 301
Interest Holders: Shell E&P Malaysia, Petronas Carigali
PM 302
Interest Holders: Hess (50 percent); Petronas Carigali (50 percent)
PM 303/PM 324
Interest holders: Petronas Carigali, Total E&P
PM 304
Interest holders: Petrofac, Kuwait Foreign Petroleum Company (KUFPEC), Petronas Carigali, PetroVietnam E&P
PM 305
Interest holders: Talisman Malaysia, Petronas Carigali
PM 306
Interest holder: Petronas Carigali
PM 307
Interest holders: Lundin Petroleum, Petronas Carigali
PM 308A
Interest holders: Lundin Malaysia, Petronas Carigali, JX Nippon Oil & Gas (Peninsular Malaysia)
PM 308B
Interest holders: Lundin Malaysia, Petronas Carigali
PM 309
Partners: Petrofac, Kencana Energy, Sapura Energy
PM 313
Partners: Petrofac, Bumi Armada, Kencana Petroleum
PM 314
Interest holder: Talisman Malaysia
PM 318
Interest holders: Petronas Carigali, Newfield Peninsular Malaysia
PM 323
Newfield, Petronas Carigali
PM 325
Interest Holders: Hess E&P, Petronas Carigali
PM 326B
Interest Holders: Hess E&P, Petronas Carigali
PM 329
Interest holders: Newfield Peninsular Malaysia, Petronas Carigali

SABAH

EXPLORATION AREAS
SB 301: Sabah Shell, KUFPEC, Petronas Carigali
SB 302
Interest holders: KUFPEC, Amerada Hess, Petronas Carigali
SB 303
Interest holders: Lundin Petroleum, Petronas Carigali
SB 305
Interest holders: Nordic Maritime, Tanjung Offshore Services





SB 307 and SB 308
Lundin Malaysia, Nio Petroleum, Petronas Carigali
SB 309
Interest holders: Talisman Malaysia, Petronas Carigali
SB 310 Samarang
Talisman Malaysia, Petronas Carigali
SB 312
Petronas Carigali, KUFPEC Malaysia

SARAWAK

SK 305
Interest holders: Petronas Carigali, Pertamina, Petro-Vietnam
SK 306
Petronas Carigali, KUFPEC
SK 307 and SK 308
Petronas Carigali, Sarawak Shell
SK 310
Interest holders: Newfield Sarawak Malaysia, Mitsubishi Coproation, Petronas Carigali
SK 316
Interest holder: Petronas Carigali
SK 317B
Interest holders: Total, Petronas Carigali
SK 318
Interest holders: Sarawak Shell, Petronas Carigali
SK 320
Interest holders: MDC Oil & Gas, Petronas Carigali
SK 333
JX Nippon Oil & Gas Exploration (Onshore Sarawak), Petronas Carigali

DEEPWATER BLOCKS

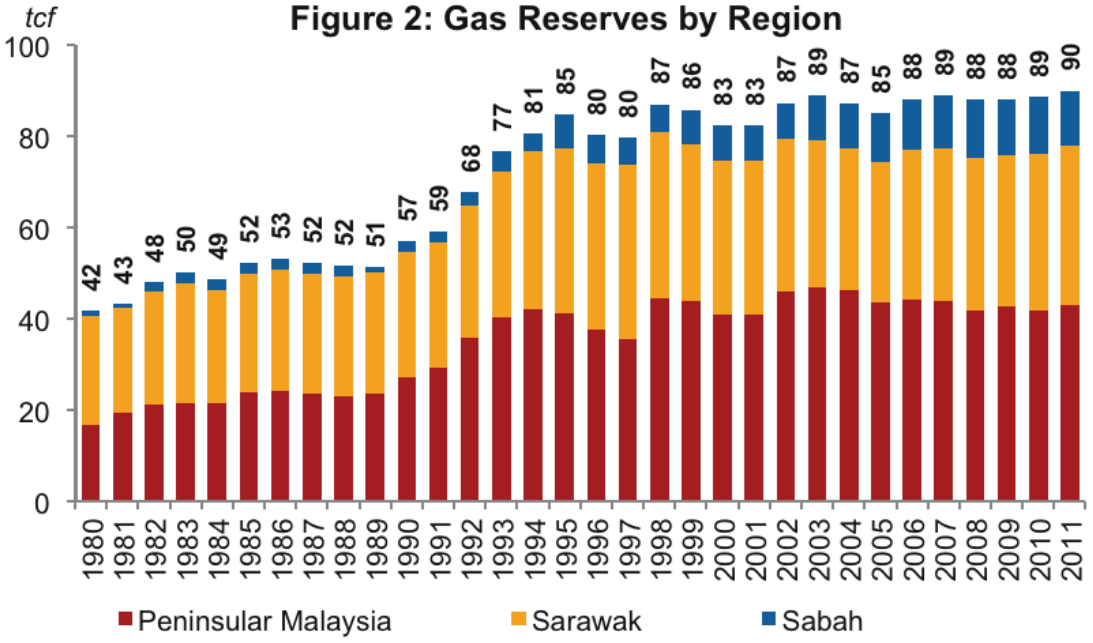
DEEPWATER BLOCK 2B
Interest holders: Sarawak Shell, Petronas Carigali
DEEPWATER BLOCK 2C
Newfield Sarawak, Petronas Carigali
DEEPWATER 2G and 2J
Petronas Carigali
DEEPWATER BLOCK E
Interest holders: Sarawak Shell, Petronas Carigali
DEEPWATER BLOCK F
Interest holders: Amerada Hess (Malaysia), Total, Petronas Carigali
DEEPWATER BLOCK G
Shell Petroleum Company, ConocoPhillips Sabah, Petronas Carigali
DEEPWATER H, P
Interest holders: Murpy Sabah Oil; Petronas Carigali
DEEPWATER BLOCK J
Interest holders: Shell Petroleum, ConocoPhillips Sabah, Petronas Carigali, Murphy Oil
DEEPWATER BLOCK K
Interest holders: Petronas Carigali, Murphy Oil
DEEPWATER BLOCK N, Q
Interest holders: BHP Billiton Petroleum Sabah, Petronas Carigali
DEEPWATER BLOCKS ND1, ND2, ND3, ND4 & ND5
Interest holder: Petronas Carigali
DEEPWATER BLOCKS ND6 and ND7
Interest holders: Sabah Shell Petroleum, Shell Sabah Selatan, Petronas Carigali
DEEPWATER BLOCK R
Interest holders: JX Nippon Oil & Gas Exploration (Deepwater Sabah), INPEX Offshore South West Sabah, Petronas Carigali
DEEPWATER BLOCK S
Interest holders: INPEX Offshore North West Sabah, Petronas Carigali

BRUNEI-MALAYSIA

DEEPWATER BLOCK CA-1
Interest holders: Total E&P Brunei Borneo, Petronas Carigali, BHP Billiton, Amerada Hess, Murphy Oil
DEEPWATER BLOCK CA-2
Interest holders: Petronas Carigali Brunei, Murphy Oil, Brunei National Petroleum Company

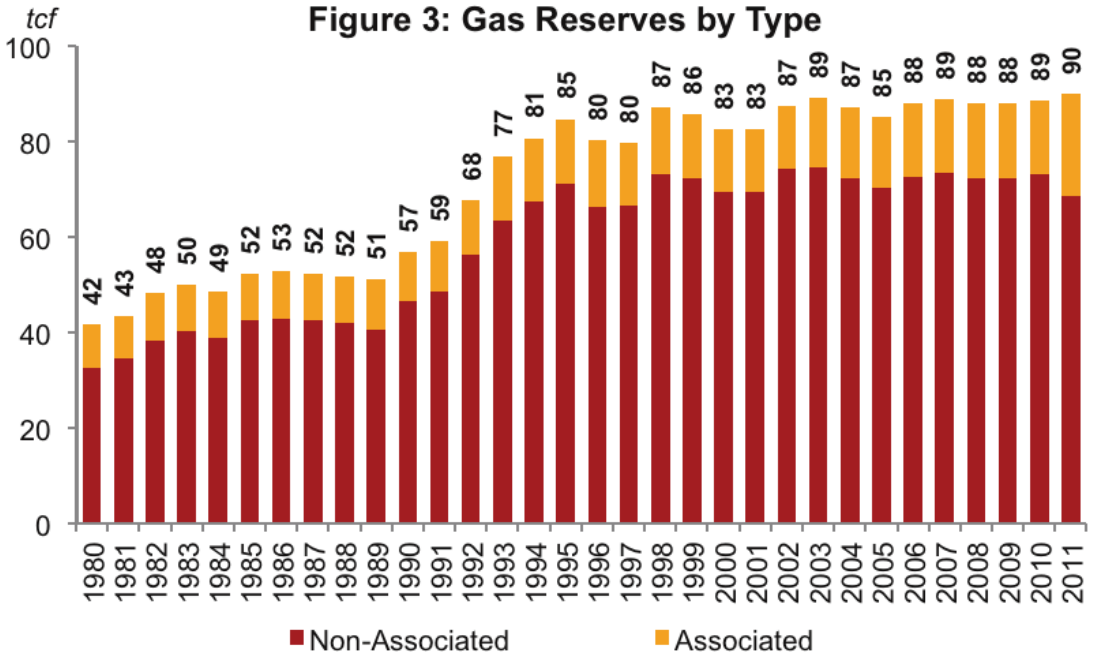
Section 1.3: Proven Recoverable Reserves

In terms of proven recoverable reserves, during the last 5 years, PETRONAS and its Production Sharing Contractors, have succeeded in making several new discoveries to replenish the country's natural gas reserves. With more than 30 significant new discoveries recorded since 2010, Malaysia's proven natural gas reserves at end of 2012 rose by some 6.2 trillion scf, or 6.7%, to reach about 98.3 trillion scf, from 92.1 trillion scf at end of 2011. A breakdown of the country's proven natural gas reserves by region is provided below in Figure 2.



