CHAPTER 1
GENERAL BACKGROUND

1.1 Introduction and Objectives

The emergence of petroleum industry in Malaysia has brought the country to a new era of development (Malaysian Business 1993). Over the years, she has provided thousands of employment opportunities, attracted billions of investment and created uncountable wealth to the nation (Sadri 1991). In most of developing countries, consumption of petroleum products has implication on its balance of payments, economic growth and fiscal deficit (Ramanathan 1999). Gasoline is one of the prime petroleum products. Internationally, a large number of econometric studies on gasoline demand have been conducted over the years, particularly during the 1970s and the early 1980s when fuel prices were high and concerns about energy conservation and energy security were strong (Uri and Boyb, 1998). Recent concerns about global warming and increasing levels of carbon in the atmosphere have re-ignited interest in understanding the demand for gasoline, particularly in explaining cross-country differences in gasoline consumption and automobile driving and in predicting the impact of fuel tax on driving pattern and fuel consumption (Espey, 1998). With automobile ownership and vehicle miles travelled increasing in virtually every country over the past decades, determining the role of fuel prices and income in fuel demand is integral to effective environmental policy making at both the national and international level (Espey, 1998).

This study is strongly motivated by the increasing environmental awareness of the public over the use of gasoline, in the light of the expansion of the domestic oil and automobile markets. The purpose of this study is to analyse the demand pattern of gasoline and its determinant factors using econometric model. It is also to review the role and involvement of government in this oligopolistic market, with the aim of establishing the influence of price and legislation on the demand for gasoline in Malaysia.

The null hypothesis adopted here is :

H0 = Price, income, vehicle stock and legislation are the determinant factors influencing gasoline demand in Malaysia

1.2 The Development of Petroleum Industry in Malaysia

1.2.1 The Historical View

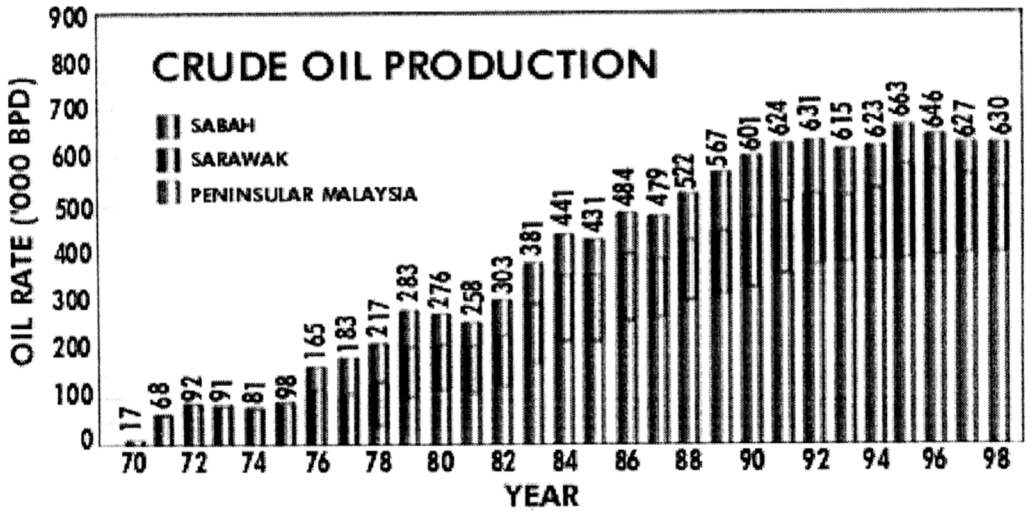
The earliest official recorded oil search in Malaysia was at the village of Miri in Sarawak in 1882, although the people of Sarawak and Sabah had long known the existence of oil seepage, or "earth oil" as it was then known (Creffield 1997). The commercial exploitation of oil began at the turn of the century. In 1909, the Anglo-saxon Petroleum Company, forerunner of the present day Sarawak Shell, won the first petroleum concession when it was given the sole rights to explore petroleum resources throughout Sarawak. Oil was struck at Miri in 1910. Daily production started at 80barrels and increased to a peak of 15,000 barrels in 1929. Miri was Malaysia's only onshore field and in just over 60 years, it produced over 80million barrels of oil (Chee 1981).

