

THAILAND

- *Thailand's primary energy demand is projected to grow at 4.6 percent annually over the next 28 years; mainly from increased demand for oil in the transport and industrial sectors.*
- *Reducing the economy's high reliance on natural gas for electricity generation will be a major challenge, just as increasing the use of coal to replace natural gas. In addition to increasing domestic oil and natural gas reserves and diversification of alternative energy sources, Thailand aims to enhance energy conservation measures to reduce energy demand in all sectors.*
- *Another way to secure Thailand's electricity supply is through power interconnection with either LaoPDR, Cambodia, and Viet Nam, through the Greater Mekong Sub Region Initiatives; of which a number of hurdles still need to be overcome (for example, lack of transmission facilities to effect transfers, regulatory protocols, cross-border tariffs, etc.)*
- *Investment of between US\$168 and 211 billion is required over the outlook period to construct the necessary infrastructure to meet Thailand's projected energy demand.*

RECENT ENERGY TRENDS AND ENERGY POLICY

Thailand's primary energy consumption has started to return to the levels of the pre-1997 economic crisis period, substantially increasing at a rate of 6.0 percent per year during 2000-2005, a slightly slower rate than that of the previous decade of 7.0 percent. Modest economic recovery, relatively stable and low petroleum prices, together with the growing number of passenger vehicles each year, have contributed to the economy's growth in total oil consumption at 5.0 percent per year in 2000-2005. In addition, the growth of energy consumption was fuelled by robust consumption for natural gas for electricity generation and to a lesser extent, for industries, at a rate of 8.0 percent. About 70 percent of Thailand's electricity is generated through natural gas, reflecting the economy's heavy dependence on natural gas for electricity generation.

Due to the economy's limited indigenous energy resources, Thailand relies heavily on energy imports, importing 64 percent of total energy consumption in 2005 mainly in the form of oil. Domestic procurement, however, have been accelerated to cope with the increasing consumption. Crude oil production increased 15 percent yearly from 62 thousand b/d in 2001 to 114 thousand b/d in 2005, which supplied only 10 percent of economy's total crude oil consumption. Natural gas production has also increased at a rate of 5.0 percent per year from 1,900 mmscfd in 2001 to 2,292 mmscfd in 2005. About 30 percent of total natural gas consumption is met by imports from neighbouring economies, like Myanmar.

With a view to reducing dependency on imported energy and strengthening energy supply security, the government formulated the "National Energy Strategy" in 2005 with the aim to reduce energy

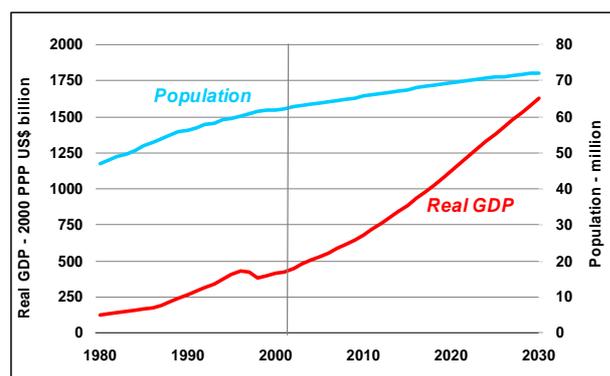
consumption by 13 and 20 percent in 2008 and 2009 respectively. Under this strategy, finding alternative energy and devising new technology for energy conservation are the top priority in the energy master plan. For example in the transportation sector alone, oil consumption is targeted to be cut by as much as 25 percent in 2009 and in 2008, about 180,000 vehicles powered by compressed natural gas is to be deployed in a bid to reduce gasoline and diesel consumption by 10 percent. Gasohol, or the so-called "E-10", is aimed to be utilised nationwide as a replacement for gasoline by 2008. Moreover, in the industrial sector, energy consumption is targeted to be reduced by as much as 20 percent through efficiency improvements by 2008. Factories inside the industrial estates are encouraged to switch to natural gas either through pipeline or liquefied natural gas or compressed natural gas. A joint public and private committee has also been established to boost energy conservation in various industries.

Government is also looking at the possibility of solving energy problems through the development of logistic system, which includes oil transport through pipelines, the improvement of mass transit system and freight transport by switching the mode of transport from cars and light trucks to the railway and waterway systems.

ENERGY DEMAND DRIVERS

Thailand's economy is projected to grow robustly at 4.7 percent over the outlook period, mainly as a result of increased export trading. The manufacturing and services sectors will remain the major contributors to GDP.

