

# Chapter 3

## Country Analysis

June 2012

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# CHAPTER 3

## Country Analysis

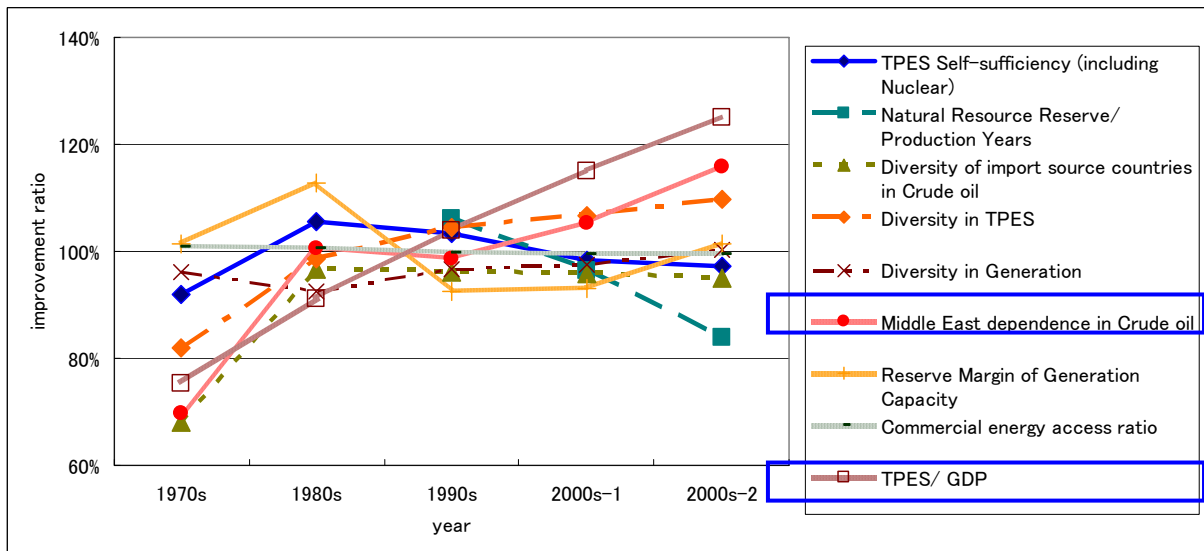
### 1. Methodology

The “scores” of each member country, gathered from the actual data, are described in this section. Since the purpose of this research is NOT to compare the scores of each index among member countries BUT to comprehend the strengths and the weaknesses of each of the member countries in securing energy, we have undertaken the procedures outlined below:

- 1) Calculation of the average indices in all OECD member countries from the 1970s to the 2000s

Figure 3-1 shows the trends of each index in OECD countries.

**Figure 3-1: Trends of each index in OECD countries**



There are three remarkable changes that have occurred over these 40 years in OECD countries. The first is a drastic improvement in their dependence on crude oil from the Middle East. The second is an improvement of energy intensity and total primary energy supply in proportion to GDP, meaning that energy-conservative

technologies have developed tremendously in these 40 years. The third is an improvement in the diversification of the primary energy supply. The development and commercialization of natural gas and nuclear as a power source would be the major factors for this improvement.

Domestic trends and progress in each ERIA member country should be evaluated as well, aside from these improvements in OECD countries. We have already collected average data in all OECD member countries in each index, as shown in Annex 1-8, and then we collected the average for each index throughout the evaluated period. We have selected the average throughout the evaluated period as a common base value to use for comparisons with country data.

2) Analysis of the “score” of each member country in comparison with the average in OECD countries

“Scores” are calculated as a ratio to the average value in the OECD. For example, the score for total self sufficiency (taking into account nuclear energy) in Japan can be calculated as below:

- Japan’s total self sufficiency in the 1970s = 10.5%
- The average in the OECD from the 1970s to the 2000s = 72.8%
- Japan’s score in total self sufficiency =  $10.5\% / 72.8\% = 0.1$

3) Consideration of the score in each member country, checking for any increases/decreases and any remarkable features

The scores in every country can be deduced if the data is sufficient. We found some remarkable increases/decreases in certain indices and tried to find any implications for efforts to secure energy and utilize resources in each country.

## **2. Country Analysis**

In this section, the major characteristics of the indices of each member country are described.

For all calculated scores described in the following chapters, the HIGHER SCORE shows the BETTER CONDITION.

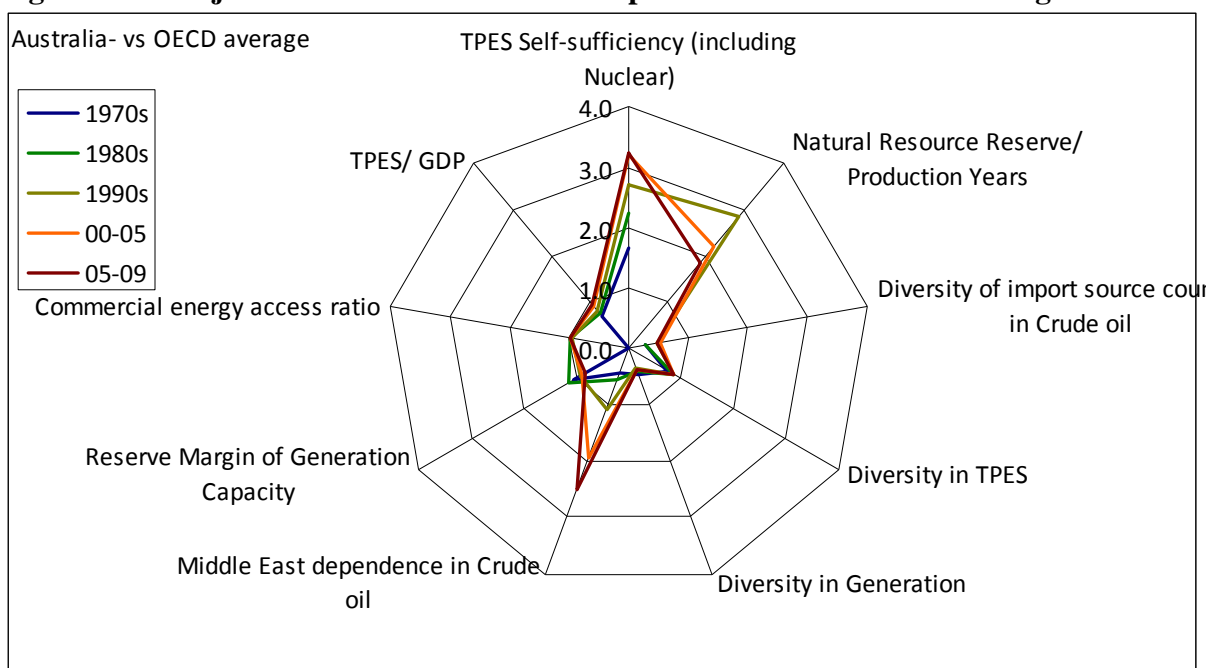
## 2.1. AUSTRALIA

Three major features are found in Australia. First, self sufficiency has been high in comparison with the OECD countries thanks to abundant coal and gas resources. Secondly, their power generation mix has not been diversified much, which reflects the high penetration of brown coal use in the power sector. Thirdly, dependence on oil from the Middle East has improved remarkably, and diversification was above the OECD average over the latest decade. One other thing of note is the gradually declining trend of reserve margin as a proportion of power generation capacity. The competitive electricity market structure may be able to explain one aspect of this trend.