Advances in petroleum recovery technology allowed attention to be diverted to offshore areas of Malaysia by the mid-1950s. Marine seismic surveys were carried out off the coast of both Sabah and Sarawak in the mid-1950s with the discovery of oil in the Patricia and Temana fields (Sadri 1991). The first offshore oilfield to go into operation was West Lutong, off Sarawak in 1968 with daily output 3000 barrels. By 1973, a total of 19 oil fields had been discovered in Malaysian waters and four brought into operation with total production of 90,000 barrels per day (Creffield 1997). Meanwhile, exploration efforts had been gathering momentum in Peninsular Malaysia when Esso and Conoco were awarded concessions off the east coast the peninsula. The first field declared commercially exploitable over this part of Malaysia was the Seligi field that went into production in 1988 (Petronas Homepage). Measuring only 12km by 8km, the Seligi field is the richest field so far

discovered in Malaysia and has estimated recoverable oil reserves of 1.2billion barrels (Creffield 1997).

Malaysia has about 3.6billion barrels of crude oil reserves and 85.8trillion standard cubic feet (scf) of gas reserves as at January 1999, placing the country at 27th and 12th places respectively in terms of world ranking (Petronas Homepage). The reserves recovered have increased tremendously from 0.9 billion barrels of crude oil in 1977. Its substantial contribution to the economy began during 1974 when oil prices increased. In 1973 oil was only accounted for 4% of total export earnings, but since 1980s it has emerged as one of Malaysia's main foreign exchange earners. Crude oil production currently stands at 719,400barrels per day, a three-fold increase in production as compared to 1977 (see Figure 1). At current production levels, it is estimated that Malaysia's present reserves will deplete in 15years, although exploration prospects are considered relatively good (Petronas Homepage). Principal export markets for Malaysia's crude petroleum are Singapore, Japan and South Korea.

Figure 1 : Crude Oil Production in Malaysia from 1970 to 1998



Source : Petronas Homepage, http://www.petronas.com.my

1.2.2 Legislation Development

In order to formulate optimum development strategy for the oil reserves in the country, Malaysian government had enacted a number of legislation resulted from the study by Walter J. Levy in 1964 (Chee 1981). They are :

(i) The Petroleum Mining Act, 1966

(ii) The Continental Shelf Act, 1966

(iii) The Petroleum (Income Tax) Act, 1967

(iv) Petroleum Mining Rules, 1968

The passing of the Continental Shelf Act enabled Malaysia to proclaim the ownership of natural resources beyond the territorial limits of the coastal states up to the water depth of 200 metres or deeper. Other Acts allowed the Government to establish various agencies for the issuance of exploration licenses, providing payment of royalties to the Federal and the State Government, taxes and profit sharing (Chee 1981).

Prior to 1974, the petroleum activities were governed by Petroleum Mining Act 1966 and Petroleum Mining Rules 1968. Oil exploration in Malaysia was undertaken by multinational oil companies under the "Concession System" where these foreign oil companies were subject to minimal control and were offered very generous terms in the form of long leases (Petronas Homepage). Although there were attempts of profit control by the government they were seemed to be ineffective (Sadri 1991). This situation ended in 1973 after the six month oil embargo imposed by OPEC that had caused severe escalation of oil prices. The Malaysian government started to recognise the importance of oils to the national economy (Foo and Ramasamy, 1991). She realised that there was an urgent need for a more nationalistic approach in the development of petroleum resources (Sadri, 1991). Subsequently, the Petroleum Development Act (PDA) was made effect on 1st October 1974.

The Act placed the entire ownership, rights, powers, liberties and privileges of exploiting petroleum resources on land or offshore Malaysia in

the hands of the national oil company, Petroliam Nasional Berhad (PETRONAS). The purpose is to enable the government through Petronas, to ensure that the development of petroleum industry (including the arena of activities related to petroleum), is in line with national interest and objectives. The establishment of Petronas marked the starting point for active national participation to control the oil industry (Petronas Homepage).

This provision implied an end to the concession system for the oil companies. The August 17th, 1994 was the transition point from the concession system to the current system of Production Sharing Contracts (PSC). Under the new system, these companies are awarded offshore blocs to prospect for petroleum. Any oil or gas extracted, after deducting 10% and 20% respectively for royalty and cost recovery from the contractors, will be shared between Petronas and the contractors in the ration of 70:30 (Information Malaysia Yearbook 1997). These contracts were signed between Petronas and contractors like Esso, Shell, British Petroleum and Elf Aquitane. The Ministry of Primary Industries introducing the Petroleum Development Bill in the Parliament on 24th July 1974 said the bill was

> ....a historic piece of legislation...(The new) petroleum policy of production sharing...is we believe, the most modern and progressive form of contractual relationship between a host government and an oil company ever to be devised to cater for the special problem and condition of developing countries interested in playing a direct and an active part in the search for oil and the development of their petroleum industries....