Figure 110 GDP and Population



Source: Global Insights (2005)

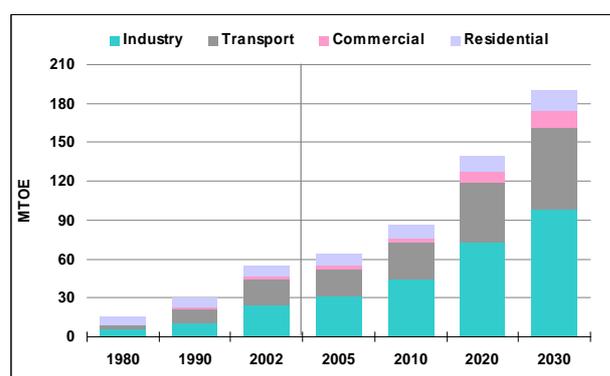
Soaring oil prices, conflict in the three southernmost provinces, as well as the avian flu outbreak in some poultry farms will have a lingering effect on the economy's growth in the short- to medium-term. Over the outlook period, Thailand's population is projected to grow at a modest rate of 0.5 percent per year, mainly as a result of the success in the population planning policy implemented during the past three decades.

OUTLOOK

FINAL ENERGY DEMAND

Thailand's total final energy demand is projected to grow at 4.5 percent per year, slower than the 6.0 percent annual growth in the last two decades. The total final energy demand will increase from 55 Mtoe to 190 Mtoe in 2030, the largest share of which will come from the industry sector (52 percent) followed by transportation (33 percent), residential (8 percent), and commercial (7 percent).

Figure 111 Final Energy Demand



Source: APERC Analysis (2006)

Industry

Industrial energy demand is projected to grow at an average annual rate of 5.0 percent, lower than the average annual growth rate of 7.5 percent over the past two decades. The government's strong

measures to improve energy efficiency and the shift of the industrial structure from energy-intensive to non-energy-intensive industries is expected to lower the projected growth in energy demand of the industrial sector. Over the outlook period, energy demand is expected to grow at almost the same level as the growth in industrial value added through 2020. This indicates the industrial value-added elasticity of energy demand will be around 1.0 between 2002 and 2020, while the elasticity will be reduced to less than 1.0 between 2020 and 2030. By fuel type, oil is projected to maintain the largest share throughout the outlook period, but will decline from 42 percent in 2002 to 32 percent in 2030. The gradual substitution of fuel oil with natural gas and the slow growth in diesel demand will result in the decline in the share of oil. On the other hand, natural gas is projected to grow at the fastest rate of 7.3 percent, slower than that of the rapid growth of 17.0 percent per year from 1990 to 2002. Natural gas is expected to be used as a feedstock for petrochemical production, as well as to replace fuel oil for boilers in the manufacturing sector.

Transport

Between 1990 and 2002, Thailand's transportation energy consumption has increased two-fold, mostly as a result of the increase in road transport. The number of passenger vehicles has grown at an annual rate of 10.4 percent, and the number of freight trucks has grown at an annual rate of 6.3 percent.

Over the outlook period, road transport is projected to continue to lead the growth in transportation energy demand, accounting for 90 percent of the incremental increase. The economy's continued income growth, at an annual rate of 4.2 percent, and the development of vehicle manufacturing industries is expected to increase the stock of passenger vehicles from 6.3 million in 2002 to 11.9 million in 2030. The increase in manufacturing, robust construction activities and further development in the agricultural sector will favour the use of trucks as the main mode of freight transport. As a result of these developments, it is projected that gasoline for passenger vehicles will increase three-fold, while diesel for minivans, trucks and farm vehicles will increase four-fold.

As a result of the rising gasoline and diesel demand and the worsening air quality problem, the government plans to implement several policy measures including the application of Euro IV emission standards from 2010. The government aims to introduce CNG vehicles; however the shares of alternative fuels such as natural gas and ethanol

will not grow substantially, and will account for only 1.0 percent of energy utilisation in road transport in 2030.

Residential and Commercial

The residential and commercial sectors currently do not have any direct use for natural gas and therefore will remain so in the future.