Source: Malaysia Energy Commission

As shown in Figure 3 (below), more than 80% of Malaysia's proven natural gas reserves comprise non-associated gas. As such, new gas fields would only be developed based on its commercial merits, and meeting the desired return on investment. With most of the new discoveries being located in the deepwater areas, where the gas is more complex, with higher CO_2 content, as well as being in a more difficult high pressure environment, the biggest challenge for PETRONAS therefore would be to formulate innovative solutions which would enable extracting the gas at the lowest cost possible. Under such a scenario, it would only be natural to expect such gas to be marketed for higher price markets such as LNG, which currently can fetch a much higher premium.



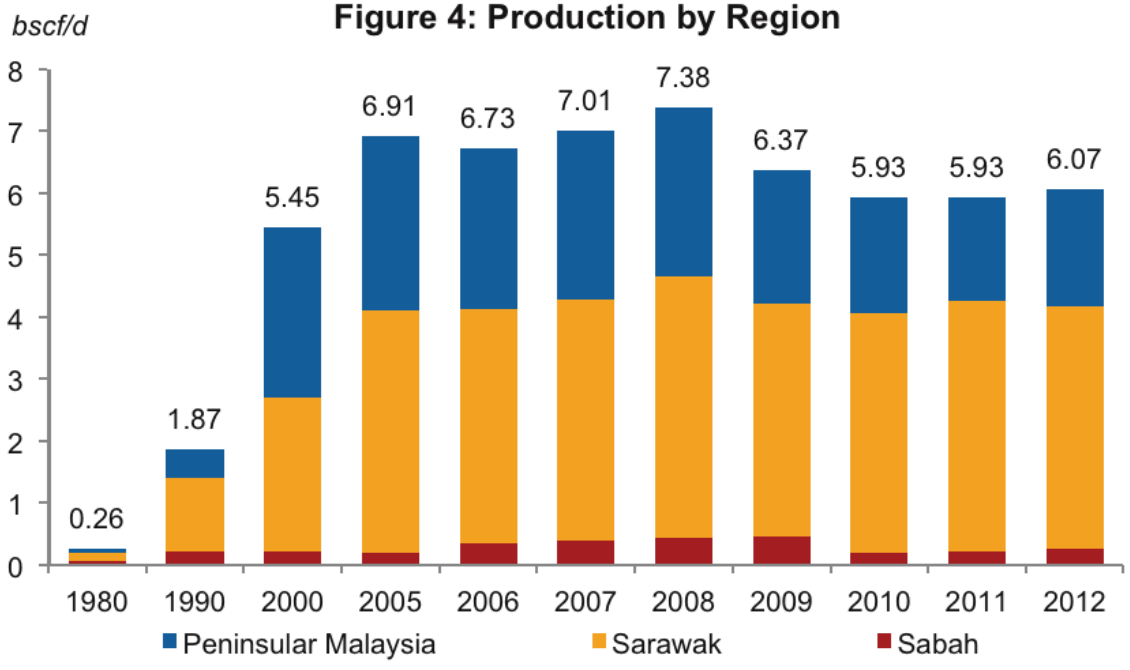
Source: Malaysian Energy Commission

Section 1.4: Natural Gas Production

In 2012, Malaysia's total natural gas production averaged about 6.0 billion scf/d, which is marginally higher than the 5.9 billion scf/d produced in 2011. The slightly higher production level was achieved despite production in July dropping by about 30%, to average around 4.3 billion scf/d. The country's 5 largest producing fields in 2012 are: Jintan, E11/F13W, Shallow Clastics, F23 and E8, all of which are located in Sarawak.

To achieve the higher production rate in 2012, PETRONAS brought onstream more than 5 new gas fields, thus bringing the number of producing fields to 55. The most recent significant fields that were brought online include Tangga Barat and Berantai in Peninsular Malaysia and Kumang Cluster in Sarawak.

Figure 4: Production by Region



Source: PETRONAS and Malaysian Energy Commission

Since 2005, Sarawak has been the largest producing region in Malaysia, with production at almost 4.0 billion scf/d in 2012, most of which went to LNG production in Bintulu. The recent discovery of several new significant fields offshore Bintulu is expected to enable Sarawak to maintain its dominance as the country's largest producer of natural gas for the foreseeable future. Similarly, PETRONAS LNG Sdn Bhd should not have any problem meeting its supply obligations to its overseas LNG buyers.

For Peninsular Malaysia, it is very significant to note that in 2012, PETRONAS was able to make available an 8.4% increase in volume, by about 159.0 million scf/d, to reach 2.05 billion scf/d, from 1.89 billion scf/d in 2011. This was made possible with the

coming onstream of the Tangga Barat and Berantai gas fields, and additional volume sourced from the Malaysia-Thai Joint Development Area (MTJDA) and the Malaysia-Vietnam Commercial Arrangement Area (MVCAA), as well as imports from Indonesia's West Natuna field. However, in lifting its entitlement from the MTJDA and MVCAA, PETRONAS has to pay a gas price whose formula is market related.

For Sabah, natural gas production in 2012 increased by about 14% over the level in 2011, to reach around 250.0 million scf/d from about 219.0 million scf/d. The state's natural gas production is poised to increase almost four-fold to reach around 1.0 billion scf/d when the Sabah-Sarawak Gas Pipeline project is completed sometime in 2013. The higher production level will be made possible with additional volume made available from the Kinabalu Non-Associated Gas and Kebabangan Cluster, which are now being developed.

Looking Ahead

1.0 For 2013, the upstream sector of Malaysia's natural gas industry is expected to remain robust and vibrant, and registering perhaps another year of impressive performance. On the exploration front, the 9 PSCs awarded in 2012 should be able to help sustain a high level of exploration activities in Malaysia's offshore acreage, at least for the next 2 to 3 years. With the high number of exploration wells budgeted to be drilled, the prospect of PETRONAS and its Production Sharing Contractors discovering more oil and gas reserves remains very high. Any new discovery would help to further boost Malaysia's natural gas reserves to well over 100.0 trillion scf.

2.0 Pending commissioning of the Sabah-Sarawak Gas Pipeline, Malaysia's total natural gas production in 2013 is expected to remain at about 6.0 billion scf/d, with production from the three regions practically at the 2012 level. Based on the production capacity of the existing 55 fields, and the existing sourcing arrangements for the additional volume, PETRONAS should have no problem maintaining production at this level for the next few years.

To ensure Malaysia's ability to meet its domestic requirement and LNG export obligations, PETRONAS and its Production Sharing Contractors are also currently developing 3 new gas fields, namely the Kinabalu Non-Associated Gas, Kebabangan Cluster, and the North Malay Basin.

3.0 The future of the upstream sector of Malaysia's natural gas industry however is not without challenges. PETRONAS is currently faced with a series of major challenges such as, managing matured fields with depleting reserves, ageing facilities, and higher CO_2 content and contaminants, and new fields which are

located in the deepwater areas where operations are more challenging, especially with high temperature and pressure environment. As such, for future operations, it would appear that PETRONAS would have to brace for a much higher unit production cost, as well as more expensive development cost for the new gas fields. It is therefore critical that the Government close the gap between the current domestic natural gas tariff and the international market price.

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, due to very small local demand, almost all 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 reserves were developed and exploited. One of the success factors is because PETRONAS was entrusted and empowered 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 in Malaysia. One of the most important recommendations from the Study was the implementation of a project to put in place the necessary distribution grid for the Peninsular, 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 facility in Kertih, Terengganu. Here, the gas is separated into its main components, namely methane (or sales gas), ethane, propane, butane, and condensate. The sales gas is then distributed to the end users throughout Peninsular Malaysia via the PGU gas distribution 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 peninsula. 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 also now linked to a pipeline grid from Thailand, where natural gas from the Malaysia-Thai Joint Development Area (MTJA) are landed at Songkhla in south Thailand, and subsequently piped into Malaysia, via Padang Besar in Perlis (as shown in Figure 5, below).

Figure 5 : Map of Peninsular Gas Utilisation Network

PGB Total Pipeline Length (in operation)	
Main	1,658 km
Lateral	374 km
C2, C3 and C4	357 km
GPP Interconnect	116 km
Sarawak	45 km
Total	2,550 km

Complex	GPP	Capacity mmscfd
GPP A	1	310
	2	250
	3	250
	4	250
GPP B	5	500
	6	500
	Total	2,060

Major Customers	
1. TNB Paka	10. TNB Tuanku Jaafar
2. YTL Paka	11. Port Dickson Power
3. TNB Pasir Gudang	12. Genting Sanyen Power
4. YTL Pasir Gudang	13. TNB Serdang
5. Senoko Energy	14. TNB Connaught Bridge
6. Keppel Gas	15. TNB Kapar
7. Pahlawan Power, Tg. Kling	16. GB3 Lumut
	17. Segari Energy Ventures
8. Panglima Power, Teluk Gong	18. Prai Power
	19. TNB Gelugor
9. Powertek, Teluk Gong	20. Technology Tenaga Perlis Consortium

Main Pipeline	Gas - in
PGU I — 32 km	
Kertih - Teluk Kalong	1984
PGU II — 685 km	
Sector I : 233 km Teluk Kalong - Segamat	1991
Sector II : 241 km Segamat - Kapar	1991
Sector III : 211 km Segamat - Singapore	1991
PGU III — 450 km	
Sector I : 184 km Meru - Lumut	1996
Sector II : 176 km Lumut - Gurun	1998
Sector III : 90 km Gurun - Pauh	1998
Loop 1 — 265 km	
Kertih - Segamat	1999
Loop 2 — 226 km	
Segamat - Meru	2001

Source: PETRONAS Gas Berhad's 2012 Annual Report

The completion of all the three stages of the PGU project in the late-90s 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 industrialisation.

On the economic scene, natural gas helped Malaysia to generate significant valuable foreign exchange earnings, whilst at the same time help to significantly 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 RM5.0 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.

For Sabah and Sarawak, due to the lack of local demand for natural gas, the infrastructure for natural gas distribution is currently very limited. However, PETRONAS is developing the Sabah-Sarawak Integrated Oil and Gas Project to harness the oil and gas resources in the offshore areas of Sabah and Sarawak. The project consists of two onshore developments.

- The Sabah Oil and Gas Terminal (SOGT) will receive, store and export crude oil as well as receive, process, compress and transport the gas produced from the fields offshore Sabah. The new terminal will complement 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.