(Foo and Ramasamy 1991).

The licensing power in petroleum downstream activities was transferred from Petronas to the Ministry of Trade and Industry (MITI) provided by the Petroleum Development (Amendment) Act (PDA) of 1975, the Petroleum Development (Amendment) Act of 1977 and the Petroleum (Amendment) Regulations of 1981. PDA was later amended in 14th of January, 1991. This amendment vested powers in Ministry of Domestic Trade and Consumer Affair (MDTCA) that was formed on 27th October 1990 after the formation of the new Cabinet following the 1990 General Election.

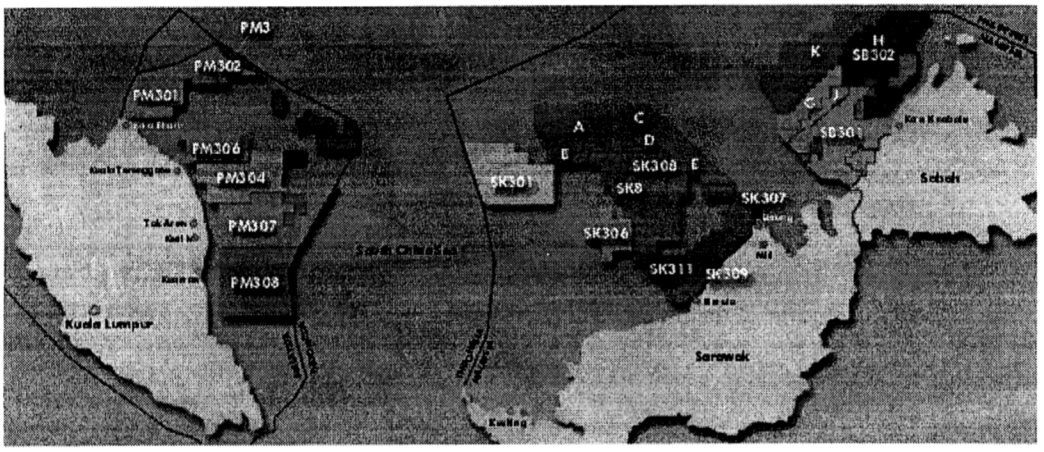
MDTCA and MITI jointly regulates all activities in the downstream sector. The MDTCA issues licenses for the marketing and distribution of petroleum and petrochemical products whereas MITI issues licenses for the processing and refining of petroleum as well as the manufacturing of petrochemical products. All licensing authority of upstream activities remain under Petronas.

1.2.3 Phases of Petroleum Operations

Basically the petroleum industry is divided into two distinct phases or sectors, namely upstream and downstream. The upstream sector involves exploration, development and production of crude oil and gas, whilst the downstream sector deals with refining and processing of crude products (oil and natural gas), marketing and distribution of the refined products and petrochemical industry.

In total, there are about 60 Production Sharing Contracts (PSC) in operation with more than 40 petroleum multinational companies. Malaysia has 494,183 km^2 of land and seabed available for oil and gas exploration of which 205,500 km^2 are currently covered by these contracts (Petronas Homepage). Until 1993, exploration and production activities took place in the broad continental shelf offshore of the states of Sabah, Sarawak and Terengganu. The country's deeper offshore areas, with water depth of 200 metres or more, have only recently been explored. Within the continental shelf, 5 major sedimentary basins in Malaysia have been identified as petroleum bearing. The water depth of these areas is between 25 and 200 metres. To date, exploration activities in the continental shelf have resulted in discoveries of 123 oil fields and 214 gas fields (Petronas Homepage). Figure 2 shows the areas and distribution of exploration blocs in Malaysia.

