2. Oil and gas sector

This chapter begins with an overview of the oil and gas industry in Malaysia. Description of the value chain of the industry is given in section 2.2, followed by the industry's economic performance in section 2.3. Section 2.4 focuses on the scope of the inquiry regarding issues in the oil and gas industry.

2.1 Oil and gas industry in Malaysia

This section provides an overview of the oil and gas industry in Malaysia.

2.1.1 History

Oil and gas production have been a mainstay of Malaysia's growth since oil was first drilled in 1910 in Miri, Sarawak. The first oil well (known as The Grand Old Lady) which was discovered by Shell, started with a production of 83 barrels per day (bbls/d) and reached a maximum of 15,000 bbls/d in 1929. There were no other drilling activities elsewhere in Borneo or Peninsular Malaya until the 1950s. [1, 2, 3]

Petroleum activities began increasing significantly in 1960s due to the discovery and development of offshore fields in Borneo. The late 1960s saw the beginning of offshore oil exploration in the east coast of Peninsular Malaysia. In the 1970s, some oil fields in Malaysia were producing 90,000 to 99,000 bbls/d. [2]

In the early days, foreign oil companies dominated the oil and gas industry in Malaysia with Shell and Esso being the two major players. This was followed by several other foreign companies such as Conoco, Mobil, Aquitaine, Oceanic and Teiseki. The national company, Petronas came on to the scene in 1974. [2]

In return for royalties and taxes, the foreign companies were given petroleum concessions by state governments, which accorded them exclusive rights to explore and produce resources. However, exploration licences of these companies ceased to have effect with the passing of the Petroleum Development Act in Parliament in 1974, which granted Petronas ownership and control of the nation's petroleum resources. [2, 3]

Exploration and production of oil and gas have since been carried out under a Production Sharing Contract (PSC), whereby local and international companies are granted exploration rights by PETRONAS. Each contract obligates the PSC Contractor to provide all the financing and bear all the risk of exploration, development and production activities in exchange for a share of the total production. [2, 3, 4]

Currently there are more than 70 PSCs with various companies, including its Exploration & Production (E&P) subsidiary PETRONAS Carigali Sdn Bhd (PETRONAS Carigali), with 43% of Malaysia's total production. Other dominant players are Shell with 22% and ExxonMobil with 16% of total production. [2, 3]

Beginning 2011, PETRONAS has adopted the risk sharing contracts (RSCs) approach as an alternative to the PSC regime in developing marginal fields. Marginal fields are those with reserves of less than 30 million barrels of recoverable oil or oil equivalent. In RSC, PETRONAS retains ownership and control of the reserves. The contractor bears all the exploration costs and the associated risks, and is compensated when a commercial discovery is made. The contractor is also entitled to a share of the profits and not a share of the production. [5, 6, 7]

2.1.2 Oil and gas reserves

Malaysia's oil reserves are the fifth highest in the Asia-Pacific region after China, India, Vietnam and Indonesia and the 28th in the world. As of January 2011, Malaysia's proven oil reserves was 4 billion barrels. Nearly all of Malaysia's oil comes from offshore fields. [8, 9, 10]

Malaysia's continental shelf is divided into three producing basins: [2, 3, 8, 10]

- Peninsula Malaysia: The Malay Basin,
- Sarawak: The Sarawak Basin, and
- Sabah: The Sabah Basin

Most of the country's oil reserves are located in the Malay basin and tend to be of high quality. Malaysia's benchmark crude oil, Tapis Blend, is of the light and sweet variety with an API gravity of 44° and sulfur content of 0.08 percent by weight. [8, 9]

With a total proven natural gas reserves of 2400 billion cubic metres, Malaysia is ranked the 13th largest in the world. Most of the country's natural gas reserves are in its eastern areas, predominantly offshore Sarawak. [1, 9]

2.1.3 Oil and gas exploration

Malaysia has approximately 615,100 square kilometres of acreages available for oil and gas exploration, 36% (218,678 square kilometres) of which are covered by Production Sharing Contracts. [2, 10, 11]

Presently, discoveries of 163 oil fields and 216 gas fields have been made in shelfal waters and deepwater environments. The first deepwater oil discoveries bearing 440 million barrels, in Kikeh area, in offshore Sabah was made by Murphy Oil in 2002. [2, 8]

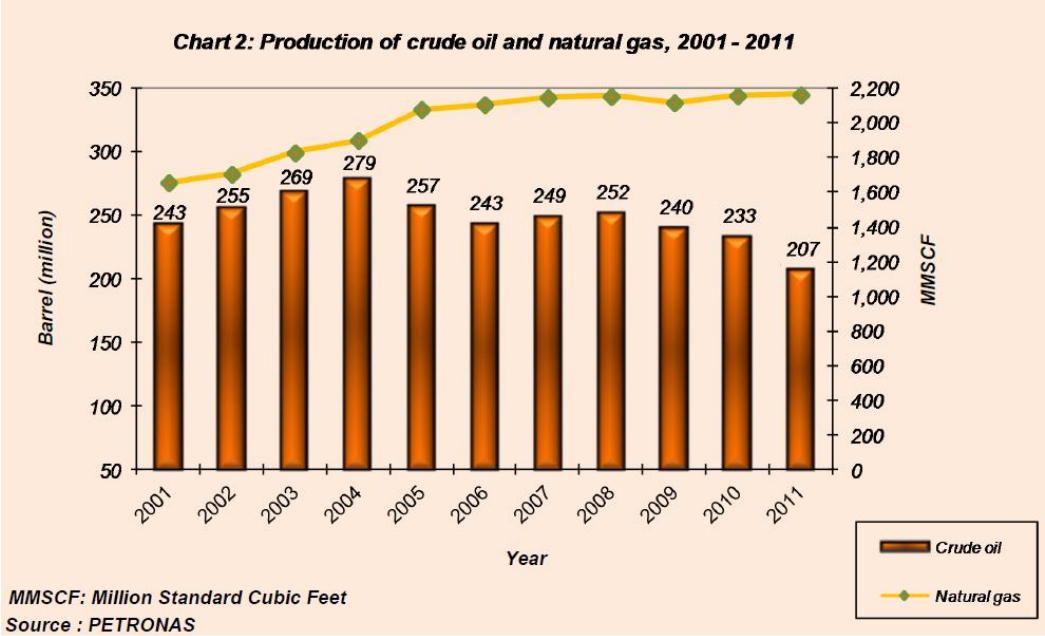
2.1.4 Oil and gas production

The performance of production of crude oil and natural gas for the period of 2001-2011 is shown in Chart 2.1. [12]

With the exception of 2007 and 2008, oil production has been gradually declining since reaching a peak of 279 million barrels in 2004. The total oil production in 2011 was approximately 207 million barrels, 10.7 per cent less than the 233 million barrels production of 2010, which in turn was a 3.1 per cent drop from that of 2009 (240 million barrels).

Production of natural gas shows a positive trend since 2001. It peaked in 2008, but showed a slight decline of 1.7 per cent in 2009. In 2010, natural gas production rose by 1.9 per cent to 2,159 million standard cubic feet (MMSCF). There was a further increase of 0.3 per cent in 2011 with a production of 2,165 MMSCF.