- The 500 km Sabah-Sarawak Gas Pipeline (SSGP) will transport gas from the SOGT in Kimanis, Sabah, to Bintulu, Sarawak, where the gas will then be processed into LNG at the PETRONAS LNG Complex. The pipeline system also has provisions for future domestic consumption in Sabah and Sarawak.

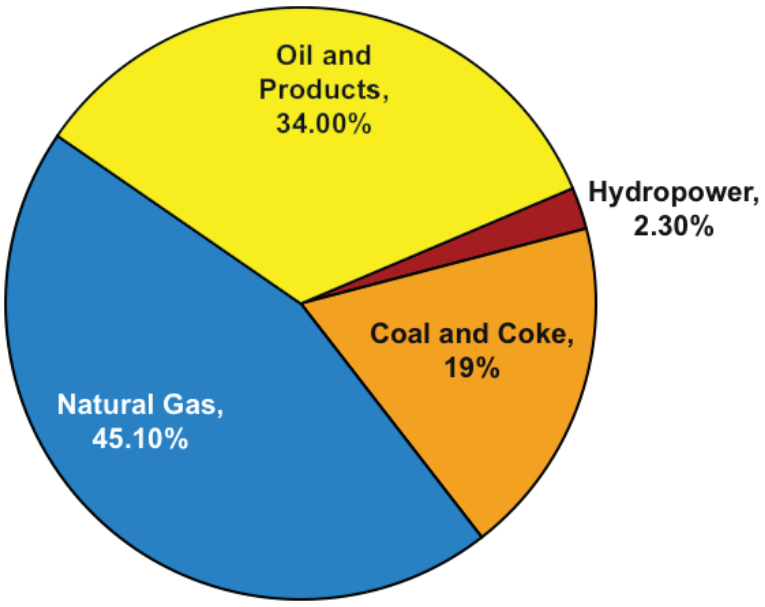
In addition to the above, in Sabah, PETRONAS is also currently undertaking two other projects, namely: the 300 MW Kimanis power plant; and the Sabah Ammonia Urea (SAMUR) project.

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 today has since dropped to about 45%, with coal meeting practically all of the country's incremental energy demand.

A chart showing natural gas' share of Malaysia's primary energy mix in 2011 is provided in Figure 6. Since there has been no major development which could significantly alter the country's energy composition, Malaysia's energy mix in 2012 is expected to remain more or less the same, except with a slight increase in the share of coal to compensate for the reduction in supply of natural gas.

Figure 6: Malaysia : Primary Energy Supply in 2011

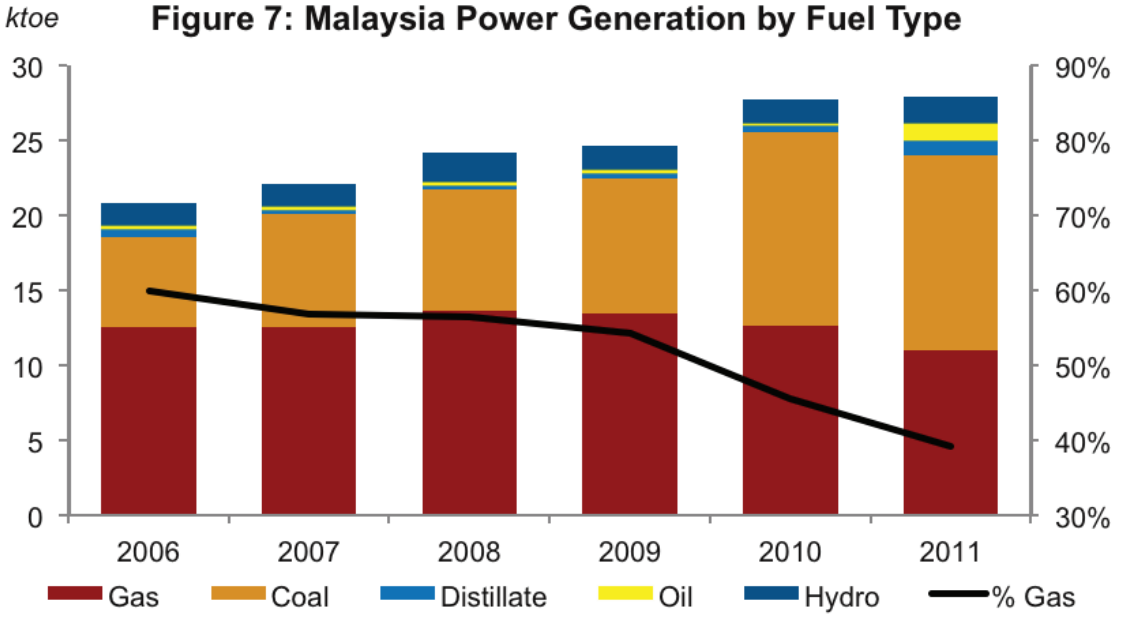


Source: Malaysia National Energy Balance 2011, Suruhanjaya Tenaga

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. The Malaysian Government's decision to continue providing subsidy for natural gas has succeeded in keeping the country's electricity tariff to be amongst the lowest in the region. Furthermore, since it is being priced in Ringgit – thereby eliminating any foreign

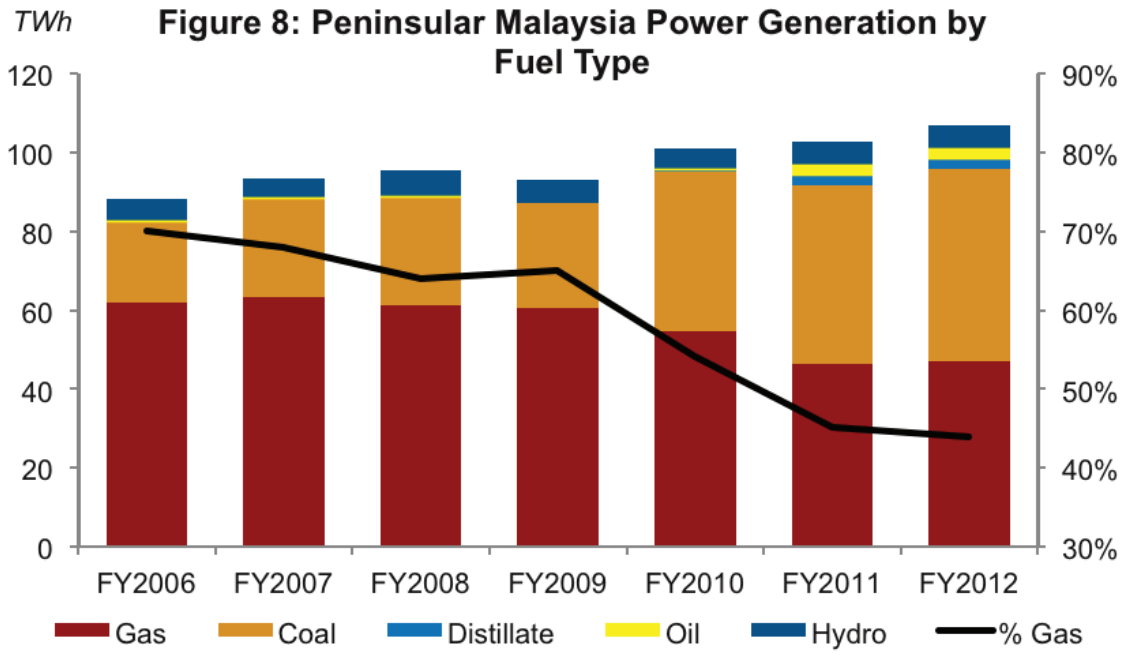
exchange risk for the power producing companies, demand for natural gas in the power sector continued to grow and reached a peak in 2000 when it accounted for almost 75% of the fuel mix for the country's power sector. However, due to the decline in production from some of the older fields offshore Peninsular Malaysia since 2007, the share of natural gas in the fuel mix for Malaysia's power sector has since dropped to around 39% in 2011. Meanwhile, the share of coal in Malaysia's power generation mix has since increased almost 47%.

Figure 7: Malaysia Power Generation by Fuel Type



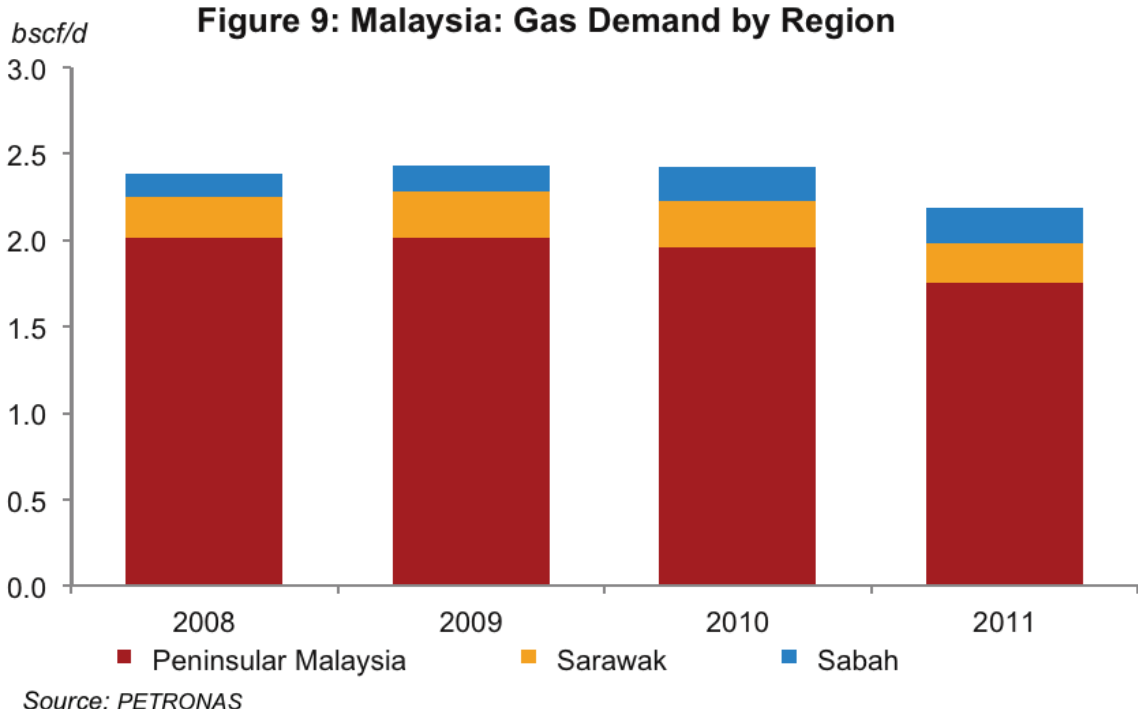
Source: National Energy Balance 2011, Suruhanjaya Tenaga

For Peninsular Malaysia, natural gas' share in the power generation mix in 2012 stood at about 45%, slightly lower than coal which accounted for 46%. Natural gas' share in Peninsular Malaysia's power generation mix is expected to remain around 50% when PETRONAS adds an additional 500 million scf/d into the PGU system with the commissioning of its LNG import and regasification terminal in Melaka in 2013.