Figure 2 : Production Sharing Contract Areas

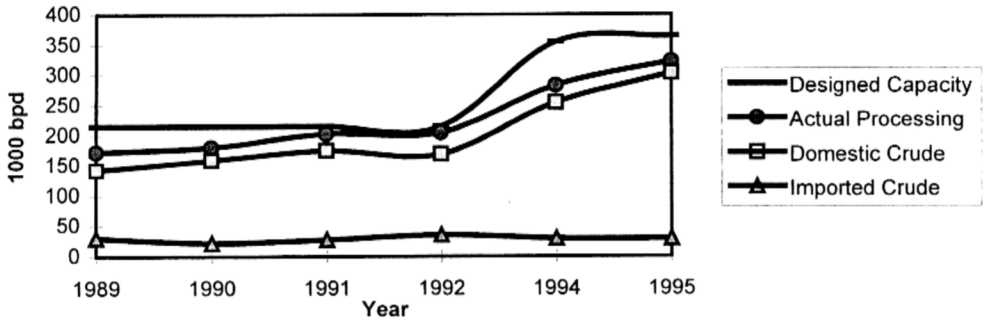


Bloc	Contractor
PM301, PM302, PM306, PM307	Petronas Carigali Sdn Bhd (PCSB)
PM3	Lundin (M) Ltd / Sands (M) Ltd AB / PVEP / PCSB
PM5, PM8	Esso Production (M) Inc (EPMI) / PCSB
PM304, PM306	Amerada Hess (M) Ltd / PCSB
PM308	Santa Fe Energy Resources of Malaysia Ltd / PCSB
SK8	Shell Oil and Gas (M) LLL / Nippon (Sarawak) / PCSB
Deepwater Blocs A, B, C & D	Esso Exploration & Production Sarawak Ltd / Mitsubishi / Mobil / Nippon Oil / JAPEX / Norsk Hydro / PCSB
SK301	YPF Malaysia Ltd / Mitsubishi Corp / PCSB
SK308, Deepwater bloc E	Sarawak Shell Bhd (SSB) / PCSB
SK307	PCSB / SSB
SK309, SK311, Deepwater bloc K	Murphy Sarawak / Sabah Oil Co Ltd / PCSB
SB302, Deepwater bloc H	Esso Exploration & Production Sabah Ltd / PCSB
SB301, Deepwater blocs G & J	Sabah Shell Pet Co / Sabah Shell Selatan / PCSB

Source : Petronas

The refining capacity of Malaysia has been increasing since the beginning of 1990s, as illustrated in the Figure 3. Presently, the licensed capacity of petroleum refineries in Malaysia stands at 528,000barrels per day including new investment from Petronas-Conoco-Statoil in Malaysia Refining Corporation (MRC) Sdn Bhd. (Melaka II) and expansion in Shell Port Dickson Refinery (see Table 1 below). Crude intake for these refineries are mainly from local resources.

Figure 3 : Domestic Refining Capacity from 1989-1995



Source : Department of Statistics

Table 1 : Present Licensed Refining Capacity in Malaysia (1999)

Location	Refinery	Capacity (barrel per day)
Melaka	Petronas	100,000
Melaka	Malaysia Refining Corp	100,000
Kertih	Petronas	45,000
Port Dickson	Esso	88,000
Port Dickson	Shell (after expansion)	150,000
Lutong	Shell	45,000

Source : Department of Statistics

Table 2 : Current Petroleum Downstream Facilities in Malaysia (1998)

Facilities	National	Petronas
Service Station	2569	500
Bulk depot	44	11
Bottling plant	20	8
Bunkering facilities	23	7
Aviation depots	19	10
Lube blending plant	7	1
NGV fuelling station	11	11
Multi-product pipeline	132km	132km

Source : Petronas

Billions of Ringgit has been invested in downstream facilities for marketing and distribution of petroleum products (see Table 2) (Petronas Homepage). Total investment in petrol kiosks for the whole country worth around RM4billion as at 1991 (Malaysian Business, April 1993). A 132km in length Multi-Products Pipeline, stretching from Melaka, Port Dickson and Dengkil is a breakthrough in the distribution of petroleum which commissioned in 1998. Total investment on the pipeline is estimated at RM150million excluding land acquisition (Petronas Homepage). This project marked a new development of strategic alliance between oil majors that brought substantial savings annually in distribution of petroleum products.

1.3 Gasoline and Gasoline Market In Malaysia

Gasoline, also known as petrol or motor spirit, is one of the value added products from crude refining. With its higher value and demand, gasoline is considered as the mainstream product and the major income generator for the petroleum companies.