Chart 2.1: Production of crude oil and natural gas, 2000 – 2011 [12]



2.1.5 Sustaining the oil and gas industry

More than half of total Malaysian oil production currently comes from the Tapis field in the offshore Malay basin. The downward trend in oil production is due to the maturing reservoirs. [9]

Among efforts being made to sustain the production of oil are the enhancement of oil recovery in currently producing regions, and the development of marginal fields such as in deepwater areas (water depth of more than 1000ft or 300m) offshore of Sabah and Sarawak using new technology. Marginal fields are those with reserves of less than 30 million barrels of recoverable oil or oil equivalent. [9, 13]

In 2011 and 2012, PETRONAS awarded risk service contracts (RSCs) in developing marginal oil fields to SapuraKencana Petroleum Berhad, Dialog-ROC Oil and Costal Energy Co for the development of the Berantai cluster, the Balai cluster and the Kapal, Banang and Meranti cluster, respectively. In May 2013, PETRONAS invited bids for 10 marginals fields of the coast of Sarawak, Sabah and Peninsular Malaysia. [6, 7]

In the natural gas sector, gas fields with high level of contaminants (carbon dioxide and hydrogen sulfide) are being considered for production. These fields were

previously deemed as not being commercially attractive because of the cost associated with production. [13]

2.2 Industry value chain

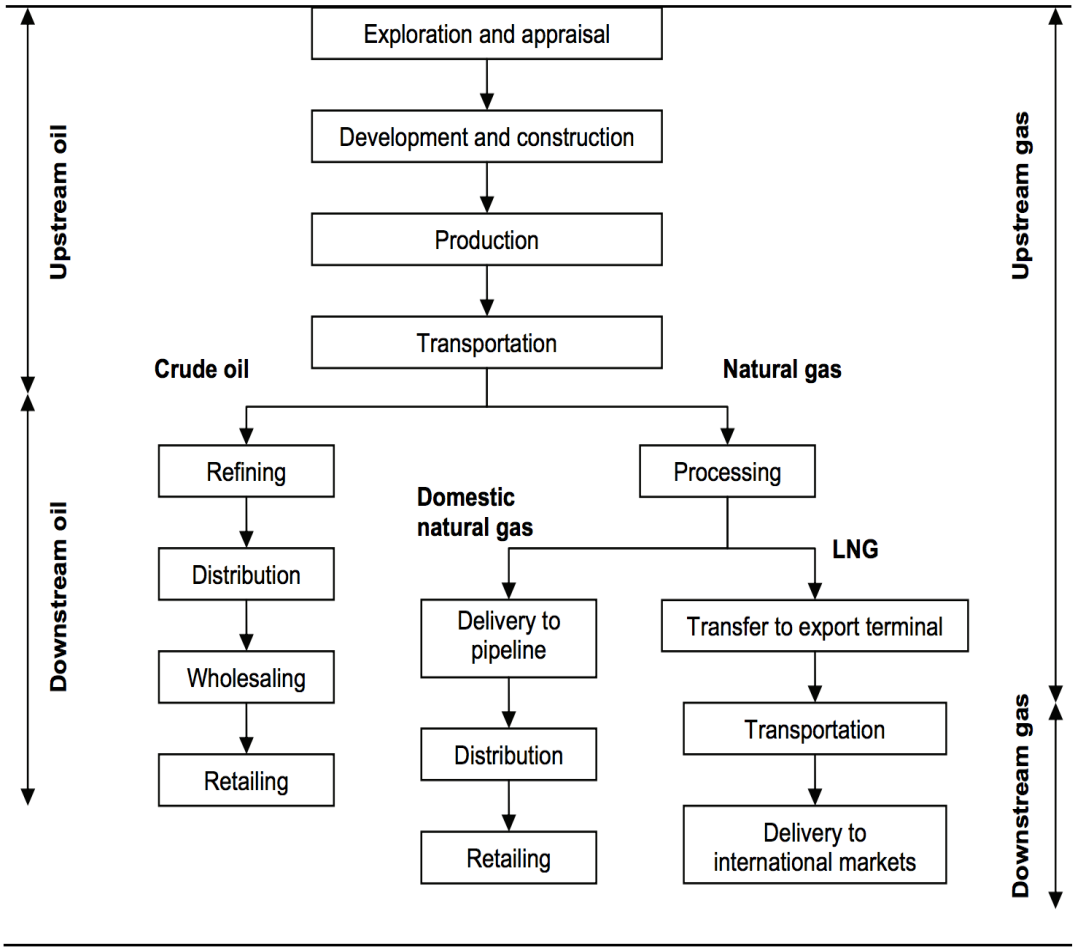
A value chain is the sequential set of activities performed on a raw material causing it to gain value at each consecutive activity and ultimately become a consumable product for end users. In the oil and gas industry, oil and gas are the raw material. The value chain in the oil and gas industry transforms crude oil and gas into various end products such as gasoline and natural gas. [14, 15, 16, 17]

Figure 2.1 illustrates the value chain of oil and gas sectors. The oil and gas value chain consists of activities that are divided into two segments:

- Upstream
- Downstream

Upstream activities are the exploration, development and production of hydrocarbon resources. Activities in the downstream segment include refinement of crude oil, processing of gas into various marketable products, marketing, trading and distribution of end products to consumers. Transportation and storage activities are present in both the upstream and downstream segments of the value chain.

Figure 2.1: The value chain of oil and gas sector [18]



2.2.1 Upstream

The upstream segment of the value chain involves the exploration, development, and production of hydrocarbons which can be oil or gas or the combination of both. Exploration for oil and gas is carried out in a specific exploration area or 'block'which is usually offshore. Development and production activities subsequently follow upon discovery of commercial quantities of hydrocarbon.

Exploration

Exploration activities begin with the collection, analysis and interpretation of seismic data to determine the potential of hydrocarbon reserves. Exploratory drilling will be initiated for the actual discovery of hydrocarbon. If the discovery is commercially viable, the next course of action will be to enter into the development phase.

Development

The development process involves the drilling of appraisal wells to assess the size and commerciality of the discovery. This is followed by the drilling of wells for full scale production; and the establishment of infrastructure and facilities as well as the connecting network at the production and refinery or processing sites to facilitate the production, process and transport of hydrocarbon.

Production

Production is the operation that begins after the well is drilled. Hydrocarbons are brought to the surface from the reservoir beneath the earth's surface and prepared for processing. In offshore production, oil and gas are produced from multiple wells and brought to the surface via platforms.

On the platforms, the hydrocarbon mixture undergoes process to remove water and contaminants and to separate gas and condensate from oil, prior to being transported onshore to storage facility, refineries or processing plants. [15]

Transportation

There are two phases of transportation. The first is the upstream transportation of crude oil and natural gas from the production site, and the second is the transportation of end products in the downstream segment. The mode of transportation can vary from pipelines, trucks and railways on land to barges and tankers across water.

At the production site, crude oil is transported by means of pipelines to storage facility and refinery. Tankers are the normal mode of transportation for export of crude oil to international markets. Pipelines are used to transport natural gas from the production site to the processing plant and customers.

Refined oil is transporated to storage facility by pipelines. Pipelines, railways and roads are normally used to distribute end products in domestic markets, while tankers are used to reach customers in transoceanic markets.

Storage

Storage is necessary to balance the fluctuations between supply and demand, and to ensure stable and secure supply to energy markets at all times. Crude oil is put in storage in great quantities after production. Large amount of refined products are also stored. Storage facilities are most often located near refining facilities and are connected to pipeline systems to facilitate shipment when product demand must be met. Storage containers come in various forms, shapes and sizes. Old tankers and barges have been adapted for offshore storage use. Special tanks are used at large capacity storage sites.

