

SINGAPORE

- Singapore's primary energy demand is projected to grow at 2.8 percent annually between 2002 and 2030, spurred by increased demand for gas in electricity generation. Gas demand in the electricity sector is expected to increase to 14.5 Mtoe in 2030 from 2.9 Mtoe in 2002.
- Expansion of the refining industry will sustain oil demand growth in the next 28 years and help maintain the economy's role as an oil trading hub. Likewise, the strategy to diversify natural gas supply and plans to be a trading hub for natural gas will increase natural gas demand.
- The absence of indigenous energy resources, high dependence on imported oil for transport fuels and oil product trade will push the economy into developing new energy efficiency and conservation measures.

RECENT ENERGY TRENDS AND ENERGY POLICY

Singapore's primary energy consumption increased from 35.0 Mtoe in 2000 to 44.1 Mtoe in 2004, primarily from oil and gas spurred by the resilient growth in the industry and transport sectors.⁹⁸ The energy mix has seen a major shift in recent years. As a result of switching from oil to natural gas in electricity generation, Singapore has dramatically increased the consumption of natural gas since 2001 when the economy started importing natural gas from Indonesia. From 2000 to 2004, the share of natural gas in primary energy consumption increased from 5 percent to 20 percent. By contrast, the share of oil in total primary energy consumption decreased from 95 percent to 80 percent over the same period.

Not having its own energy resources, Singapore relies entirely on imported oil and gas to meet the economy's growing energy requirements. More than half of Singapore's oil import was re-exported, while the other half was retained for domestic use.

Singapore is the third largest refining centre in the world after the US Gulf Coast, and Rotterdam, and the primary refined products trading hub in Southeast Asia. Singapore also serves as the world's top bunkering port due to the economy's strategic location at the entrance to the Strait of Malacca.

To ensure supply security, Singapore is seeking to diversify natural gas supply sources. The economy has undertaken a study to investigate the feasibility of importing liquefied natural gas (LNG) and the construction of LNG receiving terminal by 2012.

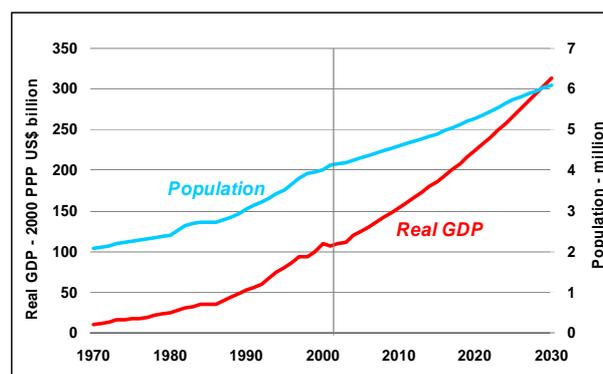
Most of the industrial activities in Singapore – refining and petrochemicals – use oil as the feedstock and are fairly carbon intensive. Therefore, as a means to minimise the burden to the environment resulting from the utilisation of oil, Singapore has

recently initiated the “Singapore Green Plan 2012”, which anticipates reducing CO₂ emissions by at least 25 percent of the 1990 level by 2012. The Plan outlines strategies to achieve the target through greater energy efficiency improvement, use of cleaner energy sources in the industry, commercial, and transport sectors. Some of the measures adopted include: 1) voluntary energy-efficiency labelling for appliances and buildings, 2) fuel switching in electricity generation, and 3) introduction of “green vehicles” (such as hybrid, and CNG).

ENERGY DEMAND DRIVERS

Singapore's GDP is expected to grow at an annual growth rate of 3.8 percent over the outlook period. The growth will continue to be led by the services and industrial sectors.

Figure 98 GDP and Population



Source: Global Insights (2005)

Over the outlook period, Singapore's population is projected to grow at a slower rate of 1.4 percent per year, compared with the 2.5 percent growth in the past two decades. The slower rate of growth reflects the economy's low fertility rate, which has been declining over for the last two decades. Population is expected to increase from 4.2 million in 2002 to 6.1 million in 2030.

⁹⁸ BP (2005)

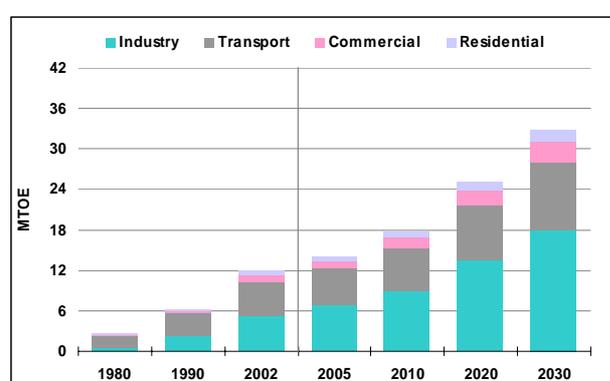
Singapore being a small island economy is highly urbanised and will remain so over the outlook period at 100 percent.