Source: TNB, PFC Energy. Note: TNB Fiscal Year is September to August.

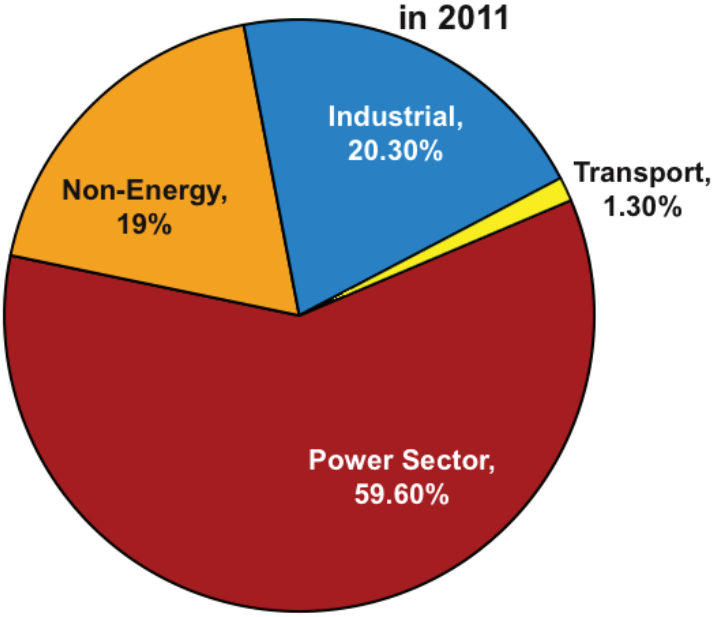
As indicated earlier, in terms of region, Peninsular Malaysia accounts for about 81% of Malaysia's total natural gas consumption, followed by Sarawak and Sabah. A snapshot of the country's natural gas demand by region is provided in Figure 8. Since there has not been any new major development which can alter natural gas consumption in Sarawak and Sabah, Malaysia's overall domestic demand pattern will likely remain unchanged in 2012.



Source: PETRONAS

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 demineralised water, to the tenants, thereby significantly reducing the owner's capital investment to setup their plants.

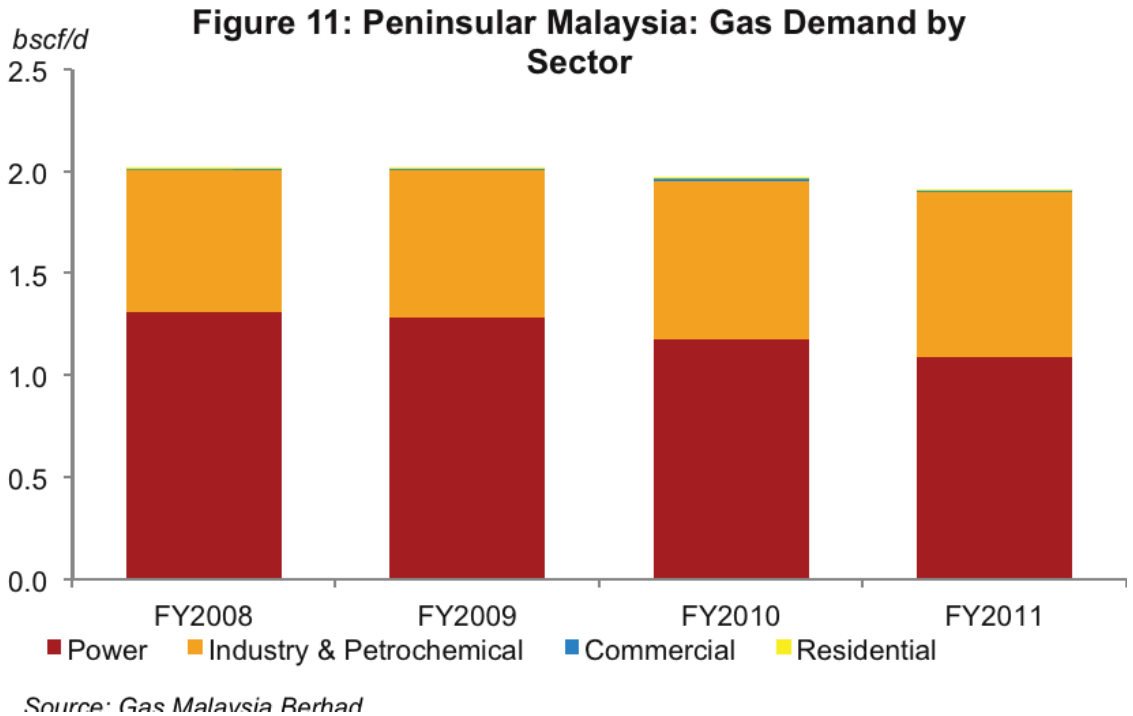
Figure 10: Malaysia: Natural Gas Demand By Sector in 2011



Source: Malaysia National Energy Balance 2011, Suruhanjaya Tenaga

Further downstream, gas was made available to small industries and retail customers via the natural gas reticulation and distribution network which is being operated by Gas Malaysia Berhad (GMB) in the Peninsular, and the Sarawak Gas Distribution Sendirian Berhad (SGDSB) in Sarawak, and the Sabah Energy Corporation (SEC) in Sabah.

Gas Malaysia, which sells natural gas to users whose consumption are below 2.0 million scf/d, have since seen its sales increase sharply from only 0.7 million mmBtu in 1993, to 127.6 million mmBtu in 2012. A chart showing the profile of Gas Malaysia's customers in terms of demand by sector for Peninsular Malaysia is shown in Figure 11.

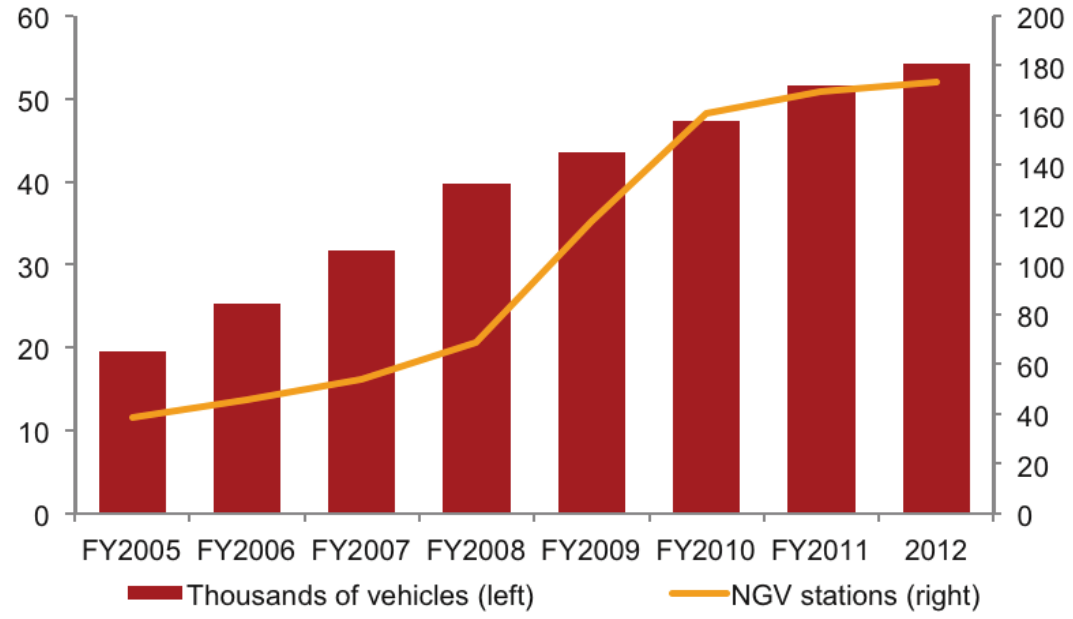


In February 2012, PETRONAS renewed the Gas Sales Agreement (GSA) with Gas Malaysia Berhad for another 10 years from 1st January 2013. Under the new GSA, PETRONAS also agrees to sell an additional volume of up to 192.0 million scf/d at the prevailing market price.

Section 2.3: Natural Gas Vehicles

An equally important development made possible by the PGU distribution 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 petroleum products. In 2012, Malaysia had about 57,000 natural gas vehicles on the road, with 175 NGV stations in operation. The lower than targeted number of NGV vehicle population is due to the lower number of NGV refilling stations in operation. More than half of the refilling stations are located in the Klang Valley, with only 4 stations located throughout the east coast of the Peninsular. 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.