1.3.1 Types of Gasoline

Generally, gasoline can be classified by its octane rating and lead content. Octane rating is a measure of anti-knock ability of gasoline - the higher the octane number of the fuel, the better an engine can resist knocking and the more efficient it can run. Two types of octane number are frequently used namely Research Octane Number (RON) or Motor Octane Number (MON). The former test is conducted in laboratory environment at milder test conditions whilst the latter is tested on actual highway driving conditions at higher speed and temperature. In Malaysia, RON is widely used for classification of gasoline. Formerly in Malaysia, gasoline with 3 grades of RON have been introduced so far i.e. RON85 (known as regular), RON92 and RON97 (premium). Due to advancement in engine technology, currently only gasoline RON92 and RON97 are available in the market.

Gasoline can also be classified as leaded and unleaded gasoline according to its lead content. Unleaded gasoline is petrol to which no lead has been added. Since 1930s, lead compound such as tetra-ethyl and tetra-methyl has been applied to petrol to boost its octane level as it was the most efficient and cost effective mean of increasing performance (AAM News 1990). Unfortunately, lead is harmful to the environment and human health. It causes smog and acid rain. It can be absorbed into the human body through breathing or food and water intake. The results of prolonged exposure to lead can range from relatively mild effects on the body to more serious ones such as behavioural and mental disorders to intellectual and growth impairment (Shell Malaysia Homepage). For these reasons, a typical permitted lead content for leaded gasoline in Europe is 0.15g/l (JICA Report 1993). In USA, it is controlled at a maximum 0.03g/l that allows continued operation of older engines, where lead is required to lubricate exhaust valve seats, rather than as an octane booster (Shell Science and Technology 1990).

Unleaded gasoline made its debut when it was introduced in the United States as early as 1971 (McArragher and Marriot 1990). Since then, "the green fuel" revolution has been gaining momentum. In Malaysia at present, there are no regulations governing the level of emissions from motor vehicles (JICA Report 1993). However, the government of Malaysia has made tremendous progress in areas which help to improve air quality, such as reduction of lead in motor gasoline and introduction of catalytic converter in all newly manufactured vehicles. In July 1985, the legislation required a reduction in lead content from the prevailing 0.84 to 0.4g/litre. As of 1st January 1990, the oil companies are required to further reduce it to 0.15g/litre. Nine years later, the country went totally "unleaded" of which all gasoline sold contain not more than 0.013g/litre of lead (Shell Homepage). Specification of gasoline sold in Malaysia as approved by SIRIM are attached in Appendix I. The development of gasoline's grade and pricing structure in Malaysia can be summarised in Table 3 below :

Table 3 : Gasoline Grade and Pricing Structure (KL Pump Price)

Type of Gasoline	Pump Price* (Malaysia sen/litre)			
	Prior 1994	1994	1995	1999
Leaded RON 97	113	113	-	-
Unleaded RON 97	113	110	110	110
Leaded RON 92	-	106	106	-
Unleaded RON 92	-	-	-	106
Leaded RON 85	106	-	-	-

* Pump price in KL (for Peninsular Malaysia)

Source : Compiled from data obtained from Ministry of Domestic Trade and Consumer Affairs (MDTCA)

The penetration of unleaded gasoline in the market has been encouraging since its first launch by Petronas and Shell in July 1990. With a start of 21 stations selling unleaded gasoline in 1990 (The Star, 26th July 1990), the product is now available at all stations in the country. However, the official introduction of unleaded gasoline only happened in 1994. Studies have shown that unleaded gasoline is more popular in countries where governments and the public are concerned for the environment. In Canada and Japan, only unleaded gasoline is used (Berita Harian, October 1990). At the point of introduction, about 25% of European motorists have turned to unleaded gasoline, but the number is fast increasing (Business Times, April 1994). Among all ASEAN countries, Malaysia is the first to use unleaded gasoline to promote a cleaner environment (JICA Report 1993).

Undoubtedly, the use of unleaded gasoline has not only benefited the motorists but also the public. Besides providing cleaner environment, unleaded gasoline is absolutely essential for vehicles using catalytic converters to minimise pollutants in the exhaust gas. Exhaust emissions such as unburned hydrocarbons, carbon monoxide and oxides of nitrogen can be reduced up to 95% through this converter. In addition, less corrosive by-products produced from unleaded gasoline also give rise to a longer service

life for spark plugs and exhaust system and hence increase the lifespan of engine oils. In all, unleaded gasoline brings better air quality and cost saving as parts replacement are less required.