**Table 3-1: Major Indices in Australia in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	1.6	2.2	2.7	3.2	3.2
Natural Resources Reserve/ Production Years			2.8	2.2	1.9
Diversity of import source countries in Crude Oil	0.26	0.3	0.5	0.5	0.5
Diversity in TPES	0.8	0.8	0.9	0.9	0.9
Diversity in Generation	0.5	0.4	0.4	0.4	0.4
Middle East dependence in Crude Oil	0.5	0.6	1.1	1.9	2.5
Reserve Margin of Generation Capacity	1.0	1.2	0.9	0.9	0.8
Commercial energy access ratio	-	1.0	1.0	1.0	1.0
TPES/GDP	0.7	0.8	0.8	0.9	0.9

**Figure 3-2: Major Indices in Australia in comparison with the OECD average**



## 2.2. BRUNEI

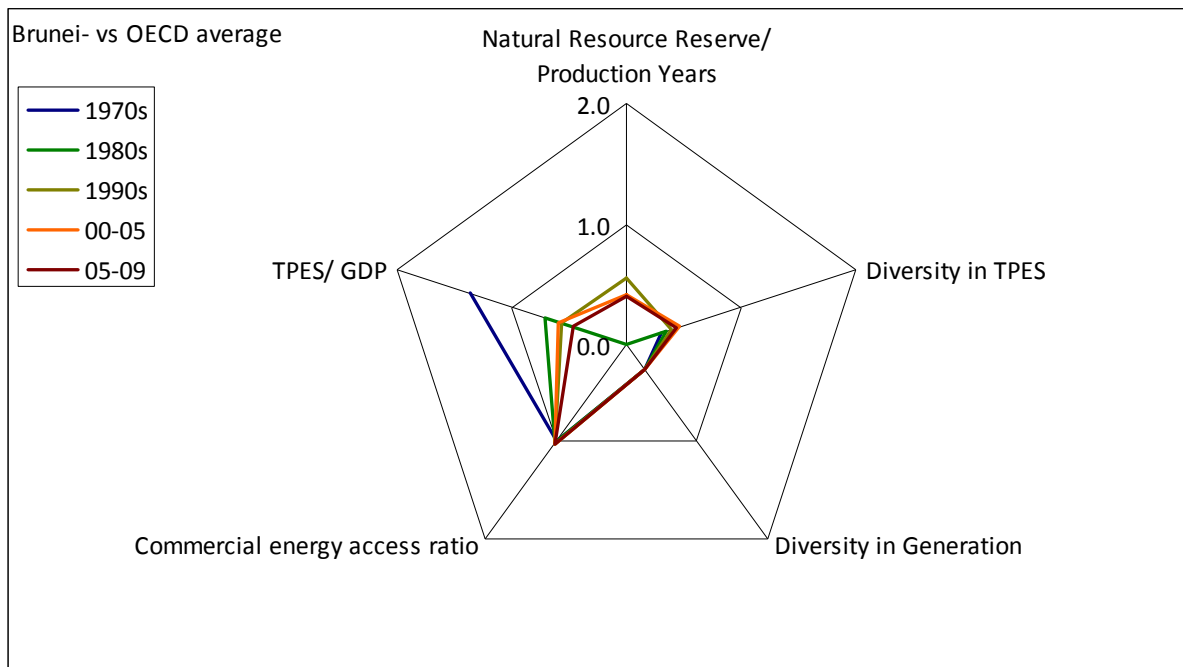
Brunei is a very rich county in natural resources and therefore its self sufficiency is one of the highest in the world. However, the self sufficiency rate has been decreasing in comparison with the OECD average, mainly due to its high consumption growth rate.

Energy efficiency, described by TPES/GDP, has been decreasing over the past 40 years. The improvement of energy efficiency while preserving fossil resources is a major issue to be addressed for the future.

**Table 3-2: Major Indices in Brunei in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	30.0	15.0	10.9	11.5	8.6
Natural Resources Reserve/ Production Years		-	0.5	0.4	0.4
Diversity in TPES	0.3	0.4	0.4	0.5	0.4
Diversity in Generation	0.3	0.2	0.2	0.2	0.2
Commercial energy access ratio	1.0	1.0	1.0	1.0	1.0
TPES/GDP	1.4	0.7	0.6	0.6	0.5

**Figure 3-3: Major Indices in Brunei in comparison with the OECD average**



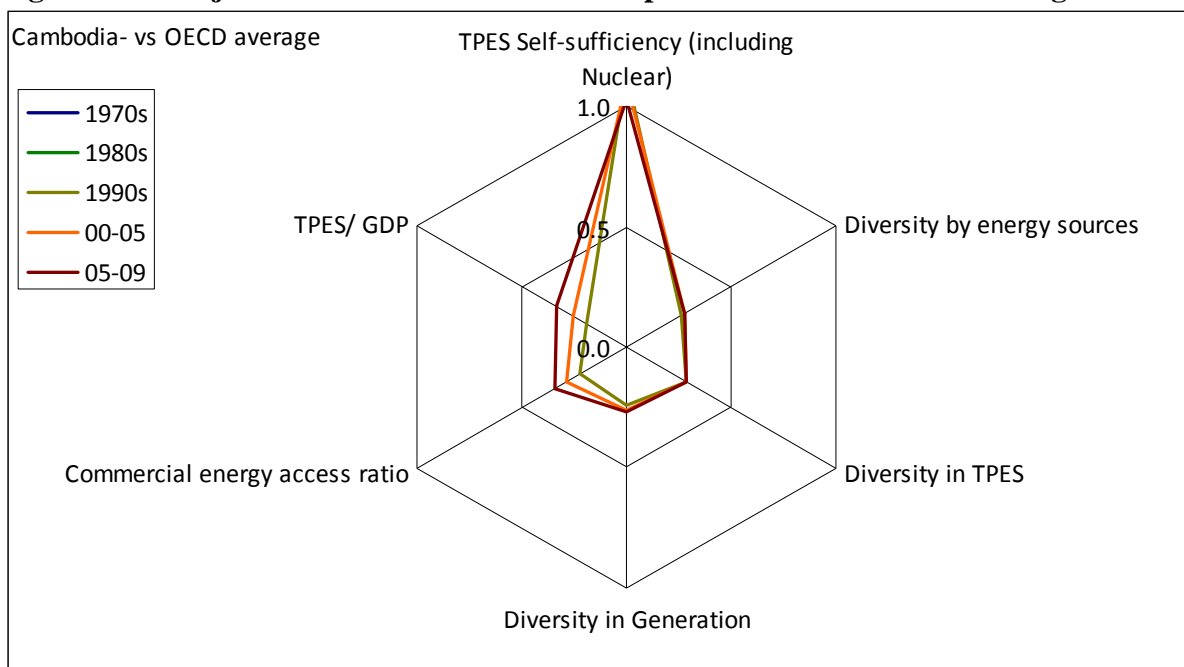
### 2.3. CAMBODIA

Self sufficiency in Cambodia has been higher than the OECD average over the past 40 years, mainly due to abundant hydropower and low energy demand. However, diversification is low both in terms of the primary energy supply and in terms of power generation. The energy efficiency, TPES /GDP ratio, has also been quite low in comparison with the OECD average, and thus Cambodia may possess a large potential to improve energy efficiency while increasing commercial energy access by switching from combustible bio-fuels to electricity.