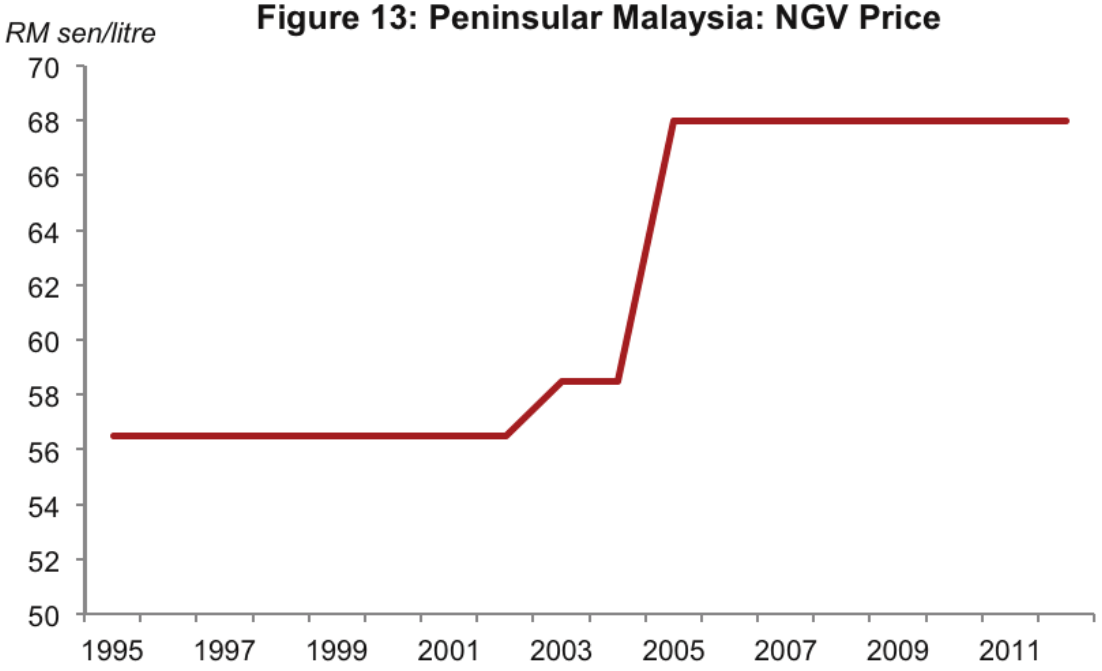
Figure 12: Peninsular Malaysia: NGV Penetration



Source: PNGV Sdn Bhd

To ensure success of the NGV programme, the Government has been maintaining the natural gas price for NGV at 68 sen/litre equivalent since 2005. This price, as shown in Figure 13 below, is almost one-third of the subsidised price for RON 95 unleaded petrol, and only 24.3% of RON 97 unleaded petrol. One of the major drawbacks which has not encouraged the sale of NGV by other oil companies is the negative margin. As a result, PETRONAS has incurred significant losses in this business. However, the national oil company is continuing with the programme as part of its contribution and obligation to improve the quality of life and the environment in Malaysia.

Figure 13: Peninsular Malaysia: NGV Price

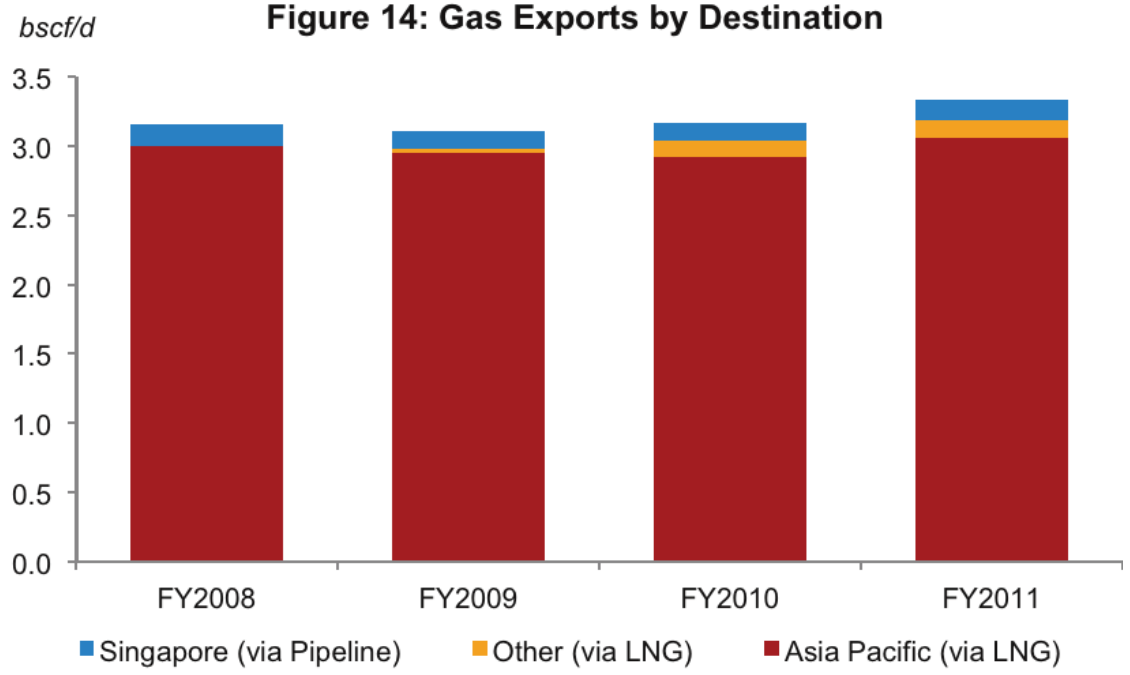


Source: PNGV Sdn Bhd

Section 2.4: Gas Exports

In 2012, Malaysia's exports of natural gas dropped by 5% to about 3.6 billion scf/d. The lower volume exported was due to a reduction in volume of LNG exported. About 97% of the exports were in the form of LNG, whilst the balance in the form of sales gas to Singapore (as per Figure 14 below). The volume exported represents slightly more than 60% of the total volume of natural gas produced by the country in 2012.

Figure 14: Gas Exports by Destination



Source: PETRONAS Annual Reports

Ever since the country started exporting LNG in January 1983, natural gas exports have since emerged as a major component of Malaysia's export earnings. According to Bank Negara Malaysia (BNM), LNG's share of Malaysia's total exports from agricultural, mining, and petroleum, increased to 36% in 2012, from only 25% in 2005.

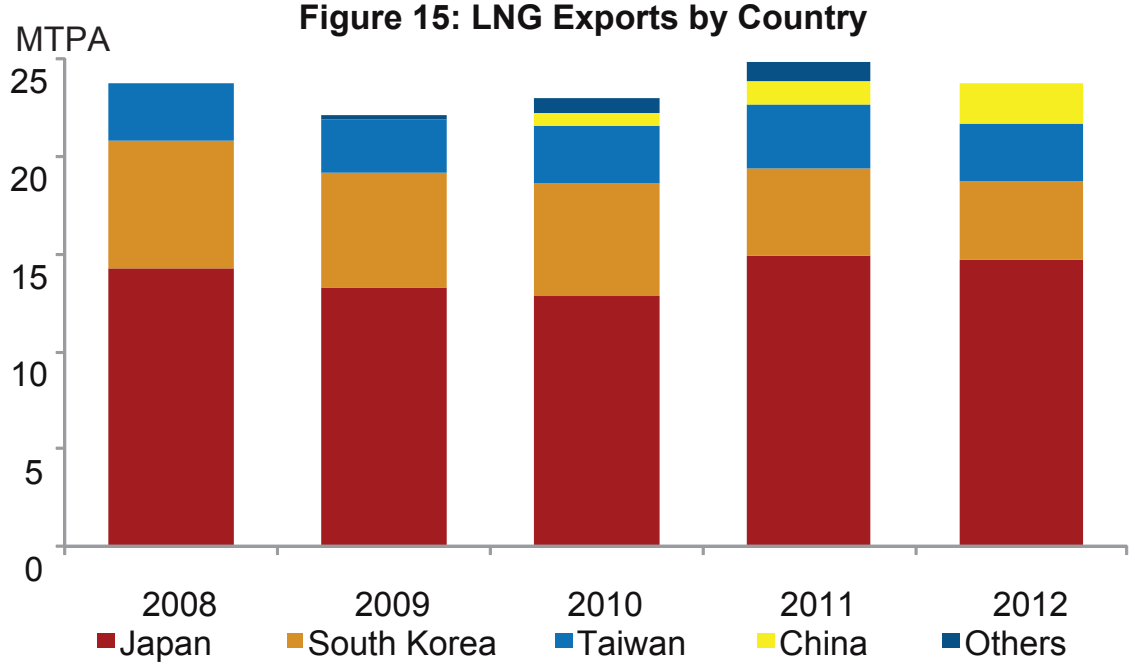
PETRONAS, through its subsidiary, PETRONAS LNG Sendirian Berhad (PLSB), currently has in place contracts with 15 different buyers totaling some 3.0 billion scf/d. To meet its supply obligations, the PETRONAS LNG Complex (PLC), located in Bintulu, Sarawak, currently has three liquefaction plants with a total combined production capacity of 25.7 MTPA.

To monetise the new natural gas reserves discovered offshore Sabah and Sarawak, which are expected to cost much more than the earlier fields, PETRONAS intend to develop and market this resource in the form of LNG, which would be able to fetch a much higher price in the region. To this end, PETRONAS is currently constructing Train 9, which will boost the PLC complex's capacity by another 3.6 MTPA, to 29.3 MTPA.

Malaysia has historically been a major supplier of LNG for Japan, South Korea, and Taiwan (JKT), with Japan representing the largest market for PLNG. Existing Japanese contracts will begin gradually declining in 2015, but a dramatic fall-off in existing contractual volumes will occur in 2019. Although South Korea and Taiwan are much smaller export destinations for Malaysia, they also will face a similar scenario towards the end of the decade. Given the importance of Southeast Asian LNG to meet these major markets' gas needs, it is likely that these contracts will be renewed.

- Supplies have been predominantly shipped to Japan and South Korea: the two countries made up 76% of Malaysia's LNG export contracts. China, which only in 2009 began receiving Malaysian gas, is expected to increase its imports from Malaysia.