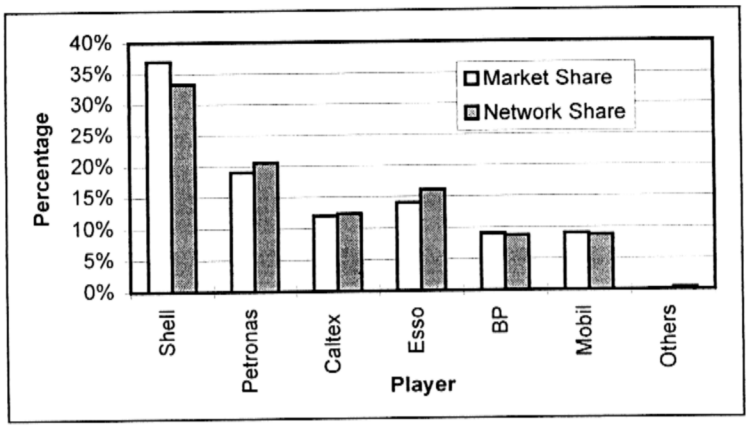
1.3.2 Market Situation

As a fast developing country, Malaysia has a relatively huge gasoline market (AAM News 1990). The size of gasoline market stands at 6.93billion litres per year in 1998 with the ratio of 75:25 for unleaded gasoline (RON97) and leaded gasoline (RON92) (Ministry of Domestic Trade and Consumer Affairs, MDTCA). Gasoline consumption has been increasing at an average rate of 8.3% per annum since 1990 to 1998. This has contributed to an estimated total revenue increase from RM900million in 1990 to RM2billion in 1998 to the government in the form of gasoline excise duty.

Malaysian gasoline market is very much oligopolistic in nature. There are altogether 8 players in the market which dominated by 3 major companies i.e. Shell, Petronas and Esso. These companies operate refineries locally with combined gasoline production of 2,391,946 tonne a year in 1998. The newcomer, a joint venture company between Conoco of US and Sime Darby group of Malaysia which carries the brand name of "Jet", started its first retail operation in September 1999. With her presence in MRC's stake, this company would be able to tap the local supply of gasoline from Petronas Melaka II refinery. The rest rely on imported gasoline mainly from Singapore.

Retail network (measured by number and distribution of retail stations),is viewed as one of the most important elements in gasoline marketing that directly influence the market share of each of the company. Among all, Shell has the highest number of stations in the country and followed by the national oil company. A comparison between retail networks vis-à-vis market share of the petroleum companies in Malaysia can be shown in Figure 4 as follows :

Figure 4 : Gasoline Market Share and Retail Network (As at September1999)



Source : Oil companies, MDTCA

1.3.3 Substitutes for Gasoline

One of the consequences of the 1973 Energy Crisis is the development of alternative fuels to substitute motor gasoline. Prior to the crisis the world was enjoying cheap energy especially when the crude oil prices were USD 1-3 per barrel. Gasoline prices were cheaper then; hence there appeared to be little incentive to develop substitute for gasoline (Chee, 1981). Rising energy price which was unprecedented before, occurred in the 1970s had triggered off massive research and development in the developed countries. As a results, today there are several options available to replace gasoline. Some of these options are perfect substitutes while others are either close substitutes or partial substitutes. Under any circumstances the crucial factors determining the suitability of this alternative as a substitutes appear to be the economics of the cost of production, the price and heat content of the alternative fuels. Its viability also depends on the price of gasoline because the higher the gap prices the greater the possibility of substitution. Technically, all the alternative fuels were developed under experimental environment. Data collected from these experiment were based on the short time frame of the experiment. Thus the long term effects of alternative fuels for motor vehicles have yet to be determined.