**Table 3-3: Major Indices in Cambodia in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	-	-	1.1	1.1	1.0
Natural Resources Reserve/ Production Years	-	-	0.3	0.3	0.3
Diversity in TPES	-	-	0.3	0.3	0.3
Diversity in Generation	-	-	0.2	0.3	0.3
Commercial energy access ratio	-	-	0.2	0.3	0.3
TPES/GDP	-	-	0.2	0.3	0.3

**Figure 3-4: Major Indices in Cambodia in comparison with the OECD average**



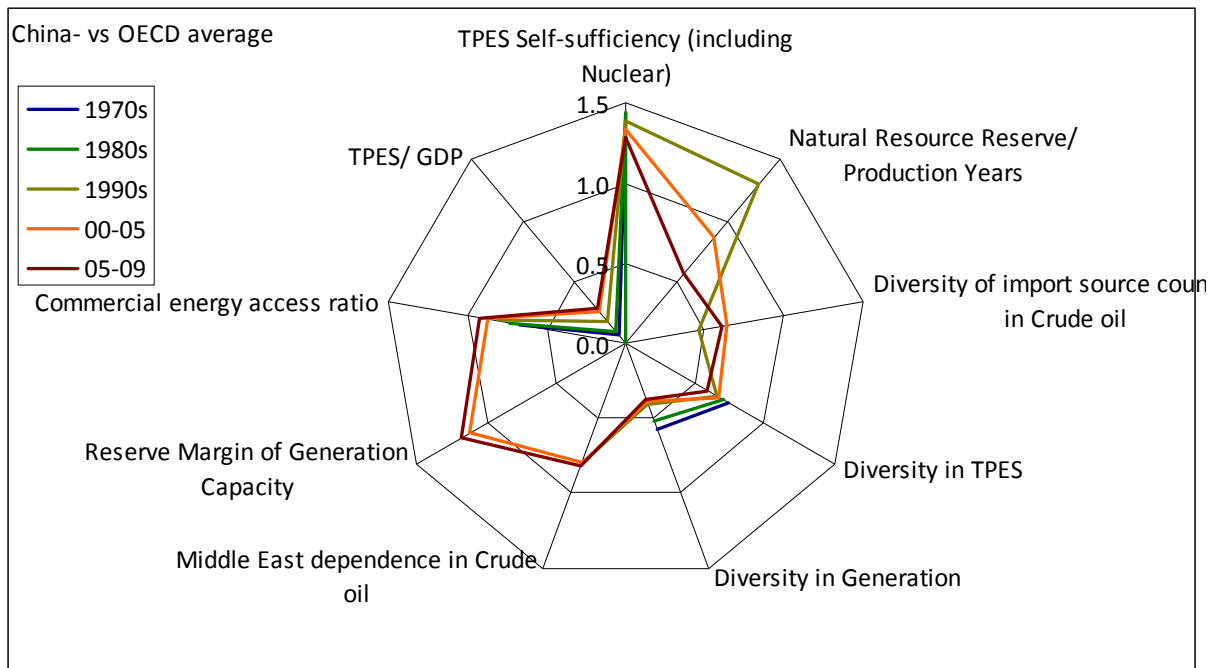
## 2.4. CHINA

Since China was an oil exporting country until the 1990s, they have not paid much attention to the diversification of import sources, nor to their power portfolio. Since the 2000s, however, China has been a large oil importing country and also the biggest energy consumer in the world. From the viewpoint of diversity, the increase of coal consumption in the power sector has caused the relevant scores to drop. When considering the changing situation related to imports dependency, which is only going to increase in China, diversifying import source countries and diversifying the energy portfolio (including in the power sector) as well as improving energy efficiency will be major issues to be pursued.

**Table 3-4: Major Indices in China in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	1.4	1.4	1.4	1.3	1.3
Natural Resources Reserve/ Production Years		-	1.3	0.9	0.6
Diversity of import source countries in Crude Oil			0.5	0.6	0.6
Diversity in TPES	0.7	0.7	0.7	0.7	0.6
Diversity in Generation	0.6	0.5	0.4	0.4	0.4
Middle East dependence in Crude Oil			0.8	0.8	0.8
Reserve Margin of Generation Capacity				1.1	1.2
Commercial energy access ratio	0.7	0.7	0.8	0.9	0.9
TPES/GDP	0.1	0.1	0.2	0.3	0.3

**Figure 3-5: Major Indices in China in comparison with the OECD average**



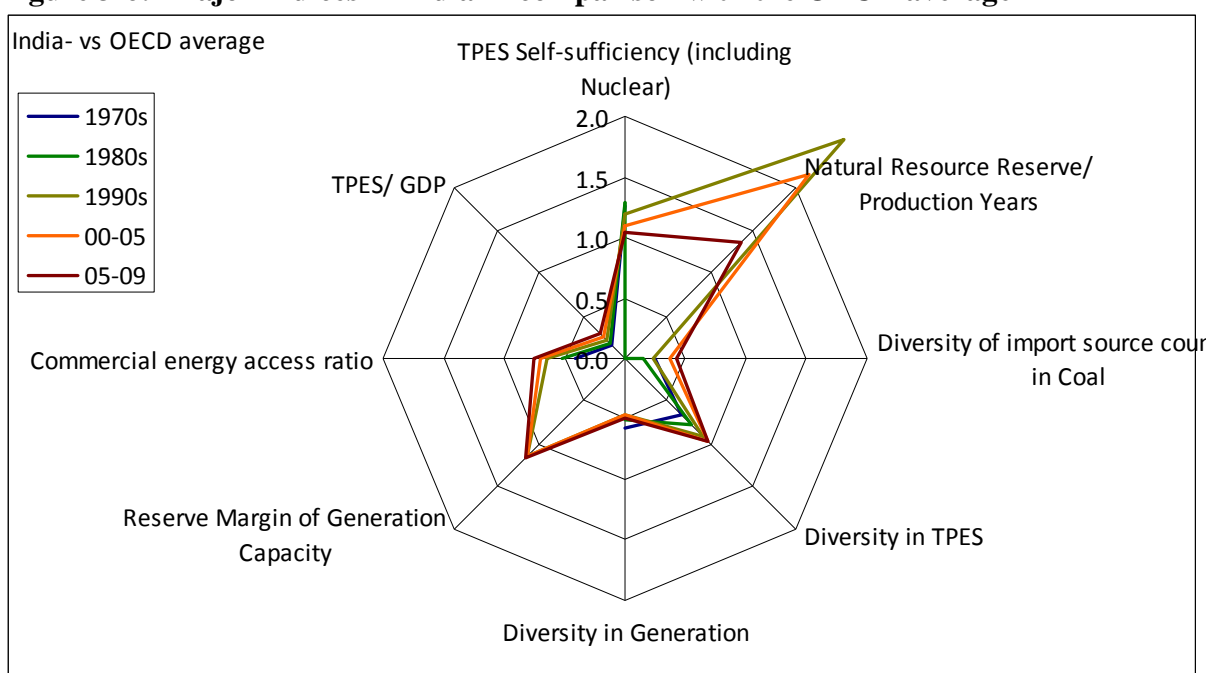
## 2.5. INDIA

India has abundant natural resources and has maintained relatively high self-sufficiency so far. Since the 2000s, however, energy consumption has been rapidly increasing due to high economic growth, and dependency on imports for energy supply is gradually rising to fill supply shortfalls from domestic resources. TPES is relatively well balanced here, but the power generation sector is not. The commercial energy access ratio has been rising and will surely have a positive impact on increases in electricity demand. It will be essential for the country to increase its energy efficiency from the current low level in order to both preserve domestic fossil resources and reduce import dependency.