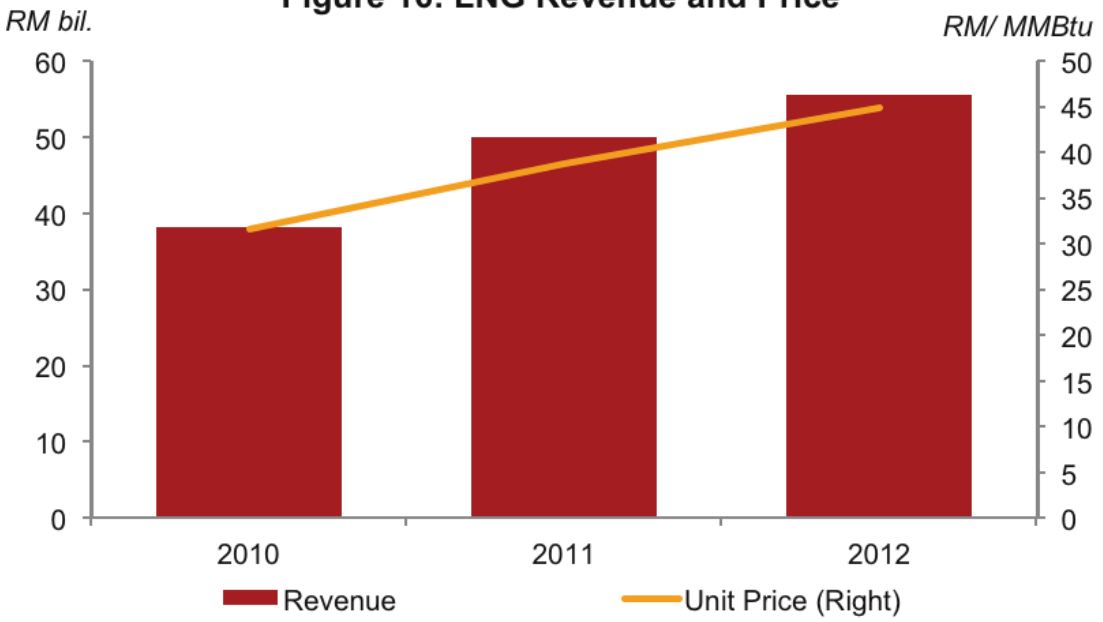
Figure 15: LNG Exports by Country



Source: PETRONAS Annual Reports

Despite the decline in contracted LNG supply from PLC, the company has achieved an average utilization rate of 100% between 2008 and 2011, but saw utilization fall in 2012 to 97%. As a result, PLC's exports in 2012 dropped by 4.9% to 23.7 million MTPA, from 25.0 million MTPA in 2011. However, total revenue from LNG exports in 2012 increased by 11% to RM55.5 billion from RM50.0 billion in 2011, on the back of a 42% increase in average export price realised, at RM44.92/MMBtu compared to RM38.67/MMBtu obtained in 2011.

Figure 16: LNG Revenue and Price



Source: Department of Statistics Malaysia

Pipeline exports to Singapore make up a small component of Malaysia's total natural gas exports. Singapore has relied on gas imports from Malaysia to meet its gas-fired power demand since January 1992.

- In 2012, Malaysia exported 143 million scf/d of natural gas to Singapore. These supplies were delivered under two separate contracts: Senoko Power accounts for 58% of the contracted volume and Keppel Gas the remaining 42%. Exports to Singapore averaged 162 million scf/d between 2003 and 2011. However, these exports are just 24% of Singaporean imports as the market relies much more heavily on Indonesian volumes. Additionally, exports to Singapore are likely to decline in the near future as Singapore becomes more reliant on imported LNG in an attempt to move away from piped imports, whilst turning the republic into a LNG trading hub for the Far East region.

Looking Forward

1. *The outlook for natural gas demand in Malaysia will very much depend on the price set by the Government. The industry is expecting a sharp drop in domestic demand if the Government decides to implement the agreed hike of RM3.0/mmBtu every 6 months, which is intended to quickly bring the domestic price on par with the regional market, and thereby reduce the amount of subsidy on this resource. On the contrary, if the price hike is more subtle, say between RM2/mmBtu and RM3/mmBtu per year, it is very likely that Malaysia's demand for natural gas will see strong growth, especially when PETRONAS makes more volume available, additional 500 million scf/d from mid-2013 onwards with the commercial operation of its LNG regasification terminal at Sungai Udang, Melaka. The additional volume would enable PETRONAS Gas to meet more demand from the power and industrial sectors. However, in the long run, if PETRONAS is not allowed to pass through the higher LNG price to the domestic market, there would be no incentive for the national oil company to continue incurring losses for its LNG imports. What constitutes an acceptable domestic natural gas price? Which formula should the Government adopt? Who should pay for the continuation of the subsidy for natural gas?*

2. *There is general acceptance that higher energy prices, including electricity tariff, would promote more efficient use of energy. More efficient use of natural gas and electricity would result in reduced overall consumption of this resource, which in turn would lead to lesser subsidy from PETRONAS and the Government. However, to-date, there is no single organisation or ministry which is seriously championing and driving this cause in a comprehensive and structured manner. Who is advocating the adoption of the more energy efficient systems such as distributed generation, co-generation, and district cooling?*

3. *China, Australia, and certain Western European countries, are pushing for the use of natural gas (both for CNG and LNG) as fuel for the public services and heavy duty vehicles segments of their transportation sector and LNG for the marine sector, which would further reduce the use of oil and also protect the environment. Considering that the world's natural gas reserves, including unconventional gas, can last more than 200 years, which is more than twice that for oil, should Malaysia also actively promote the use of natural gas for the transportation and marine sectors to further reduce its dependence on petroleum products and also towards enhancing sustainable energy for the future?*

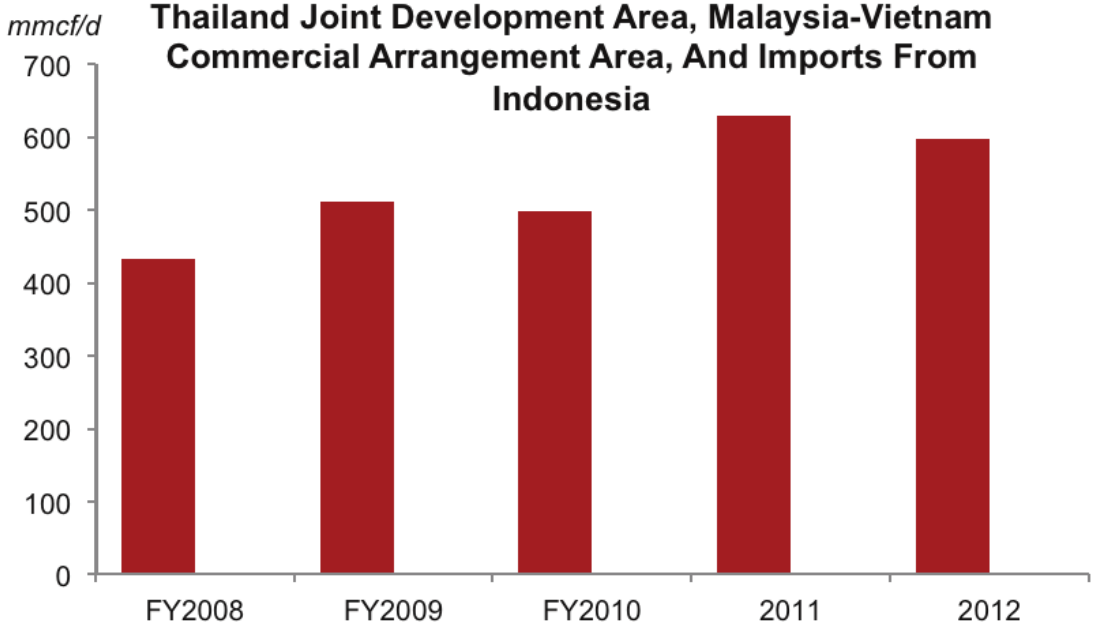
4. *The removal of subsidy for natural gas would make coal a much cheaper alternative for use in the power sector. However, this route would lead to higher carbon emission and possibly degradation in the country's environment. Should the Government legislate and set a ceiling as to how much of the country's power should be generated by coal?*

Section 3: Gas Imports

In 2012, Malaysia sourced a total of 597.0 million scf/d of natural gas from the Malaysia-Vietnam Commercial Arrangement Area (MVCAA), the Malaysia-Thailand Joint Development Authority (MTJDA), and Indonesia's West Natuna (as per Figure 17, below). This volume is about 5.1% lower than the 629.0 million scf/d sourced in 2011, and was made possible as a result of PETRONAS' ability to increase production from gas fields offshore Peninsular Malaysia by 15% to 1.46 billion scf/d from 1.26 billion scf/d in 2011. The additional volume sourced from the MVCAA, the MTJDA, and Indonesia, is needed to supplement the shortfall due to declining production from the gas fields offshore Peninsular Malaysia, as well as increased domestic gas demand. PETRONAS has been importing from Indonesia since 2002, where it currently has a contract to purchase 1.6 trillion cubic feet over 20 years from the Block B development in Indonesia's Natuna field. PETRONAS has also been sourcing from the MVCAA since 2003, and the MTJDA since 2005.

Piped gas imported from Indonesia's Natuna and MVCAA enters the PGU system at Kertih, while natural gas from Thailand is first processed at Songkhla and subsequently enters the PGU system through the tie-in at Padang Besar, Perlis.

Figure 17: Additional Volume Sourced from Malaysia-Thailand Joint Development Area, Malaysia-Vietnam Commercial Arrangement Area, And Imports From Indonesia



Source: PETRONAS

Should the pricing issue for imported LNG be satisfactorily resolved, Malaysia's natural gas imports is set to soar, with two other regasification terminals already being planned to be built by PETRONAS, in Pengerang, Johor, and Lahad Datu, Sabah. However, the final decision as to whether the LNG to be supplied to these 2 terminals should either be sourced locally, or from imports, depends entirely on PETRONAS.