2.2.2 Downstream

Downstream activities include refinement of crude oil, processing of gas, marketing, trading and distributing of end products to consumers in domestic or international markets. End products are refined products of crude oil, processed natural gas, and petrochemical products whose raw material are crude oil or natural gas.

Oil value chain

Activities in the downstream segment of the oil value chain are the refinement of crude oil, marketing, trading and distributing of refined products to consumers.

Refinement operation

Crude oil needs to undergo a refinement process in order to become refined products for end users. Crude oil is composed of mixtures or fractions of molecules. The refinement process is basically to isolate the fractions according to the their boiling point range. Refined products are produced by combining fractions from the raw crude oil with those from various refinery processing units. The most important refined product is petrol, fuel for motor vehicles. Other equally important products are diesel oil, heating oil, jet fuel, and lubricants. Crude oil is also the raw material in the production of asphalt, plastics, solvents, fertilizers, pesticides and pharmaceuticals. Table 2.1 below lists out some of the refined products of crude oil.

Table 2.1: Refined products and their uses

Refined Products	Uses
petrol	• fuel for vehicles
diesel fuel	• fuel for - trucks, buses - trains - ships
jet fuel	• fuel for airlines
heating oil	• for heating - homes - business premises
residual fuel oil	• as boiler fuel - in industrial plants for manufacturing processes - in tankers
lubricants	• as lubricant - engine parts - turbine in power plants • to make salves, ointments, and cosmetics
asphalt	• to pave roads
petroleum coke	• to make electrodes to produce aluminum • as a raw material to manufacture steel.

Marketing, trading and distribution of refined products

Refined products are exported to international markets. In domestic market, they are traded and marketed either as wholesale or retail . Refined products are moved from refineries to markets by means of various transportation modes. Tankers are used to for transport to international markets. Products are distributed in domestic market by means of pipelines, rails and roads. Domestic consumers are industry, commercial, and residential.

Petrol and diesel are two most visible products of crude oil. In domestic market, petrol and diesel are distributed to petrol service stations which then sell them to motorists as fuels for their vehicles. Retail prices of petrol RON 95 and diesel are set lower than their market prices as the government subsidises these two products.

Petrochemicals manufacturers are end users for aromatic compounds in crude oil such as benzene, toluene and xylene. They are used as the chemical building blocks in the manufacture of petrochemical products such as plastics, agricultural chemicals, and pharmaceuticals.

Gas value chain

The downstream activities in the gas value chain are processing, trading, marketing and distribution of gas to customers in international and domestic markets.

At the production site, pure natural gas is moved directly on the natural gas pipeline network to consumers such as residential, commercial, industrial, and utility companies. Raw natural gas is sent on another pipeline system to natural gas processing plants for further processing.

Processing

Natural gas is usually produced together with crude oil. Gas and oil are separated at the production site. Raw natural gas normally contains pure natural gas (methane), mixed natural gas liquids (NGL) as well as impurities in the form of hydrogen sulfide and carbon dioxide. Pure natural gas is also referred to as pipeline quality natural gas as it can be moved on the pipeline network without causing damage. [15]

Processing of natural gas removes the mixed natural gas liquids from the pure natural gas. The mixed natural gas liquids then undergoes fractionation process, which separates it into primary components: ethane, propane, butane, and natural gasoline.

Natural gas is used to produce electricity, and to provide the energy for heating at homes, and for various manufacturing processes in industries. Natural gas is also used as transportation fuel in the form of compressed natural gas (CNG). Natural gas liquids are used as raw materials in petrochemical plants for industrial, pharmaceutical, and agricultural products, burned for heating and cooking, and blended into vehicle fuel.

Uses of natural gas is shown in Table 2.2.

Table 2.2 : Uses of natural gas

End Users	**Uses**
Industry	provides energy for manufacturing processes, e.g. - to heat air to dry paint on cars in automobile plants - to dry food products like potato chips in food manufacturing plants
Utility companies	production of electricity
Vehicles	as transportation fuel in the form of compressed natural gas (CNG)

Liquefied natural gas

Pure natural gas that has been liquified is called liquified natural gas (LNG). This is usually for the purpose of transporting natural gas in areas where there is no pipeline network. To be transported, natural gas is first liquefied in a LNG liquefaction plant. This liquefied state enables the natural gas to be shrunk to 1/600th of its original volume. It is then transported in specialised LNG carriers. At the delivery point the LNG is regasified and charged into a gas pipeline system.

Transportation

Natural gas products are distributed to markets by various means of transportation. Natural gas must either be compressed or liquefied for transport. Natural gas pipeline network transports pipeline quality natural gas from production sites or processing plants to consumers.

Tankers equipped with pressurised, refrigerated, and insulated tanks are used to transport natural gas liquids and liquefied natural gas (LNG).
Natural gas liquids are also piped to petrochemical plants, refineries, and other natural gas liquids customers. Liquefied petroleum gas (LPG) in cylindrical containers are transported by road to customers.

Storage

Natural gas storage serves as a buffer between transportation and distribution. Storage is crucial in ensuring the reliability of supply to meet the demands of consumers. It also serves as insurance against any unforeseen accidents, natural disasters, or other occurrences that may affect the production or delivery of natural gas. [19]

Natural gas is usually stored underground, in large storage reservoirs. There are three main types of underground storage: depleted gas reservoirs, aquifers, and salt caverns. **Depleted gas reservoirs are used most often and comprise the majority of storage. Aquifers are water reservoirs that are conditioned to hold the gas.** In addition to underground storage, however, natural gas can be stored as liquefied natural gas (LNG). LNG allows natural gas to be shipped and stored in liquid form.

Marketing, trading, distribution of processed natural gas

Natural gas is exported in the form of liquefied natural gas (LNG). Domestic consumers are industry, commercial and residential. Processed products such as liquefied petroleum gas (LPG) is marketed either as wholesale or retail. LPG is usually supplied in cylindrical containers. Natural gas for vehicles (NGV) is piped to PETRONAS service stations and sold to motorists.

The main customer for natural gas liquids such as ethane, propane, and butane is the petrochemicals industry which uses them as feedstocks in the manufacture of various petrochemicals products. Table 2.3 below shows some of the petrochemical products.

Table 2.3: Petrochemicals products from natural gas liquids

Natural Gas Liquids	**Petrochemical Products**
Ethane	polyethylene (plastics) - for housewares, insulation, packaging films, toys
	ethylene glycol - antifreeze for car radiators
	polyester fibers, film and latex paint
	polyvinyl chloride (PVC) - for pipes
	vinyl acetate - for paints and adhesives.
	resins - for rubber
	Ethanol
Propane and butane	LPG - for cooking and heating - in transportation
	propylene oxide - for sterilizing medical and food products - to manufacture surfactants.
	Propylene glycol - as moisturizer in skin care lotions and cream. - as industrial antifreeze

	- as hydraulic and brake fluid.
	Butylene - an important chemical used in manufacturing products that improve the quality of gasoline

2.3 Industry performance

Malaysia is one of the world's significant oil and gas producers. According to the 2012 Petroleum and Natural Gas Statistics report by the Department of Statistics, the petroleum and natural gas mining industry contributed 8.7 per cent of the Gross Domestic Product (GDP) in 2011, and 9.7 per cent in 2010. The total value of gross output in 2011 was RM109.2 billion, while that of 2010 was RM98.1 billion (refer to Table 2.4). [12]

Table 2.4 : Principal statistics of petroleum and natural gas mining industry, 2010 and 2011 [12]

Variables	*2010*	*2011*	*Annual Growth Rate%*
Gross output (RM billion)	*98.1*	*109.2*	*11.3*
Intermediate input (RM billion)	*11.1*	*16.1*	*45.1*
Value added (RM billion)	*87.0*	*93.1*	*7.0*
Value of fixed assets (RM billion)	*141.2*	*146.5*	*3.8*

The same report also stated that in 2011, Malaysia produced 207 million barrels of oil, compared to 233 millions barrels in 2010. The natural gas production in 2011 and

2010 were 2,165 million standard cubic feet (MMSCF) and 2,159 MMSCF respectively (refer to Table 2.5).