**Table 3-5: Major Indices in India in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	1.3	1.3	1.2	1.1	1.0
Natural Resources Reserve/ Production Years		-	2.5	2.2	1.4
Diversity of import source countries in Coal	0.25	0.2	0.2	0.4	0.4
Diversity in TPES	0.7	0.8	0.9	1.0	1.0
Diversity in Generation	0.6	0.5	0.5	0.5	0.5
Reserve Margin of Generation Capacity			1.1	1.1	1.2
Commercial energy access ratio	0.4	0.5	0.6	0.7	0.7
TPES/GDP	0.2	0.2	0.2	0.2	0.3

**Figure 3-6: Major Indices in India in comparison with the OECD average**





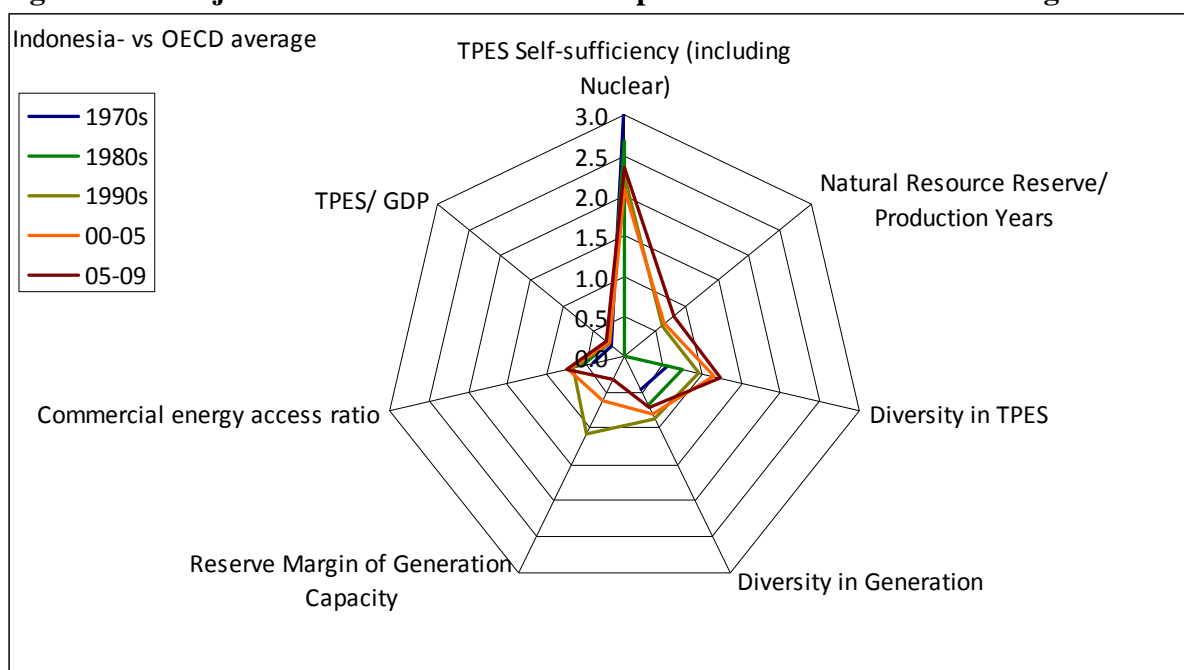
## 2.6. INDONESIA

The major features of Indonesia's ESI are the following three: first is a remarkably high self sufficiency thus far; second is a remarkable improvement in the energy portfolio, which has been above the OECD average over the recent 10 years; and third is falling electricity reliability, resulting in severe electricity shortages and frequent blackouts in urban areas. Appropriate investment into new power generation capacities may therefore be a key to enhancing the country's energy security. Beside these indices, it should be also noted that low energy efficiency and TPES/GDP should be urgently improved so as to help match the country's supply with its demand.

**Table 3-6: Major Indices in Indonesia in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	3.2	2.7	2.2	2.1	2.3
Natural Resources Reserve/ Production Years		-	0.6	0.6	0.8
Diversity in TPES	0.6	0.7	0.9	1.1	1.2
Diversity in Generation	0.4	0.7	0.9	0.8	0.7
Reserve Margin of Generation Capacity			1.1	0.6	0.3
Commercial energy access ratio	0.4	0.6	0.7	0.7	0.7
TPES/GDP	0.2	0.3	0.3	0.2	0.3

**Figure 3-7: Major Indices in Indonesia in comparison with the OECD average**



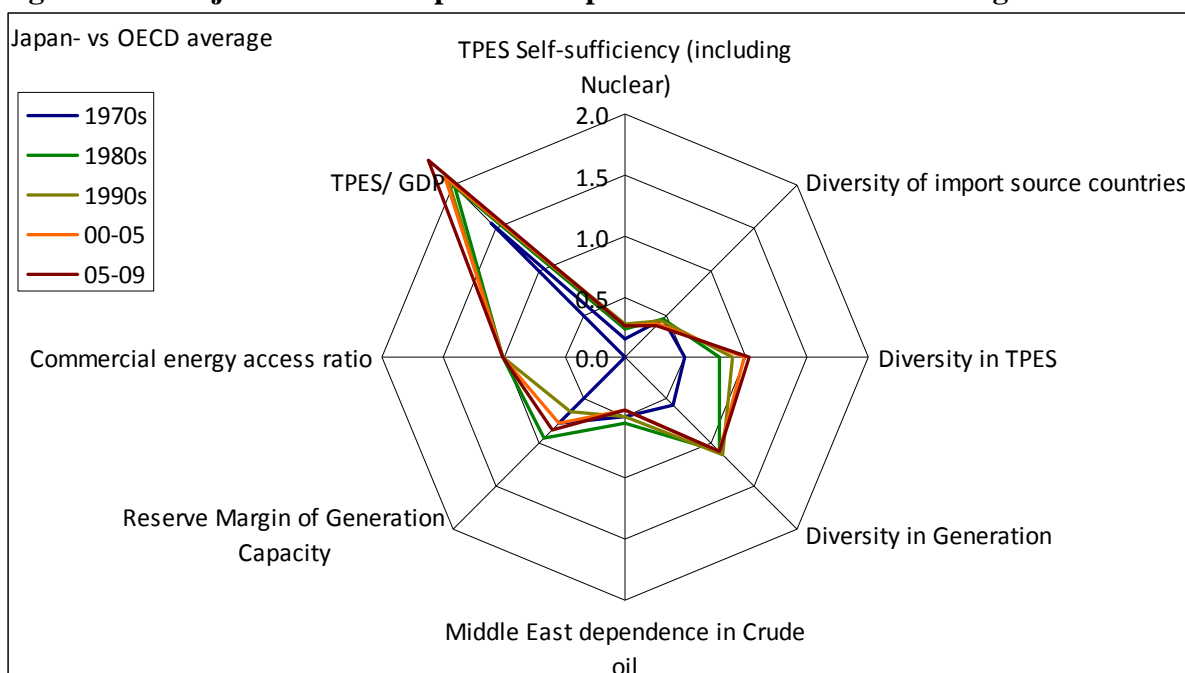
## 2.7. JAPAN

Japan is the third largest economy and one of the top energy demanding countries in the world. Due to a lack of fossil resources, Japan's dependence on imports for its energy supply has been quite high, resulting in apparently low self sufficiency. Most oil and gas comes from the Middle East. This situation has not changed for the past four decades; something which may be a potential threat to its energy security. Japan has decreased its dependence on oil by introducing nuclear energy and natural gas as alternative power sources, and, as a result, it has had a well diversified power portfolio since the 1980s. Furthermore, its lack of resources has encouraged the development of another positive feature in Japan – a remarkably high energy efficiency.

**Table 3-7: Major Indices in Japan in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	0.1	0.2	0.3	0.3	0.3
Diversity of import source countries	0.4	0.4	0.4	0.4	0.4
Diversity in TPES	0.5	0.8	0.9	1.0	1.0
Diversity in Generation	0.6	1.1	1.1	1.1	1.1
Middle East dependence in Crude Oil	0.5	0.5	0.5	0.4	0.4
Reserve Margin of Generation Capacity	0.8	0.9	0.6	0.8	0.8
Commercial energy access ratio	-	1.0	1.0	1.0	1.0
TPES/GDP	1.5	2.0	2.1	2.1	2.3

**Figure 3-8: Major Indices in Japan in comparison with the OECD average**



## 2.8. SOUTH KOREA

South Korea is still developing its energy security policy. Even though South Korea is the third largest economy in Asia and it has had high growth in relation to its energy demand since the 1990s, measures for energy security have only been launched in the last 10 years.