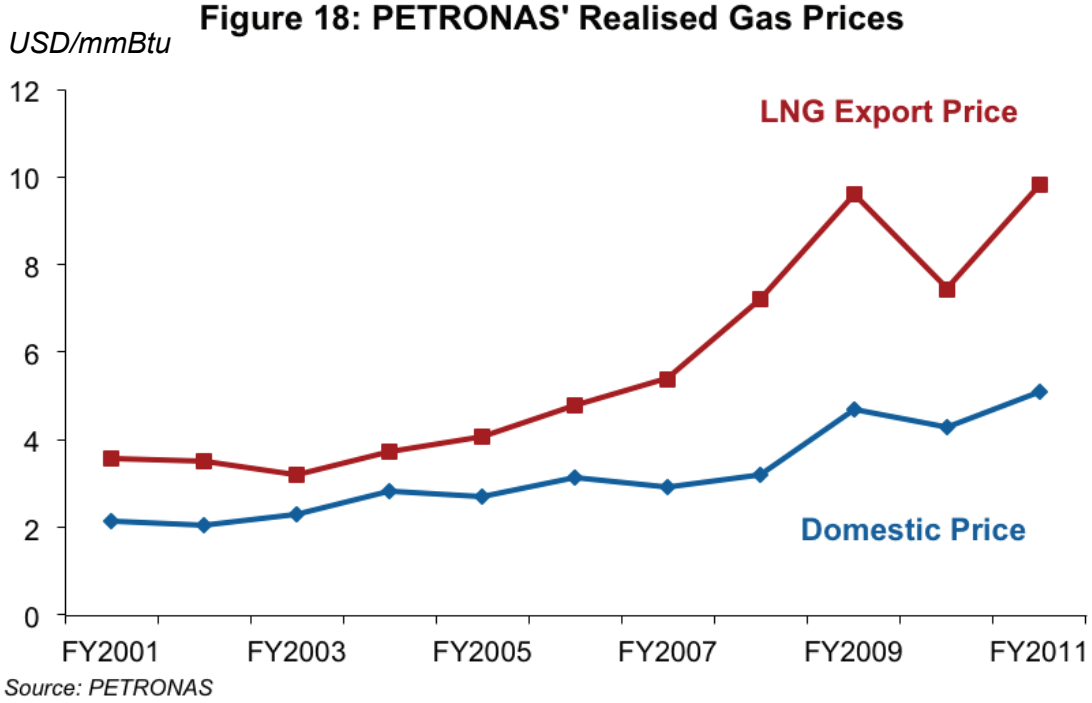
Section 4: Subsidies

Although, Malaysia's oil and gas resources are owned by PETRONAS, the domestic price of natural gas however is being regulated by the Malaysian Government. In setting the domestic natural gas price, the Government takes into account several factors, such as the competitive advantage to be enjoyed by local manufacturers vis-à-vis their regional counterparts, and the desired level of domestic electricity tariff. Low domestic natural gas prices have also been used to attract foreign companies to invest in Malaysia.

PETRONAS transports its natural gas sales volume through its subsidiary, PETRONAS Gas, which owns and operates the majority of the country's gas-transmission network, i.e. PGU system. PETRONAS Gas charges end-users a tariff based on location and quantity.

However, in recent years, the amount involved to provide the subsidy for natural gas has increased substantially. The price of LNG, which is the alternative market for PETRONAS to monetise its natural gas, has strengthened to new highs, due to strong demand from Japan and China. As a result, the gap between domestic and international prices has widened substantially. This has resulted in PETRONAS having to forego a very large sum in terms of "lost" revenue, in turn implying that optimal value is not being extracted from Malaysia's gas resources. In the meantime, PETRONAS also has to incur much higher cost to ensure sufficient volume for the domestic market, having to pay market-related prices for natural gas bought from Indonesia, MTJA and Malaysia-Vietnam CCA.

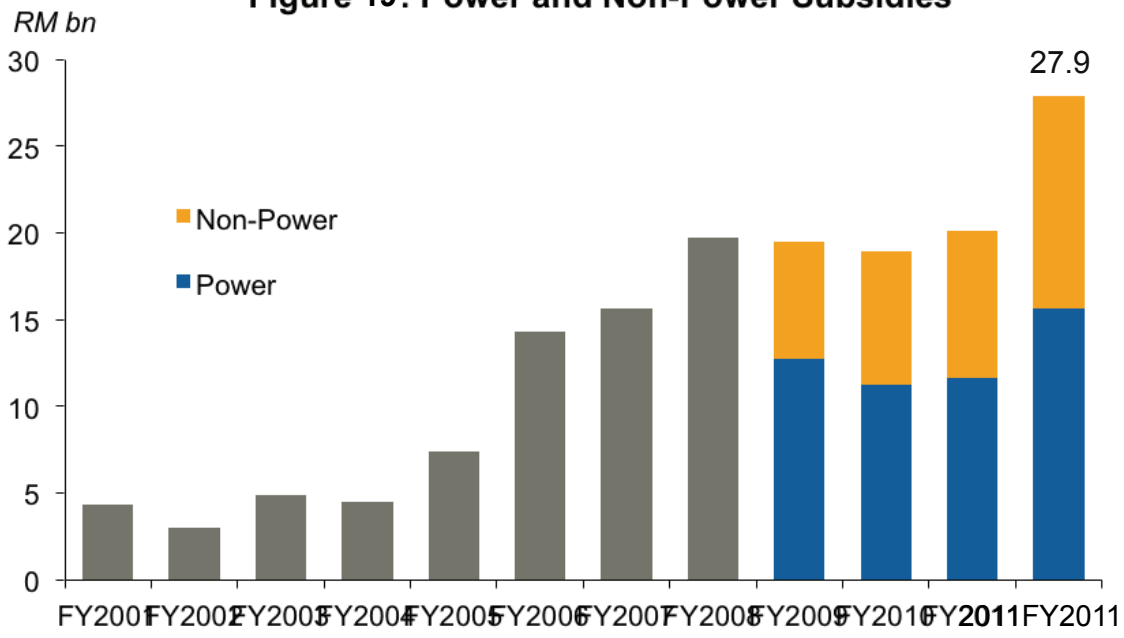
Figure 18: PETRONAS' Realised Gas Prices



Source: PETRONAS

For 2012, the total subsidy – in effect revenue lost by selling gas to the domestic market instead of at the stipulated contractual price – reached almost RM28.0 billion, which represents an increase of almost RM10.0 billion, or 55%, over the 2011 total of RM18.0 billion (April-December). Out of the total, 56% or RM15.6 billion, went to the power sector, with balance of 44%, or RM12.4 billion, going to the non-power sector – which includes industries, commercial users, residential users, and the NGV sector. During the last 5 years, the total amount of "subsidy" incurred for natural gas is estimated to be almost RM100.0 billion.

Figure 19: Power and Non-Power Subsidies



Source: PETRONAS

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 immediately. As a result, in 2011, the Government, as part of its strategy towards price reform, formalised a plan to increase the price of domestic gas by RM3.0/mmBtu (~USD1/mmBtu) every six months. However, the much anticipated price reform has yet to be implemented, and the price to the power sector– which was last adjusted in 2011 – remains at RM13.70/mmBtu, whilst the price to the non-power sector currently at RM17.90/mmBtu.

Looking Forward

1. *It has been proven in the developed countries,, especially Japan, that higher energy prices has led to more efficient use of energy. Burdened with higher energy bills, consumers would either reduce usage or adopt more innovative means which would help them achieve higher efficiency and savings, such as increased use of solar panels and district cooling system. These measures would ultimately help Malaysia reduce its consumption of power, and also natural gas.*

2. *The central issue in price reform is to strike a balance between what is a reasonable rate of increase, and how often should the increase be instituted. Too sharp an increase would probably result in a significant number of industrial*

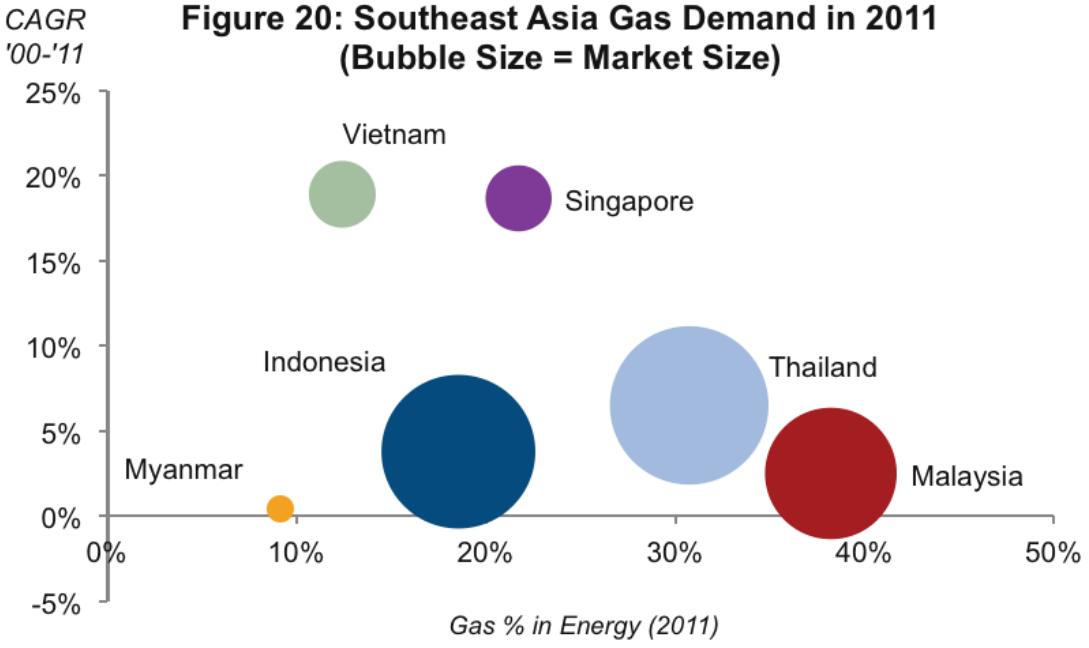
users having to cease operations, and the resulting sharp increase in power tariff would also hurt a large segment of the "rakyat". However, it is also widely accepted that the subsidies should not be continued, as in the long run they would also undermine Malaysia's energy security. What would be the ideal domestic price for natural gas, LNG market parity or cost plus basis? For a start, would a gradual, but transparent, increase like RM2/mmBtu in 2013, and RM3/mmBtu in 2014, and RM4/mmBtu in 2015, be tolerated?

Section 5: Malaysia in Perspective of Southeast Asia

Gas is becoming a critical fuel in nearly all Southeast Asian countries, but each has its own trajectory based on internal supply, demand, and regulatory realities.