OUTLOOK

FINAL ENERGY DEMAND

Singapore's total final energy demand is projected to grow at an annual rate of 3.7 percent from 12 Mtoe in 2002 to 33 Mtoe in 2030. Industry sector will maintain the largest share at 55 percent, followed by transport (30 percent), commercial (10 percent), and residential (5 percent). The commercial sector and the transport sector are both expected to grow fast at 4.4 percent per year during the outlook period.

Figure 99 Final Energy Demand



Source: APERC Analysis (2006)

Industry

Energy demand in the industrial sector is projected to grow at an average annual rate of 4.4 percent until 2030. The robust growth will be mainly driven by planned developments in the energy-intensive petrochemical industry, which accounted for about 29 percent of the total manufacturing value added in 2002, and 81 percent of total industrial energy demand. Singapore plans to remain the leading refining centre and refined products trading hub in Asia. Recent developments in the petrochemical industry include the start-up of the second naphtha cracker plant by Petrochemical Corporation of Singapore and a US\$200 million synthetic gas plant by Messer and Texaco on Jurong Island. In addition, ExxonMobil has proposed to expand existing ethylene cracking production capacity to more than 900,000 tonnes per day by 2006. Royal Dutch Shell also plans to set up a new naphtha cracker facility with a production capacity of 900,000 tonnes per day in 2009. As a result of these capacity expansions, demand for naphtha is projected to grow at an average annual rate of 4.9 percent and account for 85 percent of total industrial energy demand in 2030. Due to the capacity expansions of energy

intensive petrochemical industry, energy intensity⁹⁹ in the industrial sector is expected to increase at an average annual rate of 0.3 percent from 137 toe per US\$ million in 2002 to 150 toe per US\$ million in 2030.¹⁰⁰

Transport

Given the small land area (650 km²) and high population density (at 6,425 persons/km²), Singapore has been developing a comprehensive road transport system that can efficiently handle both freight and passenger transport. In particular, Singapore has been striving to reduce dependence on passenger vehicle and encourage the use of public transport. With the implementation of various economic instruments such as mandatory acquisition of a certificate for passenger vehicle ownership, and electronic road pricing on congested roads, Singapore has successfully slowed the growth in the number of passenger vehicles and consequently gasoline consumption.

Over the outlook period, energy demand for road transport sub-sector is expected to grow at an annual rate of 2.2 percent. Gasoline demand for passenger vehicles will grow by 1.8 percent annually, a slower rate than the previous three decades at 3.8 percent per year. As a result of the implementation of various economic instruments which limit passenger vehicle ownership, the number of vehicles per 1,000 population will not show any significant change from the 2002 level, remaining at around 102 per 1,000 population. Diesel demand for trucks is projected to grow annually at the steady rate of 2.4 percent since trucks are favoured as the main mode of freight transport for high value added manufacturing and petrochemical products.

Singapore's Changi international airport serves as a regional air transport hub and ranks as the second largest in Asia in terms of passenger handling capacity. In anticipation of the increasing number of passengers and volume of freight air transport, Singapore has been continuously upgrading airport facilities and promoting bilateral agreements with neighbouring economies on "open sky" initiatives that will facilitate the free flow of passengers and freight transport. As a result, the demand for jet kerosene, the primary fuel for air transport, is projected to grow robustly, more than doubling from 2.9 Mtoe in 2002 to 6.2 Mtoe in 2030.

⁹⁹ The amount of energy needed to produce a dollar's worth of industrial sector's value added

¹⁰⁰ Between 1980 and 2002, energy intensity in Singapore's industrial sector increased at an annual average rate of 5.9 percent as a result of drastic expansion of petrochemical industries.

Residential and Commercial

Singapore is a highly urbanised economy and utilises mainly electricity and gas in the residential and commercial sectors for space cooling and cooking.