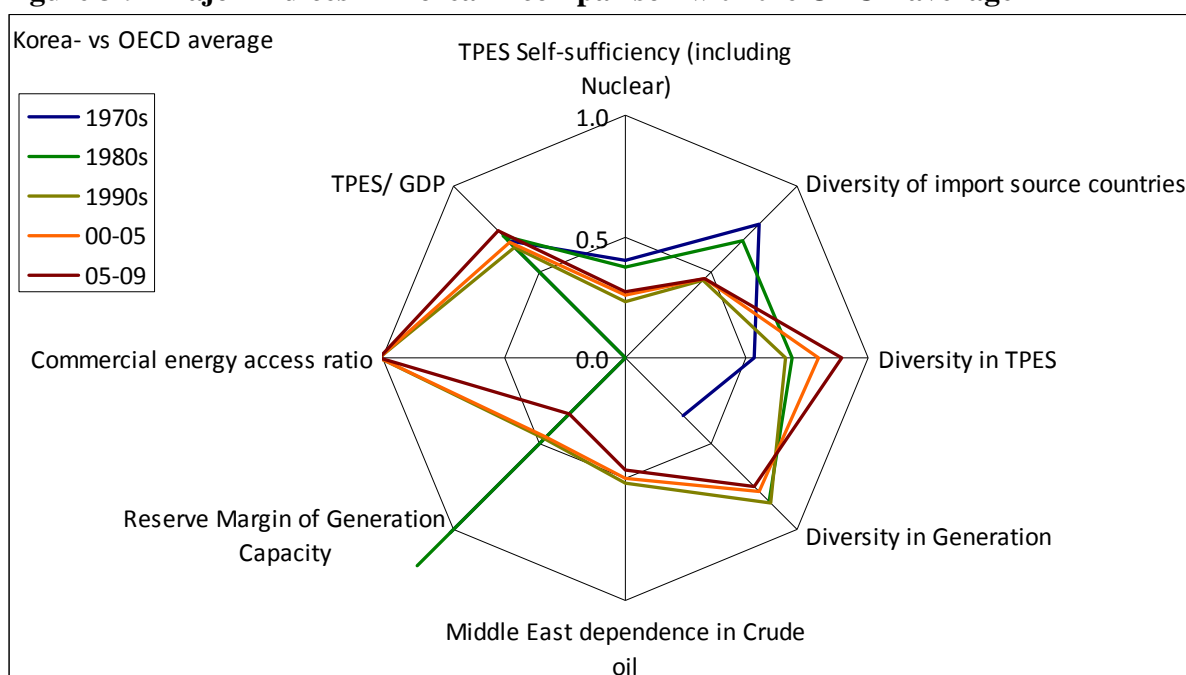
Due to a lack of domestic resources, South Korea has had to import a large amount of oil over these past 40 years and this has resulted in low self sufficiency and less diversity among its import source countries. It should also be mentioned that there is a downward trend for the reserve margin of generation capacity. The blackout which struck a large area including Seoul city in the summer of 2011 is still fresh in our minds.

Another feature of South Korea is its lower energy efficiency. The intense development of energy-saving technologies is a key measure to enhance energy security.

**Table 3-8 Major Indices in Korea in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	0.4	0.4	0.2	0.3	0.3
Diversity of import source countries	0.8	0.7	0.4	0.5	0.5
Diversity in TPES	0.5	0.7	0.7	0.8	0.9
Diversity in Generation	0.3	0.8	0.9	0.8	0.7
Middle East dependence in Crude Oil			0.5	0.5	0.5
Reserve Margin of Generation Capacity	1.0	1.2	0.5	0.5	0.3
Commercial energy access ratio	-	-	1.0	1.0	1.0
TPES/GDP	0.7	0.7	0.6	0.7	0.7

**Figure 3-9 Major Indices in Korea in comparison with the OECD average**



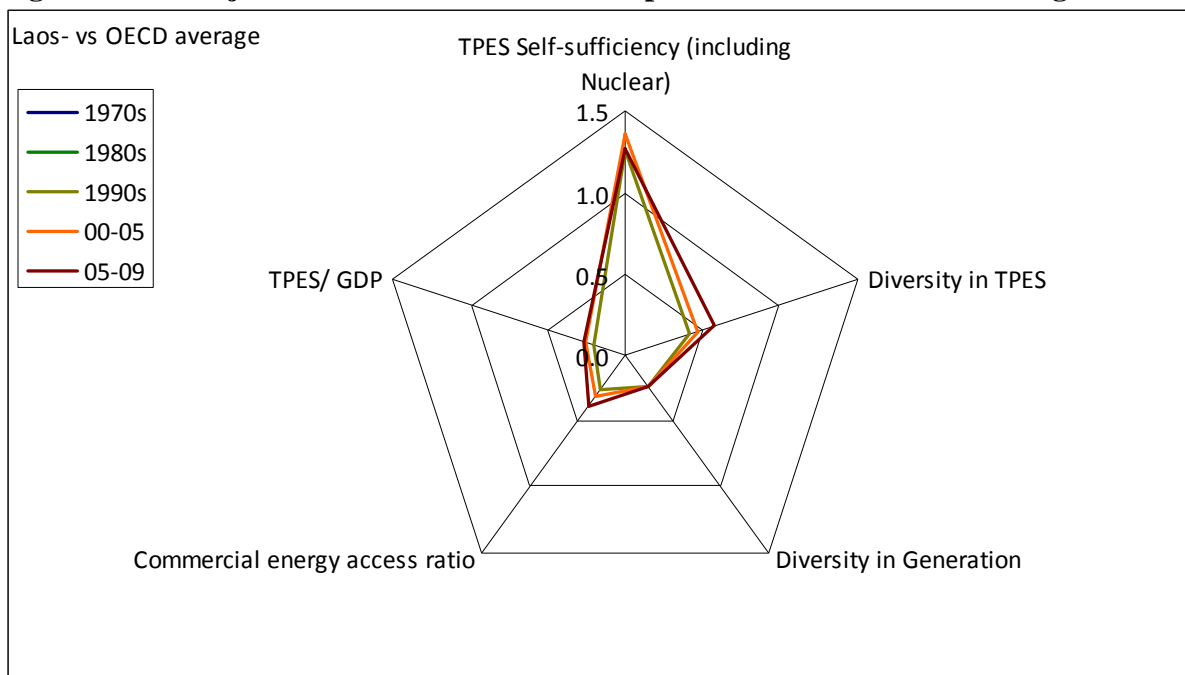
## 2.9. LAO PDR

Lao PDR does not possess abundant fossil resources such as oil, gas or coal. However, self sufficiency has been at a high level because of the availability of hydropower, which is sufficiently developed for power to be exported to neighboring countries. In other words, hydropower is the single source of power generation in this country, which means it faces the risk of reliance on a single source for its important energy supply. Commercial energy access ratios and energy intensity, TPES/GDP, has improved since the 1990's. However, the absolute level still remains low, thus continuous efforts may be required.

**Table 3-9: Major Indices in Lao PDR in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)			1.3	1.4	1.3
Diversity in TPES	-	-	0.4	0.5	0.6
Diversity in Generation	-	-	0.2	0.2	0.2
Commercial energy access ratio	-	-	0.3	0.3	0.4
TPES/GDP	-	-	0.2	0.3	0.3

**Figure 3-10: Major Indices in Lao PDR in comparison with the OECD average**



*Note:* This analysis is based on data obtained from the World Bank and ERIA, and does not reflect data provided by a WG member from Lao PDR, because of the time limitation for preparing this report.