Table 2.5 : Production of petroleum and natural gas, 2009, 2010 and 2011 [12]

Product	*2009*	*2010*	*2011*	*annual percentage change*	
				2010	*2011*
Crude Oil (million barrel)	*240*	*233*	*207*	*(3.1)*	*(10.7)*
Natural Gas (MMSCF)	*2,119*	*2,159*	*2,165*	*1.9*	*0.3*

Notes:
Total production of crude oil refers to the production of crude oil and condensate, while the total production of natural gas includes associated natural gas and non-associated natural gas.

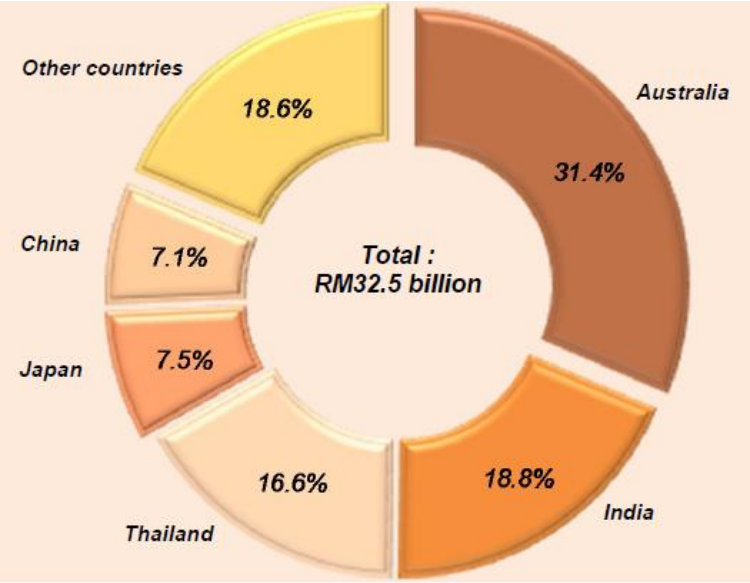
Malaysia exports petroleum-based products which are crude petroleum, liquefied natural gas, and petroleum products. Exports of petroleum- based products in 2011 amounted to RM117.5 billion, equivalent to 16.8 per cent of total export in Malaysia (refer to Table 2.6).

Table 2.6 : Exports and imports of petroleum-based products, 2011 [12]

Product	*Exports (RM billion)*	*%*	*Imports (RM billion)*	*%*
Crude petroleum	*32.5*	*27.6*	*24.0*	*42.3*
Petroleum products	*33.0*	*28.1*	*32.7*	*57.7*
Liquefied natural gas	*52.0*	*44.3*	*-*	*-*
Total	*117.5*	*100.0*	*56.7*	*100.0*

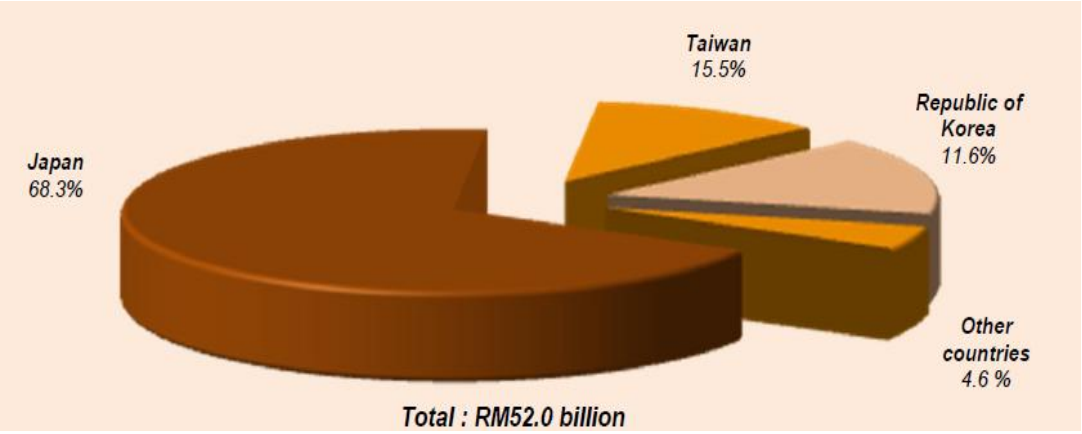
Major buyers of Malaysia's crude oil in 2011 were Australia with a share of 31.4 percent, India (18.8 per cent), Thailand (16.6 per cent), and Japan (7.5 per cent) (refer to Chart 2.2).

Chart 2.2 : Malaysia's exports of crude petroleum by country, 2011 [12]



Japan was the leading importer of Malaysia's liquefied natural gas in 2011 at 68.3 per cent, followed by Taiwan (15.5 per cent) and Republic of Korea (11.6 per cent) (refer to Chart 2.3).

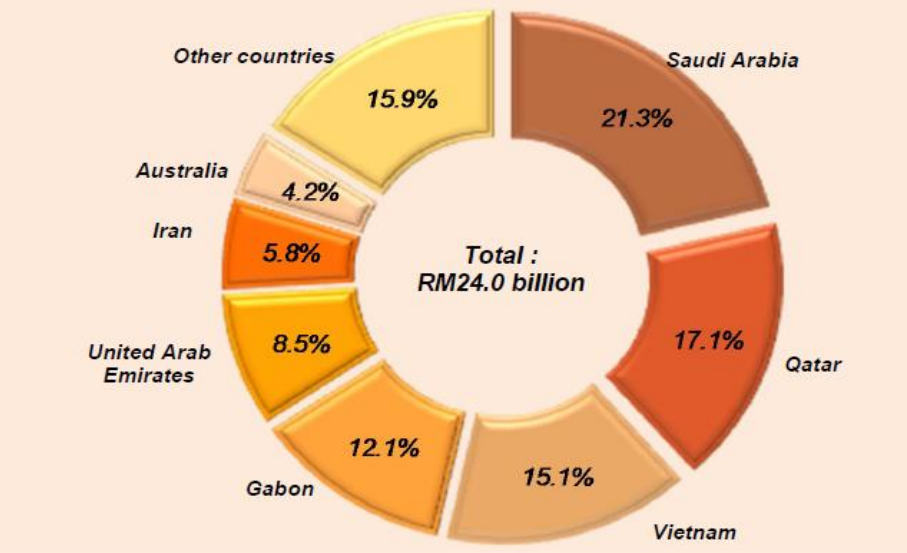
Chart 2.3 : Malaysia's exports of liquefied natural gas by country, 2011 [12]



Malaysia also imports crude petroleum and petroleum products for its domestic consumers. In 2011, the largest import commodity was petroleum product with a value of RM32.7 billion, followed by RM24.0 billion of imports of crude petroleum (refer to Chart 2.4). Saudi Arabia and Qatar were the two primary exporter countries

of crude petroleum to Malaysia in 2011, accounting for 38.4 per cent. This was followed by Vietnam (15.1 per cent), and Gabon (12.1 per cent).