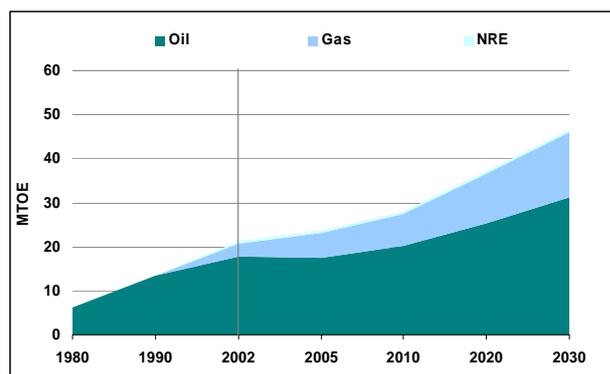
Energy demand in the residential sector is projected to grow at an annual rate of 3.7 percent over the outlook period, slower than the average annual growth rate of 5.4 percent over the past two decades. Demand for electricity, the major energy source in the residential sector, is expected to increase at 3.7 percent per year and account for 92 percent in 2030. Gas demand, on the other hand, is projected to grow at an annual rate of 3.1 percent and account for 8 percent of total residential energy demand in 2030.

Electricity is the only energy source utilised in the commercial sector. Over the outlook period, electricity demand is expected to increase at an annual rate of 4.4 percent, lower than the average annual growth rate of 8.1 percent in the past two decades. Faster growth in electricity demand is expected as a result of strong growth in the service sector, supported by the government’s policy to maintain Singapore’s position as Southeast Asia’s financial and high-tech hub.

PRIMARY ENERGY DEMAND

Primary energy demand is projected to grow at an annual rate of 2.8 percent, from 21 Mtoe in 2002 to 47 Mtoe in 2030. Natural gas will grow the fastest rate at 5.8 percent per year, followed by oil at 2.1 percent during the same period.

Figure 100 Primary Energy Demand



Source: APERC Analysis (2006)

Demand for natural gas is projected to increase dramatically from 3.1 Mtoe in 2002 to 14.7 Mtoe in 2030. Natural gas demand will be largely driven by the electricity sector, accounting for almost all of the total incremental growth up to 2030. Singapore continues to shift from oil to natural gas in the electricity generation to reduce the economy’s oil dependency. In 2002, all of the natural gas consumed

was met by imports from Malaysia and Indonesia through pipelines. Over the outlook period, to enhance the security of natural gas supply, Singapore is considering diversifying its sources for natural gas. By 2030, 40 percent of natural gas demand is expected to be met through LNG imports.

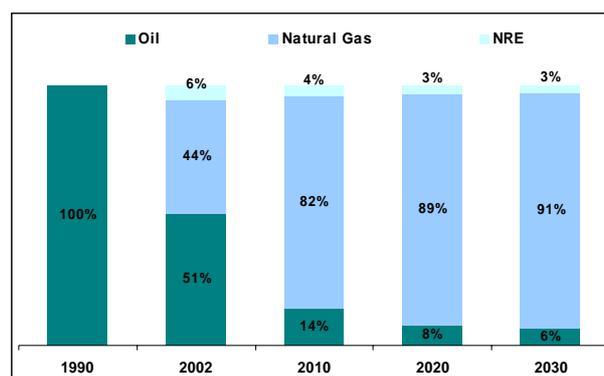
Oil demand will be boosted by the industry and transportation sectors, which will respectively account for 61 percent and 39 percent of total oil demand growth. Oil demand is projected to increase from 17.7 Mtoe to 31.3 Mtoe in 2030. To meet the projected oil demand growth, Singapore has been working to increase trade relations with the Middle East to guarantee against supply disruptions of crude oil. In addition, the expansion of independent storage facilities is underway as a means to increase the economy’s strategic reserves and protect against supply disruptions of crude oil.

ELECTRICITY

The electricity demand of Singapore is projected to increase at 3.8 percent per year over the outlook period. By 2030, installed generating capacity is expected to increase from 8 GW in 2002 to 18 GW.

The share of natural gas in the electricity generation mix is expected to increase from 44 percent in 2002 to 91 percent in 2030. Subsequently the share of oil is expected to significantly decrease from 51 percent in 2002 to 6 percent in 2030. Biomass from the waste-to-energy facilities will account for a small share at around 3 percent in 2030.