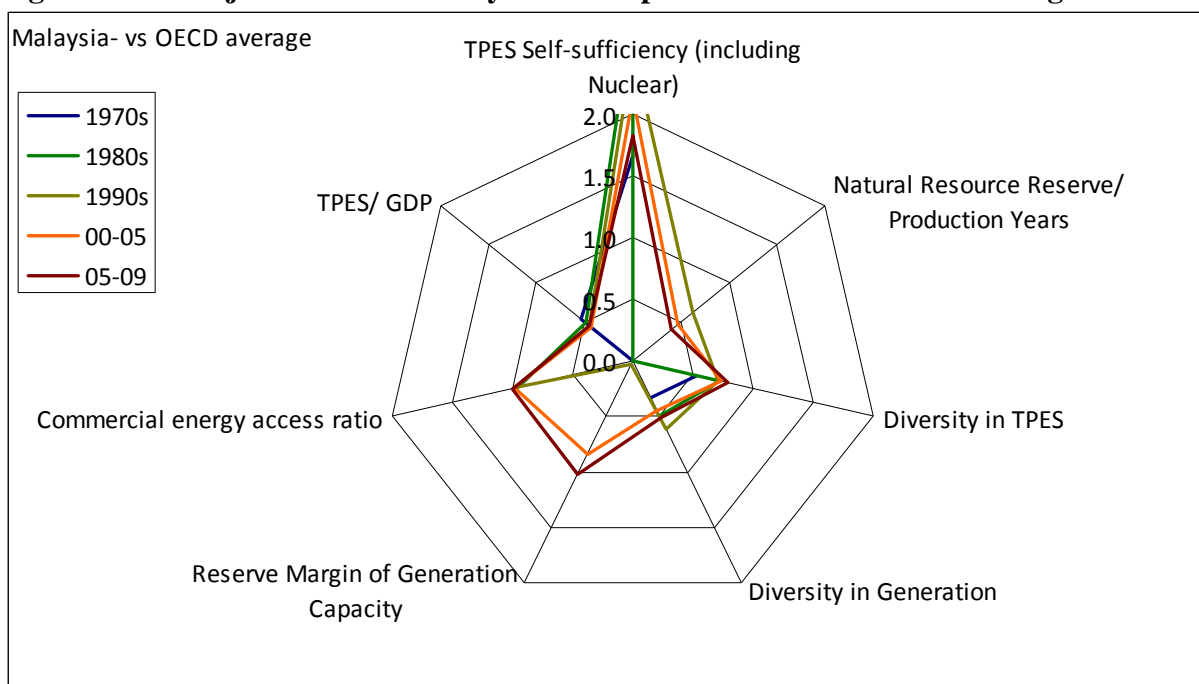
## 2.10. MALAYSIA

Malaysia is rich in oil and gas resources. Its self sufficiency has always been over 100% in the past 40 years, and it has been a good supplier to Japan, South Korea and so on. Its R/P ratio has been decreasing, however, mainly due to recent production increases. The conservation of natural resources to provide a sustainable and long-lasting supply of energy is a top priority in Malaysia's basic policy for energy security. At the same time, a heavy dependence on natural gas for power generation is something that poses risks, and as such the country is now pursuing the diversification of its power portfolio by employing other types of energy, such as coal, nuclear and renewable energies.

**Table 3-10: Major Indices in Malaysia in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	1.7	2.8	2.5	2.1	1.8
Natural Resources Reserve/ Production Years		-	0.6	0.5	0.4
Diversity in TPES	0.5	0.7	0.7	0.7	0.8
Diversity in Generation	0.3	0.7	0.7	0.7	0.8
Reserve Margin of Generation Capacity			0.0	0.8	1.0
Commercial energy access ratio	-	1.0	1.0	1.0	1.0
TPES/GDP	0.5	0.5	0.5	0.4	0.4

**Figure 3-11: Major Indices in Malaysia in comparison with the OECD average**



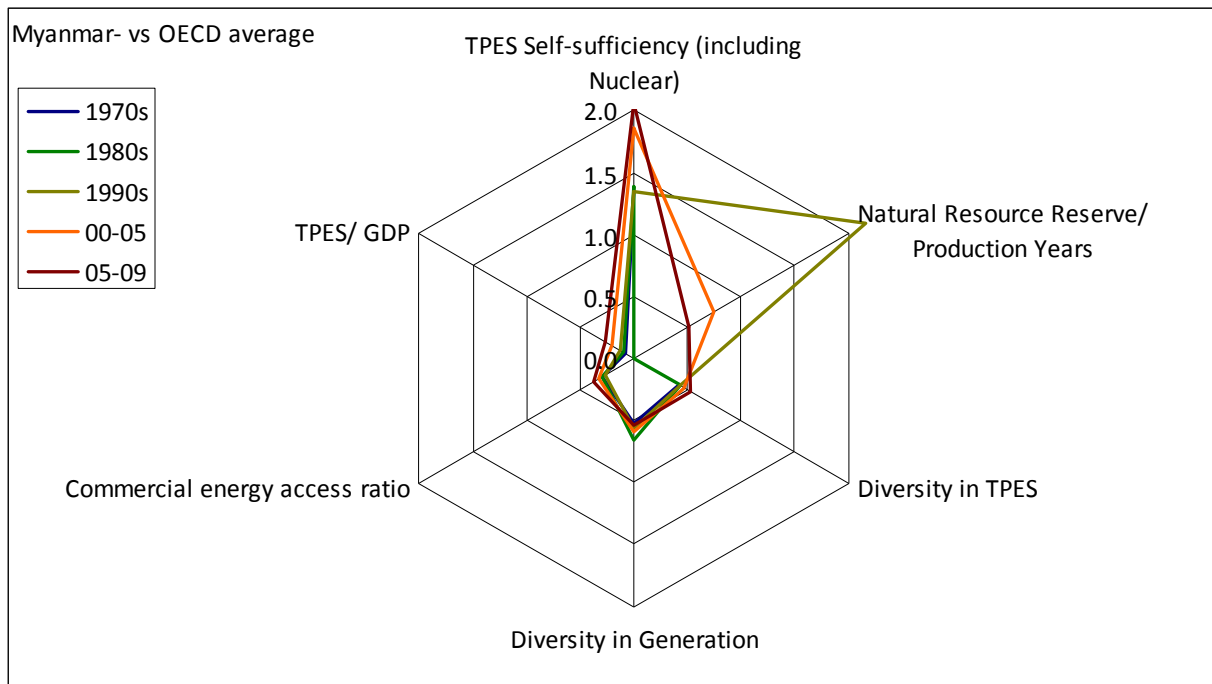
## 2.11. MYANMAR

Myanmar has few natural resources except for gas, but has relatively high self efficiency mainly due to abundant hydropower. Even though they are importing oil and coal for power generation, in terms of the international electricity trade they are in an exporting position. Recently, however, the commercial energy access ratio has been improving, meaning an increase in electricity demand. Diversity in TPES and in power generation are lower than the OECD average, thus they may have room to improve in these areas. While the efficiency of energy use has gradually improved after the 2000's, it still remains at the lower level, and thus is expected to be improved for the future.