Chart 2.4 : Malaysia's imports of crude petroleum by country, 2011 [12]



2.4 Scope of the study

The inquiry focuses on two areas in the downstream segment of the value chain of the oil and gas industry. They are

- the retail trade of petroleum products in the domestic market, and
- the manufacturing activity in the petrochemical industry.

2.4.1 Retailing of petroleum products

Retailing is the final step in the distribution of petroleum products in the domestic market. Two activities in the retail trade of petroleum products which have been selected as the subjects of the inquiry are

- petrol stations, and
- the distribution of liquefied petroleum gas (LPG) in cylinders

Petrol stations

As of August 2013, there were 3291 petrol stations and 332 mini stations operating across the country (refer to Chart 2.5 and Chart 2.6). There were 200 petrol service stations selling NGV in Malaysia (Chart 2.7). [20]

These petrol stations are operated by dealers who are appointed by oil companies like PETRONAS, SHELL, PETRON, BHP, and CALTEX. Basically, each dealer is in partnership with the oil company. The dealer provides the start-up capital for the business and the oil company is responsible for the setting up of the petrol station. Each oil company has its own terms of dealership agreement.

Chart 2.5: Number of petrol service stations by states [20]

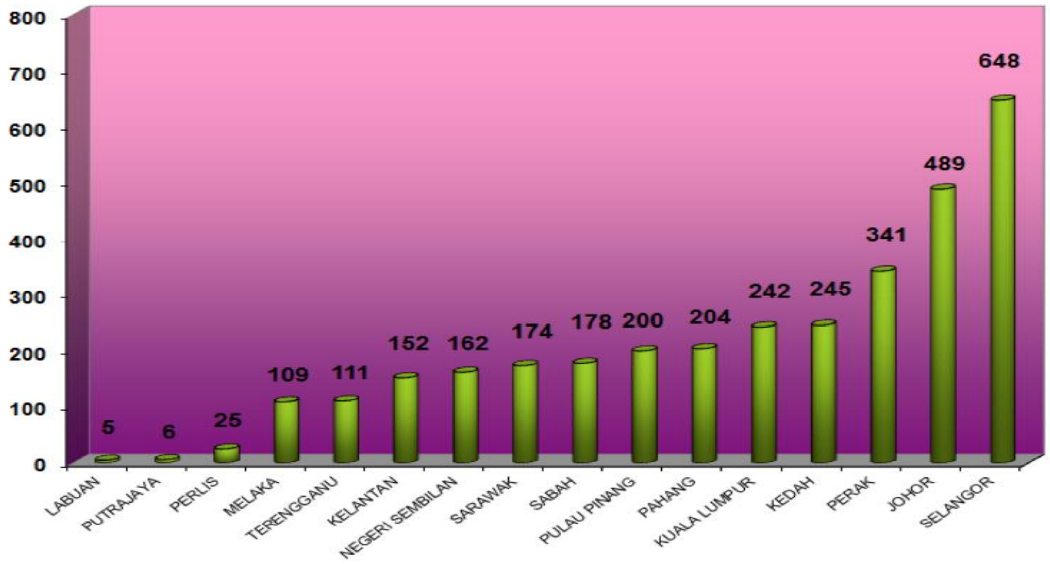


Chart 2.6: Number of mini petrol kiosks by states [20]

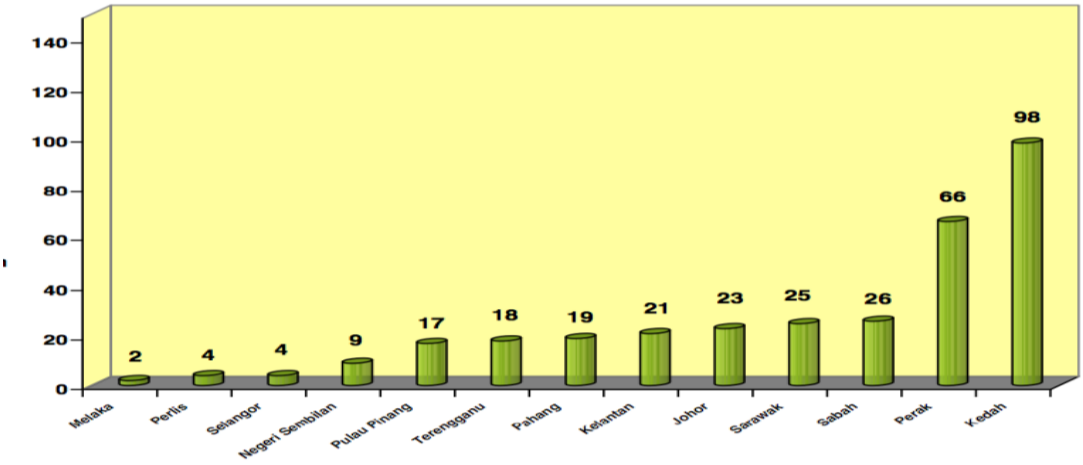
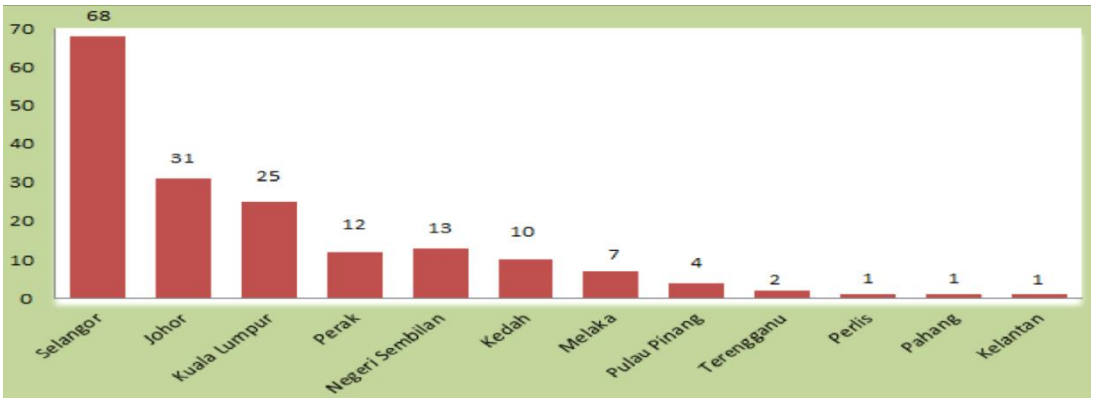


Chart 2.7: Number of petrol service stations selling NGV [20]



Setting up of a petrol station is governed by the *Petroleum Development Act 1974 (Act 144)*. Permission from the Ministry of Domestic Trade, Co-Operatives and Consumerism (MDTCC) must be obtained in accordance with section 3A (2) of the Petroleum Regulations 1974 (refer to Box 2.1).

Box 2.1 **Petroleum Regulations 1974: Section 3A(2)**

"Application for permission to commence or continue any business of marketing or distributing of petroleum or petrochemical products under section 6(3) of the Petroleum Development Act 1974 shall be made to the Secretary-General, Ministry of Domestic Trade, Co-operatives and Consumerism."