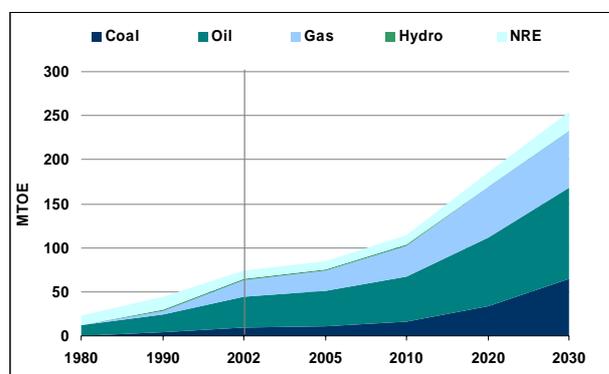
Thailand's residential energy demand is projected to increase at an annual rate of 2.0 percent over the outlook period, slightly higher than that of the 1.8 percent average annual rate in the past two decades. Along with income growth and improvement in people's living standards, electricity is expected to grow the fastest at an annual rate of 5.0 percent. Electricity will surpass combustible renewables and waste to become the biggest source of energy in the residential sector after 2020, with the share of electricity in the total residential energy demand increasing from 22 percent in 2002 to about 49 percent in 2030. Demand for petroleum products (kerosene and LPG for cooking) is projected to grow at 1.7 percent, from 1.7 Mtoe in 2002 to 2.8 Mtoe in 2030.

Strong economic growth will drive the commercial sector's electricity demand, to grow annually at the fastest rate at 5.7 percent, from 2.7 Mtoe in 2002 to 13 Mtoe in 2030.

PRIMARY ENERGY DEMAND

Total primary energy demand is projected to grow at an annual rate of 4.6 percent over the outlook period, from 74 Mtoe in 2002 to 258 Mtoe in 2030. Among the fossil fuels, coal is projected to grow at the fastest rate of 7.0 percent per year, followed by natural gas at 4.5 percent and oil at 3.9 percent.

Figure 112 Primary Energy Demand



Source: APERC Analysis (2006)

Coal is mainly utilised for electricity generation accounting for 70 percent of the incremental growth in primary energy demand. The share of coal is

projected to increase to 25 percent in 2030 from only 13 percent in 2002. Due to the low quality of Thailand's indigenous coal resources, the economy will have to import 91 percent of the total coal requirements in 2030.

Natural gas demand is projected to be largely driven by electricity generation and will account for more than 70 percent of the total incremental demand growth. The share of natural gas will decline from 34 percent in 2015 to 25 percent in 2030, as it is replaced by coal in electricity generation.

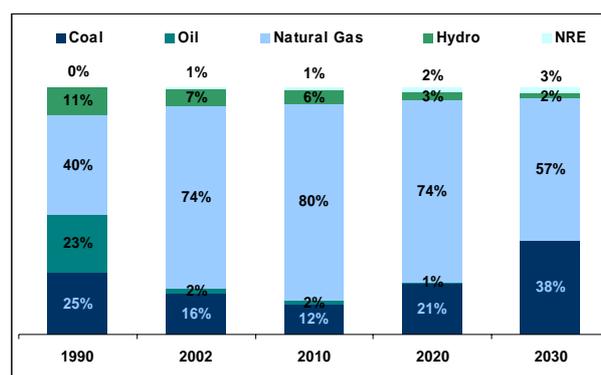
Oil demand is projected to grow annually at 3.9 percent, from 35 Mtoe in 2002 to 103 Mtoe in 2030, mainly driven by the transport and industry sectors. Net oil import dependency is projected to increase from 89 percent in 2002 to 94 percent in 2030 as a result of increasing demand and declining domestic oil production. Various alternative fuels have recently been introduced to further reduce oil demand.

ELECTRICITY

The economy's electricity generation is projected to increase annually at 5.5 percent, from 111 TWh in 2002 to 504 TWh in 2030, less than half the growth rate of 14.1 percent observed before the financial crisis in 1997.

Throughout the outlook period, natural gas will maintain the dominant share in the electricity generation mix but the share will decline from 74 percent in 2002 to 57 percent by 2030.

Figure 113 Electricity Generation Mix



Source: APERC Analysis (2006)

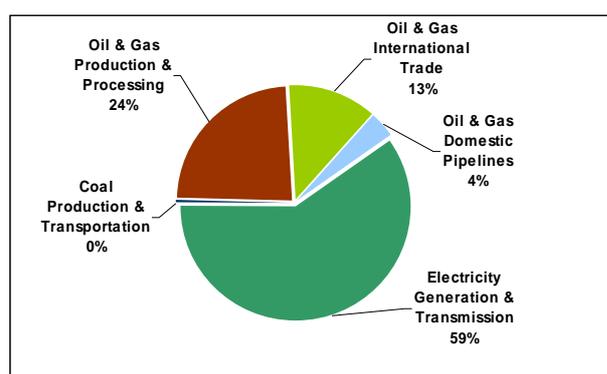
The economy's installed generating capacity is expected to increase from 23 GW in 2002 to 91 GW in 2030. Coal is projected to have an increasing share as more coal-fired electricity generation plants are commissioned after 2015. Subsequently capacity of coal-fired electricity generation is expected to increase from 3 GW in 2002 to 26 GW in 2030. On the other hand, the share of hydro will decline from 13 percent in 2002 to 4 percent in 2030, due largely

to environmental concerns. As part of Thai-Lao cooperation in promoting electricity generation in Lao, Thailand previously concluded an agreement to purchase electricity from various projects, with being expected to reach 42 TWh or 8 percent of the total generation in 2030.