**Table 3-11: Major Indices in Myanmar in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	1.3	1.4	1.3	1.9	2.1
Natural Resources Reserve/ Production Years		-	2.2	0.7	0.5
Diversity in TPES	0.4	0.4	0.4	0.5	0.5
Diversity in Generation	0.5	0.7	0.6	0.6	0.5
Commercial energy access ratio	0.3	0.3	0.3	0.3	0.4
TPES/GDP	0.1	0.1	0.1	0.2	0.3

**Figure 3-12: Major Indices in Myanmar in comparison with the OECD average**



## 2.12. NEW ZEALAND

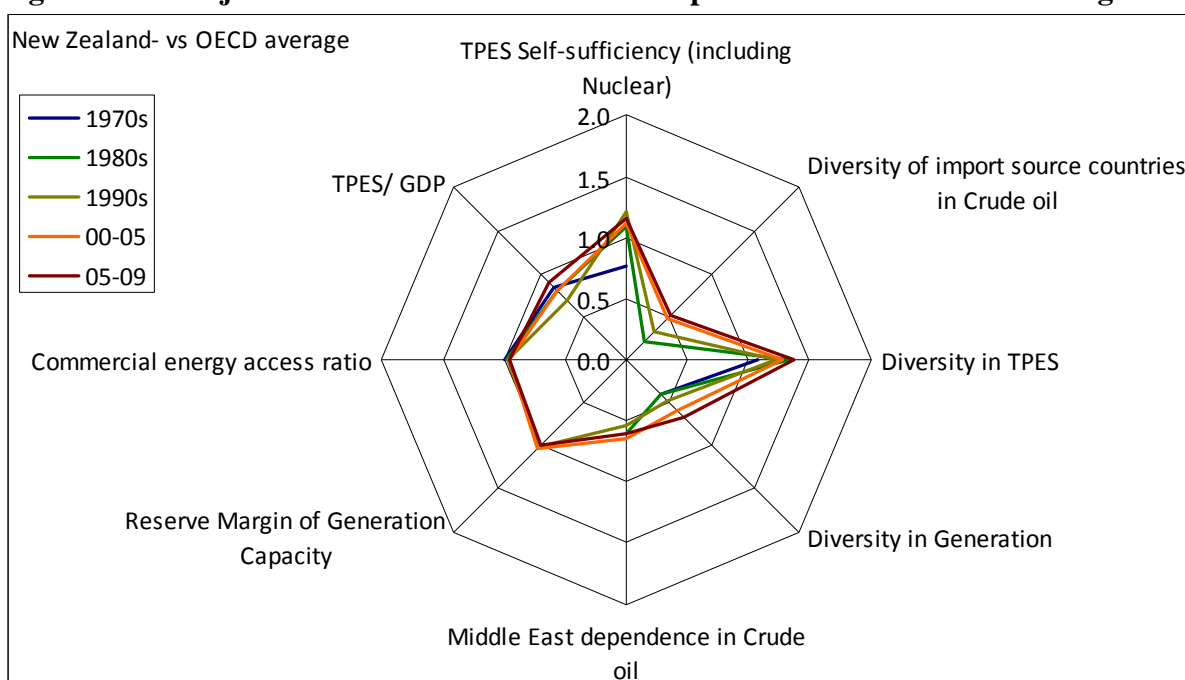
New Zealand does not have fossil resources large enough to satisfy its domestic demand for oil and gas. However, due to its large capacity for hydropower generation and rich coal resources, its self sufficiency has been relatively high in comparison with the OECD average over the past 40 years.

Another remarkable feature of the country is a well diversified primary energy portfolio. This is mainly thanks to its high ratio of renewable energies, specifically, bio-fuels for electricity and heat, and geothermal energy. Diversity in import source countries, including Middle East dependency, is a point of weakness. New Zealand may further enhance its energy security by improving these aspects of its energy supply.

**Table 3-12: Major Indices in New Zealand in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	0.8	1.1	1.2	1.1	1.2
Diversity of import source countries in Crude Oil		0.2	0.3	0.5	0.5
Diversity in TPES	1.1	1.3	1.2	1.3	1.4
Diversity in Generation	0.4	0.4	0.5	0.6	0.7
Middle East dependence in Crude Oil		0.6	0.5	0.6	0.6
Reserve Margin of Generation Capacity			1.0	1.0	1.0
Commercial energy access ratio	1.0	1.0	1.0	1.0	1.0
TPES/GDP	0.8	0.8	0.7	0.8	0.9

**Figure 3-13: Major Indices in New Zealand in comparison with the OECD average**



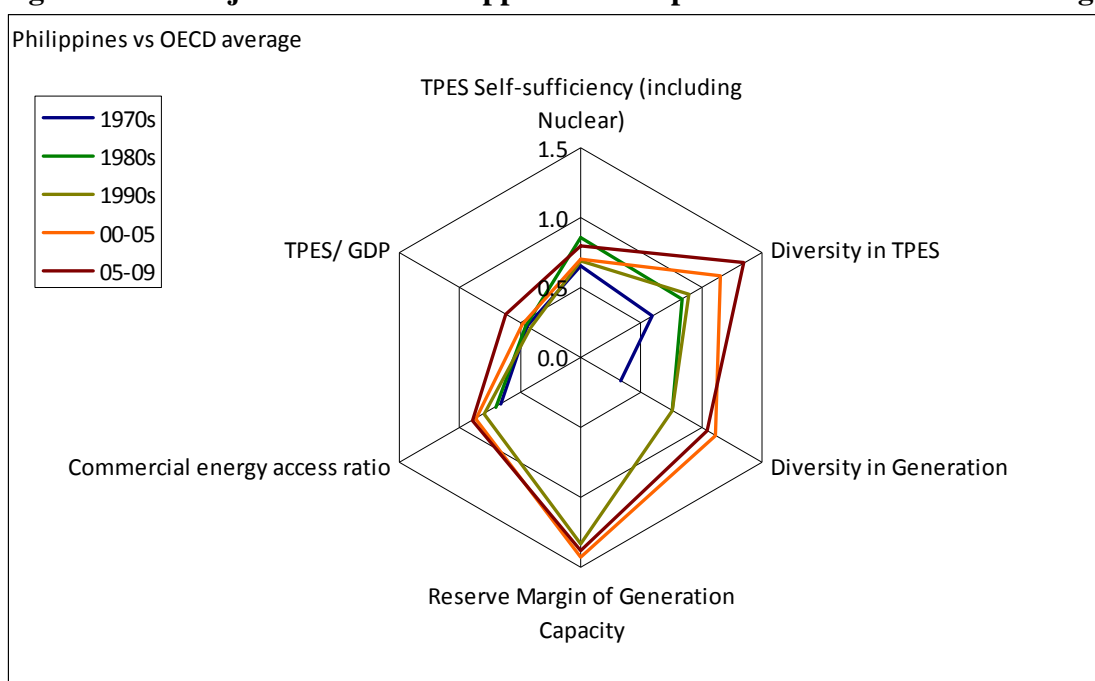
### 2.13. THE PHILIPPINES

The typical features of The Philippines are a well diversified primary energy supply and high reserve margin in terms of power generation capacity. Both features mainly come from abundant geothermal resources. The Philippines has developed geothermal power stations while restraining development of domestic fossil resources, and this has resulted in a low self sufficiency and high diversity for its energy and power portfolios. Improvement in the commercial energy access ratio can be observed. On the other hand, energy intensity has not changed much throughout the past four decades.