Petrol stations sell petrol namely RON 95 and RON 97, and diesel to motorists. They are declared controlled goods under the *Petroleum and Electricity* (*Control of Supplies) Act 1974 (Act 128)*. Controlled goods are goods which have their prices and distribution regulated by MDTCC. Petrol station operators must apply for a retail licence of controlled goods from MDTCC for retail sale and storage of RON 95 and RON 97, and diesel.

Retail prices of RON 95 and diesel are set lower than their market prices as they are subsidised by the government. Vehicle fuel has been subsidised in the country since 1983 although the price of RON97 has been allowed to float since September 2009. In 2011, 10 per cent of the government's operating expenditure was spent on fuel subsidies. [21]

Table 2.7 shows the current prices of RON 95 and diesel.

Table 2.7: Current retail and market prices of RON 95 and diesel as of August 2013 [20]

PRODUCT	RETAIL PRICE/LITRE (RM)	MARKET PRICE/LITRE (RM)	SUBSIDY (RM)
RON 95	1.90	2.75	0.85
DIESEL	1.80	2.81	1.01

Most petrol stations in Malaysia have a convenience store. These convenience stores sell controlled goods other than petroleum products, which are so declared under the *Control of supplies Act 1961 (Act 122)* and Supplies Control Rules & Regulations. Retail sale of controlled goods such as sugar, all purpose flour, cooking oil and liquified petroleum gas (LPG) is regulated by MDTCC. A single composite licence obtained from MDTCC allows the sale of petrol and diesel and any or several of these goods. A licence from the Ministry of Agriculture (MOA) is required to sell rice which is a controlled item regulated under the *Control of Padi and Rice Act 1994 (Act 522)*. Table 2.8 shows a list of controlled goods.

Table 2.8: List of controlled goods [27]

No	*Controlled Goods*
1	*Sugar*
2	*Milk including condensed milk, powdered or dried milk and Evaporated milk*
3	*Salt*
4	*Cement and Clinker*
5	*Wheat flour (All purpose flour)*
6	*Cooking oil*
7	*Fertilisers*
8	*Pesticides*

9	*Formic acid or any other acid used for coagulating latex*
10	*Mild steel round bars*
11	*Kerosene*
12	*Prepared or preserved fish in airtight containers*
13	*All types of rice (State of Sabah Only)*
14	*Paddy (State of Sabah only)*
15	*Petrol motor spirit and Motor gasoline af all grades*
16	*Diesel fuel*
17	*Liquefied petroleum gas (LPG)*
18	*All types of bread*
19	*Fuel oil*
20	*Chicken*
21	*Rubber wood*
22	*Facemask (1-ply, 2-ply, N95)*

Distribution of liquefied petroleum gas (LPG)

Liquefied Petroleum Gas (LPG) is a mixture of propane and butane and has many commercial applications. It is often used for cooking and heating in homes and commercials, and an important source of energy in industries. LPG is also used as vehicle fuel. [22]

LPG is normally bottled in gas cylinders for sale to domestic, commercial and industrial consumers. LPG for cooking purposes in homes is available either in 10kg, 12kg or 14 kg cylinders. LPG in 50kg cylinders is meant for commercial and industrial users.

Marketing and distribution of bottled LPG is regulated by MDTCC under the *Petroleum Development Act 1974*. LPG dealers are authorised by MDTCC in accordance with section 3A (2) of the Petroleum Regulations 1974. The retail price

of bottled LPG is also regulated by MDTCC under the *Petroleum and Electricity (Control of Supplies) Act 1974* as LPG is controlled goods.

The sale of bottled LPG as cooking gas to domestic consumers is subsidised by the government. Currently, consumers pay RM19 for a 10 kg bottled LPG eventhough its market price is RM37.70. Figure 2.2 and Chart 2.8 show the pricing for bottled LPG. [20, 21]

Figure 2.2: Actual and subsidised prices of bottled LPG [20]

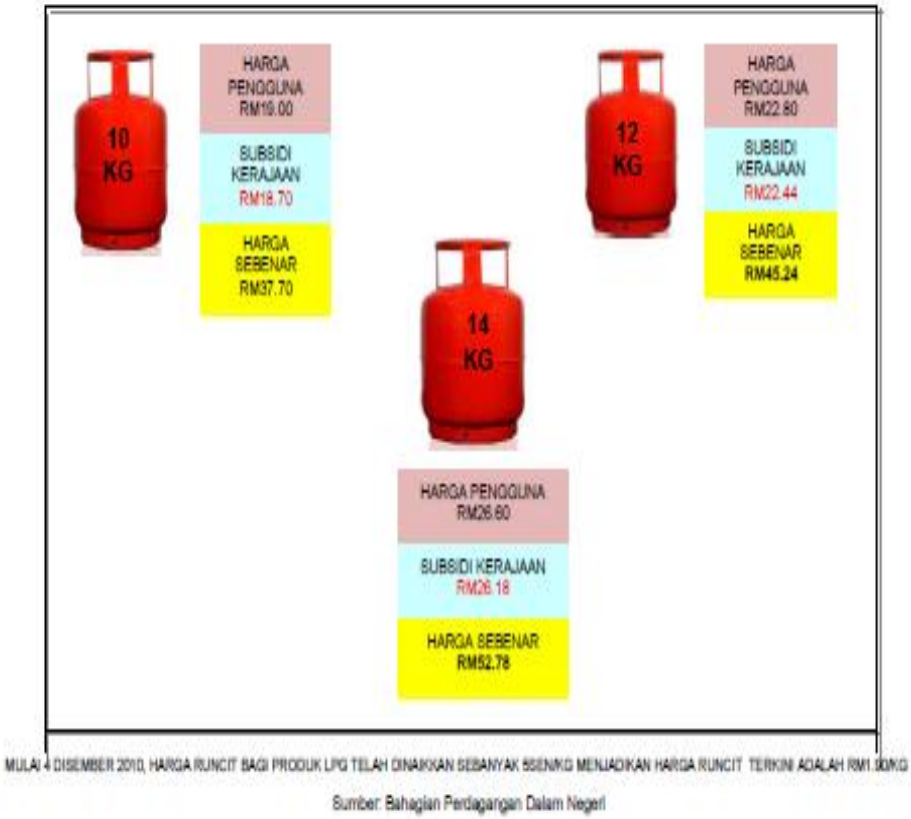
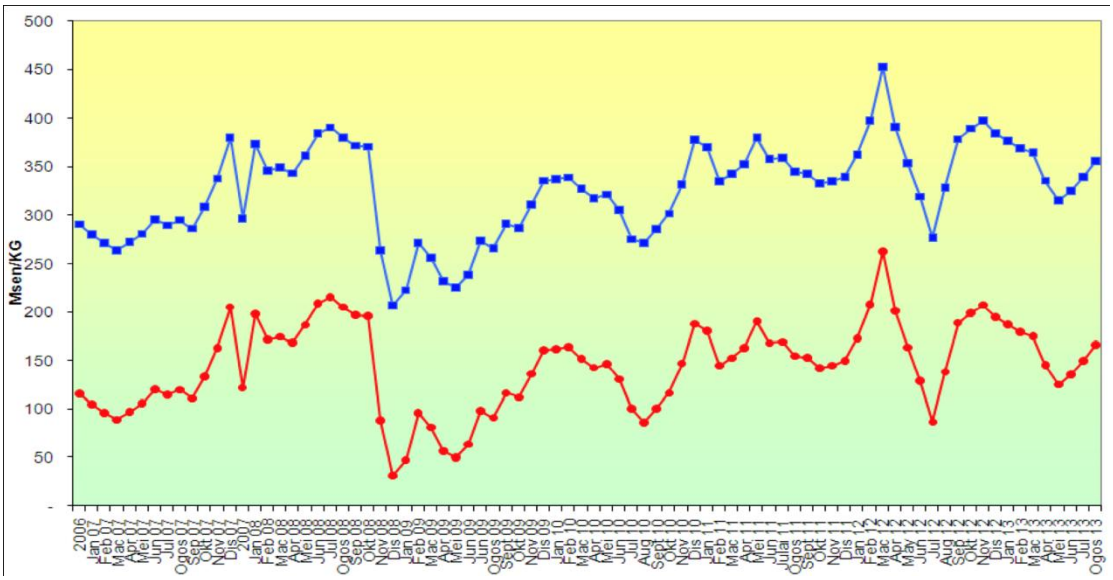