Gas Demand and Penetration. In 2011, Malaysia ranked as the third-largest gas market in Southeast Asia, after Indonesia and Thailand. Naturally, the smaller markets grew at a much faster pace between 2000 and 2011 since gas was relatively new to their energy balances. Compared to Indonesia and Thailand though, Malaysia grew slower. However, compared to its neighbors, Malaysia had the most gas penetration: 38% of the fuel mix was derived from gas. However, gas in Malaysia's power sector is now competing heavily with coal which will ultimately reduce gas' share in the energy mix going forward. Other Southeast Asian countries are likely to feel similar pressures. Indonesia is the largest coal exporter in the region, but also intends to use more coal in its own power sector which will also limit gas penetration.

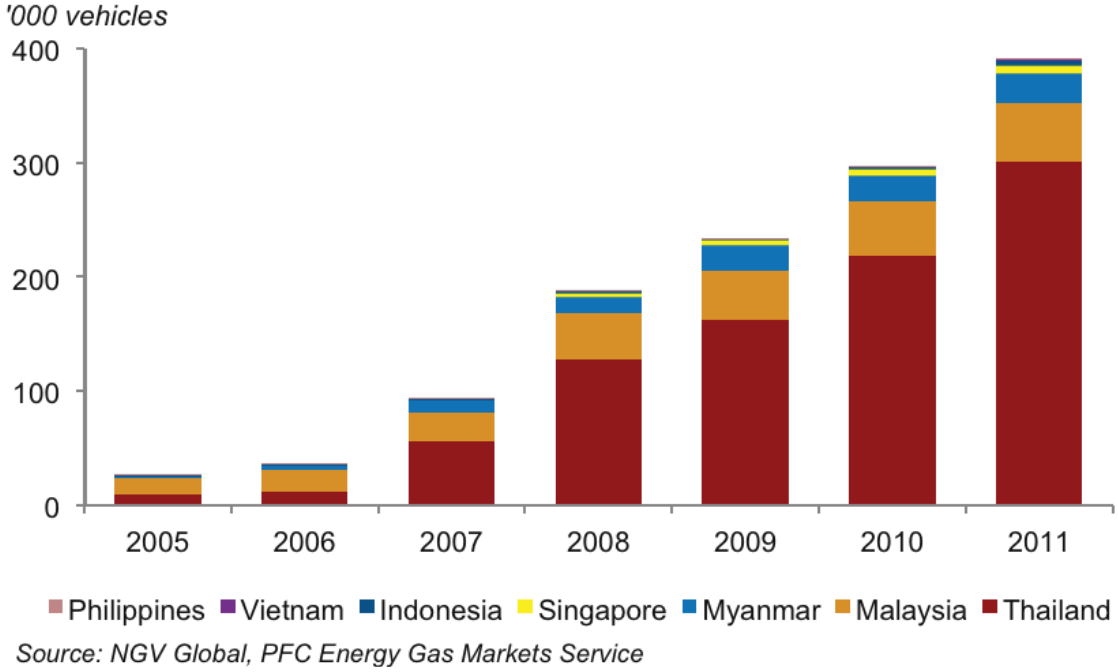
Figure 20: Southeast Asia Gas Demand in 2011 (Bubble Size = Market Size)



Source: PFC Energy Gas Markets Service

Natural Gas for Vehicles. Except for Thailand, natural gas for vehicles (NGV) are a small component of gas demand in South East Asia. The market for NGV in the region took off in 2007 when Thailand began building a large fleet due to the Thai government's active promotion of NGV utilization by fixing the price for compressed natural gas (CNG) at a very low level, despite protests from PTT which supplies CNG at a higher price. The Malaysian government too played a pivotal role in the country's NGV programme by regulating the CNG price. In 2011, Thailand accounted for 78% of the NGV market in Southeast Asia, followed by Malaysia with 13%. For other countries to catch up, governments will need to take a more active role in developing the NGV industry which can contribute towards the reduction in air pollution and over-dependency on oil in the road transport sector.

Figure 21: Natural Gas Vehicles in Southeast Asia

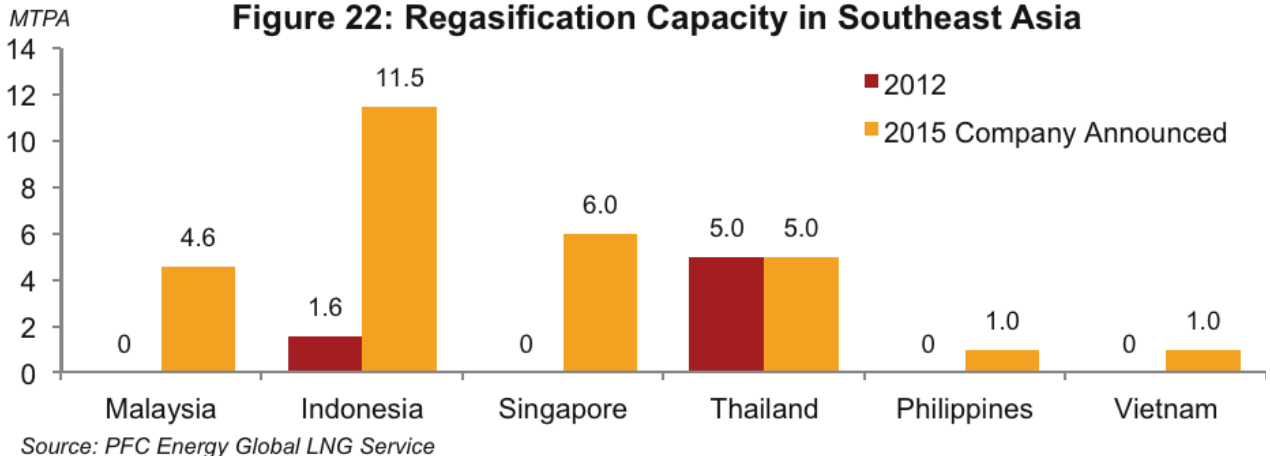


Source: NGV Global, PFC Energy Gas Markets Service

Regasification. All Southeast Asian countries except Myanmar have plans to turn to LNG imports to meet gas demand. Thailand was the first importer in the region, beginning imports in 2011. The country has proven its willingness to pay for spot cargoes and recently signed a contract to import LNG on a long-term basis from Qatar. Although Malaysia and Indonesia are large exporters of gas, the geography of both countries complicates gas market needs – thus both have turned to regasification as a way to increase gas access points. Singapore has thus far depended solely on pipeline imports to meet mainly power needs, but began importing LNG in 2013. The Philippines and Vietnam have been considering building regasification for several years, but ultimately their willingness to pay for LNG may inhibit them from moving forward with

projects. By 2015, companies have proposed 29 MTPA of regasification capacity in the region, of which Malaysia accounts for 16%.

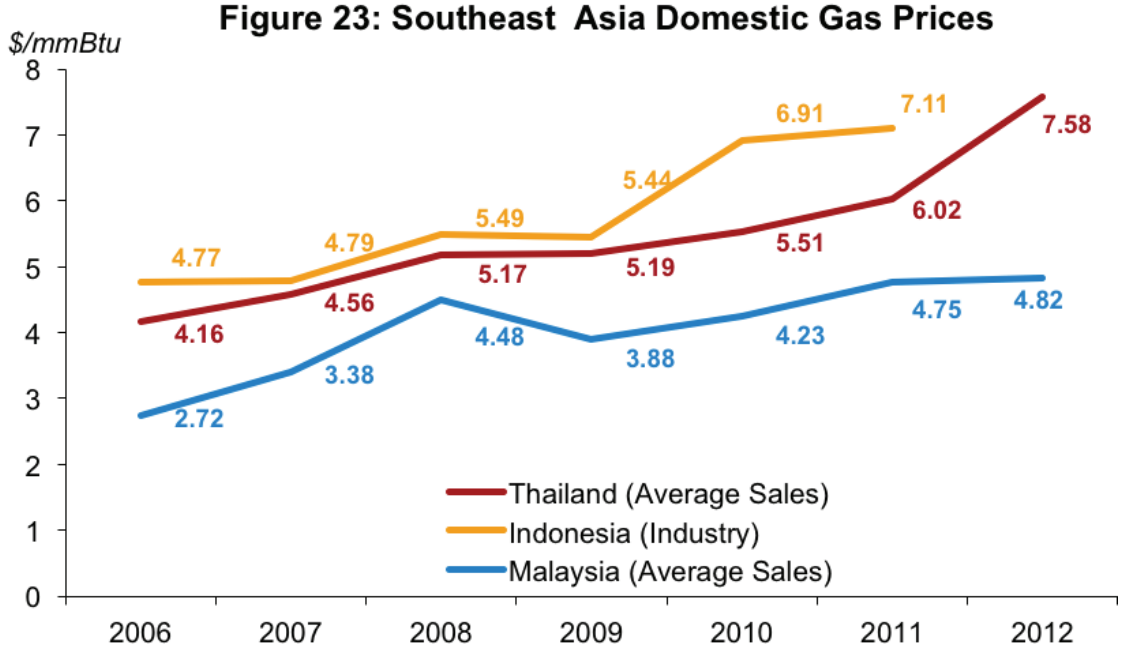
Figure 22: Regasification Capacity in Southeast Asia



Source: PFC Energy Global LNG Service

Gas Price Reform. One of the most critical factors that will determine the role of gas in Southeast Asian countries is the pace of gas price reform. In all but Singapore and the Philippines, some semblance of price reform is in discussion. In most cases, there is upward pressure on pricing to accommodate higher priced LNG imports. Upward price movement is also critical for alleviating NOC budget pressure in Southeast Asia. Many NOCs in the region – which include Malaysia's PETRONAS, Thailand's PTT, Indonesia's Pertamina, and Vietnam's PetroVietnam – are forced to sell at low prices, despite rising production costs.

Figure 23: Southeast Asia Domestic Gas Prices



Source: PFC Energy Global LNG Service, PTTEP, PGN, Malaysia Energy Information Hub

Domestic prices in Thailand, Indonesia, and Malaysia have been trending upwards since the middle part of the last decade, but as of 2011 there was generally a large variance between countries. Thailand especially saw an upward swing in prices during 2012 when the country became more reliant on LNG imports which have been purchased from the spot and short-term market.

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