Figure 101 Electricity Generation Mix



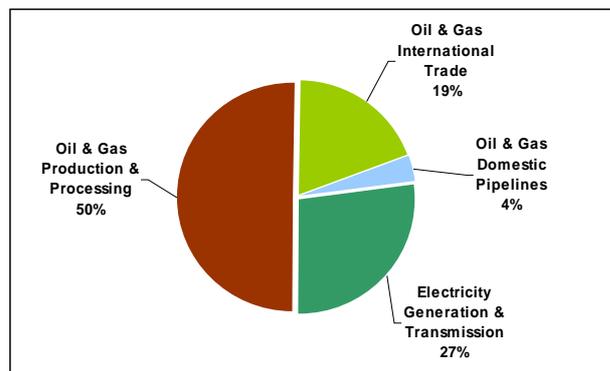
Source: APERC Analysis (2006)

INVESTMENT REQUIREMENTS

The total investments needed to develop Singapore’s energy infrastructure will reach a total of US\$ 31-42 billion by 2030. To maintain the economy’s leading position in the refining sector and export hub would require additional investment of between US\$20-29 billion. The construction of new electricity generation capacity and transmission

facilities will require substantial investments accounting for between US\$9-11 billion by 2030.

Figure 102 Investment Requirements

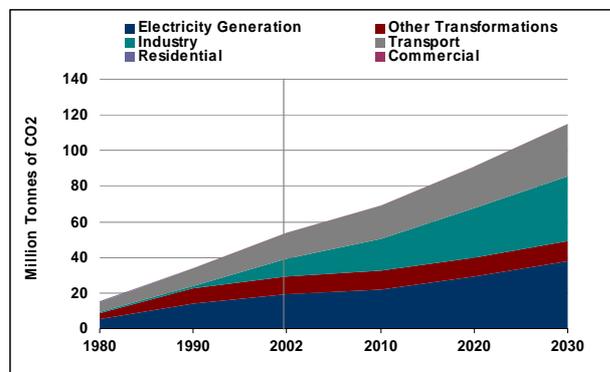


Source: APERC Analysis (2006)

CO₂ EMISSIONS

Over the outlook period, Singapore's total CO₂ emissions from the energy sector are projected to increase from 54 million tonnes of CO₂ in 2002 to 115 million tonnes of CO₂ in 2030. The share of CO₂ emissions is roughly distributed among the electricity, industry, and transportation sectors, each of which accounts for approximately 30 percent of the total CO₂ emissions in 2030.

Figure 103 CO₂ Emissions by Sector



Source: APERC Analysis (2006)

MAJOR ISSUES

MAINTAINING THE ECONOMY'S LEADING POSITION IN REFINING

Singapore is highly dependent on oil as the major energy source. Strategic location at the entrance to the Straits of Malacca, sound financial system, accessibility to infrastructure, transparent legal system and skilled workforce have established the economy as one of the top three oil trading and refining hubs in the world. However, to maintain the leading position will remain a major challenge for Singapore as regional rivals increasingly improve their export

market volumes. Refineries in India, Malaysia, and Thailand have all recently increased oil products export capacity and have been exerting competitive pressure on Singapore in the international and regional oil products market. Moreover, the trend towards cleaner fuels in Asia marketplace will pose a major challenge to an export oriented refinery. A substantial investment will be needed to upgrade existing facilities or to build new ancillary units. In addition, a more complex logistical support would be required to enable the segregation and handling of different grades of refined products.

One advantage the economy has over its rivals is that the oil industry in Singapore is the least governed among other sectors, which means the industry is conducting business in a totally free-market environment. Incentives have also been provided in favour of the industry. Some examples include low corporate tax and absence of legal oil reserve requirement.

SECURITY OF NATURAL GAS SUPPLY

Singapore promotes the utilisation of natural gas as a means to diversify energy sources away from oil and has been working on ways to make the economy a regional gas trader. The economy has initially set a target of increasing the share of natural gas in the electricity generation mix to 60 percent by 2012, but was consequently met in 2003 way ahead of schedule.

Singapore also plans to diversify the sources of its natural gas imports. The supply disruption of natural gas in 2003 from Indonesia has raised concerns about the security of natural gas supply. The incident has culminated in the government deciding to conduct a study on the viability of building an LNG receiving terminal to reduce dependence on pipeline natural gas. The success of the plan however will depend on LNG's competitiveness with pipeline natural gas and the ability of Singapore to use LNG facilities as a buffer stock of gas.

IMPLICATIONS

To maintain the economy's position as the major oil products exporter in Asia, Singapore has been providing incentives to oil companies to solicit more investment in the refining and petrochemical businesses. The leading oil products export position may however be challenged by other refineries in the region for example, China, Korea and India. Constant vigilance will need to be exercised such that Singapore constantly remains one step ahead of its competitors into the future.

In endeavouring to diversify the economy's import dependence away from oil, Singapore has

instead stressed the promotion of natural gas utilisation. The construction of an LNG receiving terminal will depend on the competitiveness of LNG with pipeline natural gas and whether regulation towards an integrated multinational regional natural gas market is realised.

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