Chart 2.8: Actual and Subsidised prices of LPG from Jan 2007 to August 2013 [20]



2.4.2 Petrochemicals industry

The petroleum and petrochemicals industry is one of the leading industries in Malaysia. The industry covers petroleum products, natural gas and petrochemicals. The total investment in the petroleum and petrochemicals industry stood at RM60.7 billion in 2011. Malaysia is today an exporter of major petrochemicals products within the ASEAN region, exporting both commodity grade polymers, as well as petrochemical derivatives. [23, 24, 25, 26]

Natural gas, natural gas liquids, and petroleum refinery products are used as feedstock in the production of petrochemicals products. Among petrochemicals products produced in Malaysia are: [24]

- commodity grade plastic resins, such as polyethylene (PE) resins, polypropylene (PP) resins, polyvinyl chloride (PVC) resins and polystyrene (PS) resins;
- engineering grade plastic resins, such as acrylonitrile-butadiene (ABS), polyoxymethylene (POM) resins and polyester co-polymer (PETG) resins;
- petrochemical derivatives, such as ethylene oxide (EO), butanols and acetic acid; and
- specialised and fine chemicals, such as food additives and raw materials for pharmaceuticals.

The development of petrochemicals industry has been in great progress since the early 1990s. There are three integrated petrochemicals complexes (IPCs) established in Kerteh, Terengganu; Gebeng, Pahang, and Pasir Gudang-Tanjung Langsat, Johor. Aromatic plants in Kerteh use condensates as the raw material to produce paraxylene and benzene. Ethylene-based products are also produced in Kerteh. Propane is used as the raw material for the propane dehydrogenation plant in Gebeng. Naphta obtained from petroleum refining provides feedstock for plants in Pasir Gudang-Tanjung Langsat. Other petrochemicals plants are located in Bintulu, Sarawak; Gurun, Kedah; Penang, Labuan and Kluang, Johor. Table 2.9 shows the petrochemicals zones in Malaysia, while Table 2.10 shows the producers of petrochemicals feedstocks. [23, 24, 26]

Table 2.9: Petrochemicals zones in Malaysia

Petrochemical Zones in Malaysia

Petrochemical Zones	Facilities & Infrastructures	Products
Kertih, Terengganu	• Gas processing plants • Peninsular Gas Utilisation (PGU) project • Centralised utility faciltities • Institute Technology Petroliam • Kertih Port • Kuantan Port	• Praxylene • Benzene • Ammonia • Acetic Acid • Ethylene • Polyethylene • Ethanolamines • Ethoxylates • Glycol Ethers • Butanol • Butyl Acetate • Ethylene Oxide • Ethylene Glycol • Low Density Polyethylene • Vinyl Chloride Monomer • Polyvinyl Choride
Gebeng, Pahang	• Peninsular Gas Utilisation (PGU) project • Centralized utility facilities • Kuantan Port • Environment Technology Park • East Coast Highway	• Acrylic Acid and Esters • Syngas • Butyl Acrylate • Oxo-alcohols • Phthalic Anhydride and Plasticizers • Butanediol • Tetrahydrofurane • Gamma-butyrolastone • Polyester Copolymers
		• Purified Terephthalic Acid • Dispersion Polyvinyl Chloride • Methyl Methacrylates Copolymers • MTBE • Propylene • Polyacetals • Polypropylene • Polybtylene Terephthalate (PBT)
Pasir Gudang - Tanjung Langsat, Johor	• Peninsular Gas Utilisation (PGU) project • Tank farms developed for storage of petrochemical liquid • Johor Port • Tanjong Pelepas Port • Tanjung Langsat Port	• Ethylene • Propylene • BTX • Polyethylene • Polypropylene • High Impact Polystyrene • Ethylbenzene • Styrene Monomer • Expandable Polystyrene • Ethylene Vinyl Acetate
Bintulu, Sarawak	• Bintulu Port • Bintulu Airport	• Ammonia • Urea • LNG • Synthetic Gas Oil • Synthetic Kerosene • Synthetic Naphtha • Synthetic Solvents • Synthetic Detergent Feedstock • Synthetic Paraffin Wax / Waxy Raffinate

{Source: MIDA}

Table 2.10: Production of petrochemicals feedstocks

Production of Petrochemical Feedstocks

PETROCHEMICAL PRODUCTS	CAPACITY (mtpa)	COMPANY
Naphtha	2.4 million	• Petronas Penapisan (Terengganu) Sdn Bhd • Petronas Penapisan (Melaka) Sdn Bhd • Malaysia Refinery Company Sdn Bhd • Shell Refinery Company (FOM) Bhd • Esso (Malaysia) Bhd
Methane (sales gas) million • *Ethane* • *Propane* • *Butane* • *Condensate* Liquefied Petroleum Gas (LPG)	20.4 million	• Petronas Gas Berhad • Malaysia LNG Tiga Sdn Bhd
Ethylene	1.63 million	• Titan Petchem (M) Sdn Bhd • Ethylene Malaysia Sdn Bhd • Optimal Olefins (M) Sdn Bhd
Propylene	854 thousand	• Titan Petchem (M) Sdn Bhd • MTBE (M) Sdn Bhd • Optimal Olefins (M) Sdn Bhd
Benzene, Toulene and Xylene (BTX)	775 thousand	• Titan Petchem (M) Sdn Bhd • Aromatics Malaysia Sdn Bhd

{Source: MIDA}

Factors contributing to the rapid development of the industry include the availability of resources in hydrocarbon feedstock from oil and gas, good infrastructure and supporting industries, cost competitiveness as well as strategic location in ASEAN. [24, 26]

Malaysia holds the world's 28th largest crude oil reserves with proven oil reserves of 4 billion barrels. Malaysia is also the world's 13th largest natural gas reserves with a

capacity of 2400 billion cubic meters. The PETRONAS LNG Complex in Bintulu, Sarawak is the world's largest production facility at a single location of liquified natural gas (LNG) with production capacity of 23 million metric tonnes per year. Petrochemical zones in Kerteh, Terengganu and Gebeng, Pahang receive feedstocks from gas processing plants in Terengganu through the Peninsular Gas Utilisation (PGU) system. [23, 25]

Downstream petrochemicals activities also contribute to the growth of petrochemicals industry in Malaysia. At least 60 per cent of the plastic resins and polymers consumed by the domestic market are sourced locally. They are used in producing plastic parts and components, and packaging material which have applications in other industries such as the electrical and electronics, construction, medical devices, automative, furniture, agriculture industries and household consumer products. Fertilisers made from petrochemicals, such as urea and ammonia are used by the agriculture industry. Specialty and fine chemicals derived from petrochemicals are used as food additives, flavours and preservatives, as well as in the manufacture of pharmaceuticals, cosmetics and paints. [24]