INVESTMENT REQUIREMENTS

The expansion of electricity generation capacity, transmission, including oil and natural gas import infrastructure would require total investment of US\$168-211 billion by 2030.

Figure 114 Investment Requirements



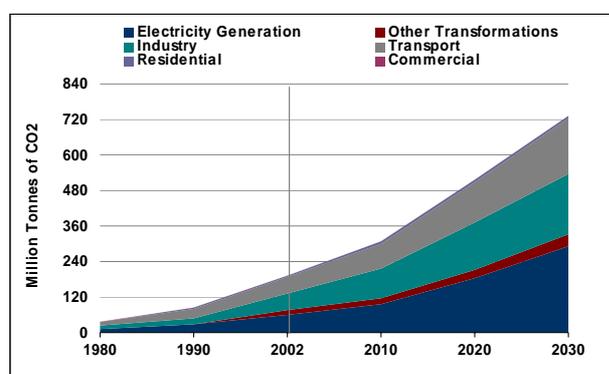
Source: APERC Analysis (2006)

Of this total, government initiatives to extend the economy's indigenous energy reserves will likewise require investment of about US\$35-51 billion over the same period.

CO₂ EMISSIONS

Over the outlook period, Thailand's total CO₂ emissions from the energy sector are projected to increase from 193 million tonnes of CO₂ in 2002 to 734 million tonnes of CO₂ in 2030. The electricity sector will be the major contributor accounting for 40 percent of total CO₂ emissions in 2030, or 294 million tonnes CO₂.

Figure 115 CO₂ Emissions by Sector



Source: APERC Analysis (2006)

MAJOR ISSUES

FUEL DIVERSIFICATION FOR ELECTRICITY GENERATION

Currently all natural gas utilised in the economy is met by domestic production, however, production is projected to decline from a peak of 26.6 Mtoe in 2010 to 16.5 Mtoe in 2030. This expected production decline coupled with the heavy reliance on natural gas for electricity generation, at 74 percent of total electricity generation capacity in 2002, has become a major concern for the government of Thailand and has prompted the desire to diversify fuel sources in order to reduce the economy's vulnerability in the future. Alternative sources such as imported coal and low calorific domestic lignite – with high sulphur content – are seen as a potential supply for the new capacity needed from 2011 onwards.

However, due to opposition on the siting of coal-fired power plants and a deep-sea port to handle coal deliveries/imports by local residents, Thailand is expected to face difficulties promoting coal. One example where local opposition influenced the construction of new coal-fired power plants was an incident in which leakage of heavy sulphur from the Mae Moh power plant in Lampang led to the cancellation of two Independent Power Producers (IPP) coal-fired power plants at Bo Nok and Hin Krut in 2002.

Thailand has tried to promote the utilisation of renewables as another means to diversify energy sources away from natural gas. However, widespread diffusion of renewables has been hampered by the cost competitiveness of renewables with other energy sources, high initial capital costs and the limitation of available renewable resources – especially biomass.

IMPLICATIONS

It is clear that with Thailand's projected high economic growth, supply of the much needed natural gas and oil will be a continuing challenge. Although Thailand has been very active in securing the economy's energy supply through various measures, a very important step is to consider building strong relations with neighbouring economies particularly those of the Greater Mekong Sub Region (GMS) for power interconnection.

Although economies in the GMS possess considerable sources of low-cost electricity generation (from hydro, natural gas and coal), these resources are geographically isolated from load centres and economic borders. Therefore, by interconnecting these areas of supply and demand it

would be possible to provide equitable and cheaper access to electricity, lower costs (through economies of scale), and reduce GHG emissions and other pollutants.

International developers in LaoPDR have started hydro development and have expressed an interest in exporting electricity to Thailand, while there are also plans to build power plants in the Yunan Province of southern China for possible interconnection to Thailand and Viet Nam. Other bilateral arrangements are also being considered and studied including the assessment of barriers to regional electricity trade and cooperation in the region.

Additional energy supply sources such as from overlap areas with Vietnam and Cambodia would have to be sought through joint exploration and drilling in order to secure its supply in the long term.

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