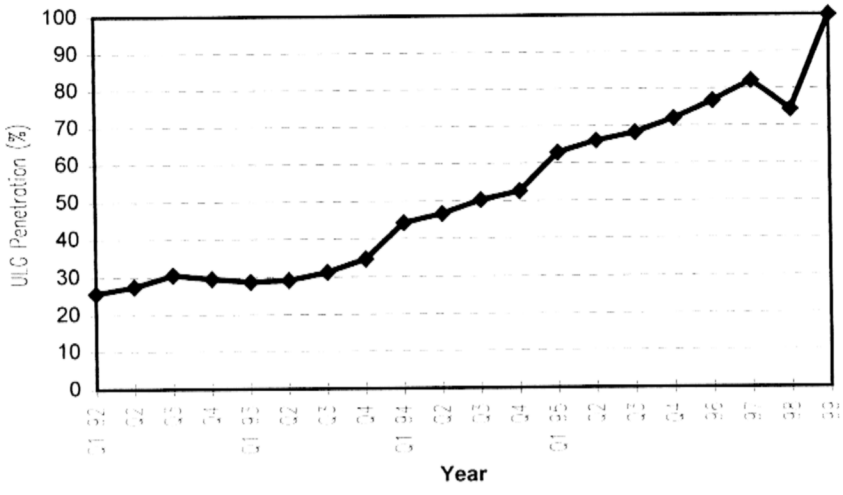
1.3.4 The Penetration of Unleaded Gasoline

Exhaust emissions from cars are the major contributors to poor air quality and a potential health hazard. For this reason, the US (and especially the state of California) have imposed regulatory constraints upon cars and their emissions technologies since 1970. In the USA, unleaded petrol is now almost universal (Kahn 1996). In the European countries, unleaded petrol was first introduced in the mid of 1980s and its use has been encouraged by a number of European Union (EU) led regulations and widespread fiscal incentives (Stoneman and Battisti 1998).

In Malaysia, unleaded gasoline was introduced in 3 stages : the first stage involved voluntary introduction by some major players in 1991, the second stage was the country-wide launch of unleaded gasoline after the tax incentive announcement by the government in 1994 and finally, total lead phase out was achieved in January 1999 for both RON92 and RON97 grades.

Within two years of unleaded gasoline introduction, the demand for this environmental-friendly fuel had reached 25.7% diffusion rate i.e. 810,600 tonne in 1992 as shown in Figure 5. There was no fiscal incentive to motorists for the use of unleaded gasoline during that time. The demand for unleaded gasoline in initial stage was attributed to consumer preference and heavy communications by oil companies. Consumers with high environmental awareness had converted to unleaded gasoline on voluntary basis. The penetration rate was then stabilised at 25-30% of total gasoline consumption, owing to reasons like market saturation for this segment, supply constraints and also concerns over compatibility of gasoline in older vehicles.

Figure 5 : Unleaded Gasoline Penetration Pattern In Malaysia



Source : Shell (M) Trading Sdn. Bhd., MDTCA

In January 1994, 3 sen tax incentive was implemented to promote the use of unleaded gasoline and therefore shifted the demand curve of this product to the right - more quantity demanded as tax reduced. This situation can be observed from the surge in demand for unleaded gasoline from 293,900tonne in fourth quarter of 1993 to 419,237tonne in first quarter of 1994, a record growth in the demand of 42.6% within 3 months. Meanwhile, the diffusion of unleaded gasoline rose from 34.7% to 44.2% within the same period. The demand for unleaded gasoline was on upward sloping trend since then. Total consumption of unleaded gasoline in 1994 was estimated at 1,720,200tonne and its penetration rate hit more than 50% by end of 1994. In 1995, the market share of unleaded gasoline had overtaken its close substitute - the leaded gasoline. The penetration rate in 1995 was estimated at 67.2% with total sales of unleaded gasoline touched 3,042,000tonne. Demand for unleaded gasoline continued to grow due to requirement in newer engines to run on RON97 fuel. It reached more than 80% penetration in 1997. Unfortunately, the demand for gasoline dropped significantly in late 1997 possibly due to economy recession.

It is interesting to note that in 1998, price conscious customers have switched to leaded gasoline RON92 as there was a substantial price difference for 4sen between leaded and unleaded grade of two different RON ratings. The demand for unleaded gasoline shifted to the left and quantity demanded shrunk at the same price level. Total gasoline consumption in 1998 stabilised at the same quantity sold in 1997. However, there was a substantial increase in leaded consumption from 960,153tonne to 1,389,705tonne in 1997 and 1998, respectively. Such a sudden hike in leaded gasoline consumption indicated the switch-over of price-conscious consumers from ULG to leaded product. Leaded gasoline was totally removed and unleaded gasoline obtained its 100% market share since January 1999.