The petrochemicals industry has foreign and local investors. The source of foreign investment is multinational corporations (MNCs) from the USA, Germany and Japan. There are also joint-venture set-ups between local investors and MNCs. PETRONAS is the major domestic investor in the industry. PETRONAS has contributed significantly to the development of support infrastructure, dedicated utilities and services to the petrochemicals zones in Kerteh and Gebeng. PETRONAS has also established joint-ventures with various MNCs, which include BASF, BP Chemicals, Eastman Chemical, Idemitsu Petrochemical, Mitsui, DSM and Dow Chemical Company. The significant investments by PETRONAS and MNCs have made the local petrochemicals industry well diversified with the availability of a wide range of products. [23, 24, 25, 26]

The People's Republic of China is expected to remain the largest market for Malaysia's export of petrochemicals products with considerable potential for higher value-added products such as petrochemicals derivatives. Demand for commodity-type petrochemicals from ASEAN countries, especially Cambodia, Lao PDR, Myanmar and Vietnam, is expected to increase, as well as demand for higher value-

added products such as fine and specialty chemicals, from Thailand, Indonesia and the Philiphines. [24]

Malaysia also imports petrochemicals which are not locally produced to be used as raw material for the production of other downstream petrochemical products. For example, ethylene dichloride is imported for the production of vinyl chloride and subsequent production of polyvinyl chloride resins. [24]

Malaysian petrochemicals companies face competition to gain greater access to the ASEAN market as there are other ASEAN countries such as Singapore, Thailand and Indonesia developing their own petrochemicals industries. Malaysia will need to increase the volume of production and provide a more conducive environment to promote investments in a wider range of high value-added products to capture the ASEAN market. [24]

Although Malaysia continues to attract foreign investment, the industry is facing competition from other petrochemical producers in ASEAN. However, the local downstream industry gives Malaysia an advantage as it becomes the domestic market for petrochemicals products. Malaysia will therefore need to further develop the downstream industries, thereby increasing the demand for locally produced petrochemicals. [24]

2.5 References

[1] Mohamed Ridza Abdullah, Mohamad Nazran Basirun. (2011). *Malaysia*. Retrieved from Mohamed Ridza & Co website: http://www.ridzalaw.com.my/downloads/2011-the-international-comparative-legal-guide-to-gas-regulation-2011-malaysia.pdf

[2] Report on Malaysia oil and gas exploration and production. Retrieved from bpmb website: http://www.bpmb.com.my/GUI/pdf/annual_report/2011/20.pdf

[3] Razmahwata bin Mohamad Razali. (2005). *Oil and gas industry in Malaysia-an overview*. Retrieved from MYIEM website: http://www.myiem.org.my/assets/download/JanBul05.pdf

[4] Basics of petroleum exploration. Retrieved from MCCA website: http://mcca.com.my/basics-of-petroleum-exploration.html

[5] What are risk service contracts (RSCS)? Retrieved from Worldvest-ap website: http://worldvest-ap.com/index.php/marginal-field-investment-opportunities/what-are-risk-service-contracts-rsc/

[6] Mohamed Ridza Abdullah, Mohamad Nazran Basirun. (2013). Malaysia Chapter - Oil & Gas Regulation 2013. Retrieved from ICLG website: http://www.iclg.co.uk/practice-areas/oil-and-gas-regulation/oil-and-gas-regulation-2013/malaysia

[7] Malaysian risk service contracts-the implications. Retrieved from Allens website: http://www.allens.com.au/pubs/ener/foener13jun13.htm

[8] Malaysia oil and gas profile. Retrieved from a barrel full website: http://abarrelfull.wikidot.com/malaysia-oil-and-gas-profile

[9] Malaysia: retrieved from EIA website: http://www.eia.gov/countries/analysisbriefs/Malaysia/malaysia.pdf

[10] Oil and gas to Malaysia. (2013). Retrieved from Austrade website: http://www.austrade.gov.au/Export/Export-Markets/Countries/Malaysia/Industries/Oil-and-gas

[11] Halliburton, R. A. (2012, May 30). *Oil & gas industry-opportunities and challenges ahead*. Retrieved from MIDA website: http://www.mida.gov.my/env3/uploads/events/InvestMalaysia2012/4-Oilngas_Halliburton.pdf

[12] *Petroleum and natural gas statistics*. (2012). Retrieved from the website of the Department of Statistics: http://www.statistics.gov.my/portal/images/stories/files/LatestReleases/petroleum/summary_findings2012.pdf

[13] *Malaysia goes deeper and further afield*. (2010 July 20). Retrieved from OGFJ website: http://www.ogfj.com/articles/print/volume-7/issue-7/special-report/malaysia-goes_deeper.html

[14] Oil and gas value chain. Retrieved from Petrostrategies website: http://www.petrostrategies.org/Learning_Center/oil_and_gas_value_chains.htm

[15] Tobin, J., Shambaugh, P., Mastrangelo, E. (2006, January). *Natural gas processing: the crucial link between natural gas production and its transportation to market*. Retrieved from EIA website: http://www.eia.gov/pub/oil_gas/natural_gas/feature_articles/2006/ngprocess/ngprocess.pdf

[16] *In-depth introduction to the international oil and gas industry*. Retrieved from Petroleum Online website: http://www.petroleumonline.com/

[17] Tordo, S, Tracy, B. S., Arfaa, N. (2011, March). *National oil companies and value creation*. Retrieved from worldbank website: http://elibrary.worldbank.org/doi/pdf/10.1596/978-0-8213-8831-0

[18] Australian Government Productivity Commission, *Review of Regulatory Burden on the Upstream Petroleum (Oil and Gas) Sector*, December 2009

[19] *The transportation of natural gas.* Retrieved from Naturalgas website: http://www.naturalgas.org/naturalgas/transport.asp

[20] *Petroleum*. Retrieved from MDTCC website: http://www.kpdnkk.gov.my/documents/10137/f8642acf-6a86-4374-975a-c85b6b02a2b8

[21] The International Institute for Sustainable Development. (2013). *A citizens' guide to energy subsidies in Malaysia*. Retrieved from IISD website: http://www.iisd.org/gsi/sites/default/files/ffs_malaysia_czguide.pdf

[22] *Liquified petroleum gas (LPG).* Retrieved from gas Malaysia website: http://www.gasmalaysia.com/why_GM/lpg.php

[23] *Petrochemical industry*. Retrieved from MITI websiite: http://www.miti.gov.my/cms/content.jsp?id=com.tms.cms.section.Section_40ecf693-c0a81573-6a5e6a5e-cb98d1a8

[24] *Resource based industries: petrochemicals industry*. Retrieved from MITI website: http://www.miti.gov.my/cms/documentstorage/com.tms.cms.document.Document_879bae59-c0a81573-1bef1bef-926c5327/chapter14_25.pdf

[25] *Industries in Malaysia: Petrochemical and polymer industry*. Retrieved from MIDA website: http://www.mida.gov.my/env3/index.php?page=petrochemical

[26] *Petrochemical industry*. Retrieved from MPA website: http://www.mpa.org.my/industry.html

[27] List of controlled goods. Retrieved from MDTCC website: http://www.kpdnkk.gov.my/en/senarai-barang-barang-kawalan