**Table 3-13: Major Indices in The Philippines in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	0.7	0.9	0.7	0.7	0.8
Diversity in TPES	0.6	0.8	0.9	1.2	1.3
Diversity in Generation	0.3	0.8	0.8	1.1	1.1
Reserve Margin of Generation Capacity			1.3	1.4	1.4
Commercial energy access ratio	0.7	0.7	0.8	0.9	0.9
TPES/GDP	0.4	0.5	0.4	0.5	0.6

**Figure 3-14: Major Indices in Philippines in comparison with the OECD average**





## 2.14. SINGAPORE

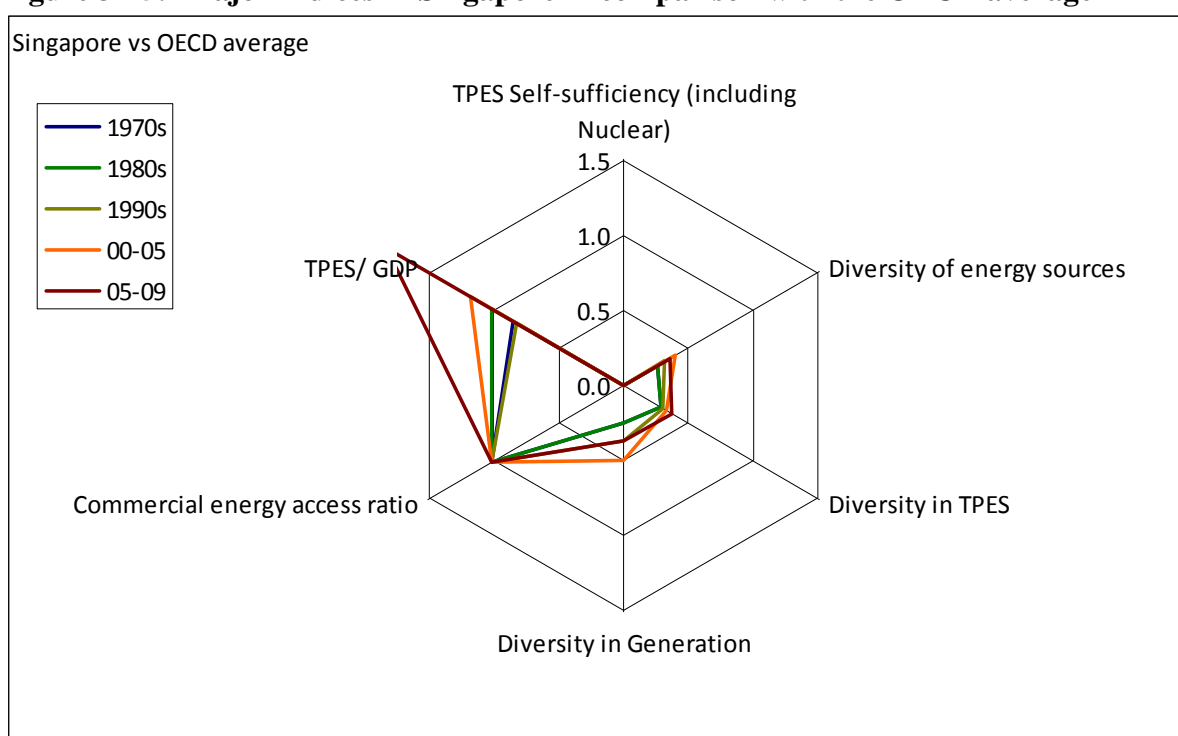
Self sufficiency in Singapore has hardly ever been more than zero, as it has no fossil fuel resources and little potential for renewable energies. However, it has developed a strong policy for securing a stable energy supply by importing oil and gas from neighboring countries, constructing an efficient energy market, and increasing energy efficiency.

The next challenge for Singapore might be the diversification of power sources as well as the development of alternative import source countries.

**Table 3-14: Major Indices in Singapore in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	0.0	0.0	0.0	0.0	0.0
Diversity in energy sources	0.3	0.3	0.3	0.4	0.4
Diversity in TPES	0.3	0.3	0.3	0.3	0.4
Diversity in Generation	0.2	0.2	0.4	0.5	0.4
Commercial energy access ratio	1.0	1.0	1.0	1.0	1.0
TPES/GDP	0.8	1.0	0.8	1.2	1.8

**Figure 3-15: Major Indices in Singapore in comparison with the OECD average**



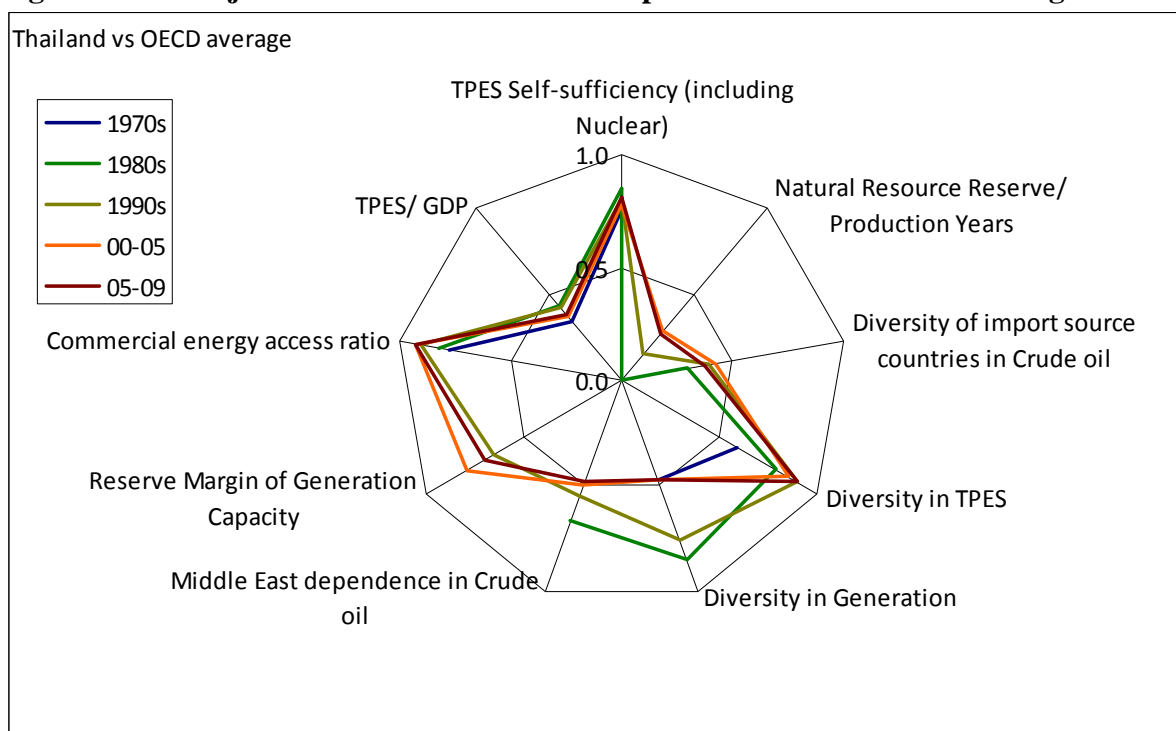
## 2.15. THAILAND

The fossil fuel resources in Thailand are insufficient to meet the country's growing energy demand. It has less diversification in terms of its import source countries for oil due to a high dependency on the Middle East. The diversity of power sources has been worsening since the 1990's in comparison with the OECD average. The dependence on natural gas for power generation poses concerns related to energy security, and thus Thailand is trying to utilize other energies such as coal, renewable energy and nuclear. Thailand's energy intensity has changed little since the 1980's, and as such there may be room for improvement.

**Table 3-15: Major Indices in Thailand in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	0.8	0.9	0.8	0.8	0.8
Natural Resources Reserve/ Production Years		-	0.2	0.3	0.3
Diversity of import source countries in Crude Oil		0.3	0.4	0.4	0.4
Diversity in TPES	0.6	0.8	0.9	0.9	0.9
Diversity in Generation	0.5	0.8	0.8	0.5	0.5
Middle East dependence in Crude Oil		0.7	0.5	0.5	0.5
Reserve Margin of Generation Capacity			0.7	0.8	0.7
Commercial energy access ratio	0.8	0.8	0.9	0.9	0.9
TPES/GDP	0.3	0.4	0.4	0.4	0.4

**Figure 3-16: Major Indices in Thailand in comparison with the OECD average**



## 2.16. VIETNAM

Vietnam is importing oil products while exporting crude oil, since the capacity of its oil refineries is not sufficient for domestic demand. Self sufficiency has been over 100% over these past 40 years mainly because crude oil exports surpassed the import of refined oil products. As seen in the low R/P ratio, if Vietnam does not see new development, its self-sufficiency may face a critical moment in the near future. Two features of the way energy is used in Vietnam are the low commercial energy access ratio and the low energy efficiency. Improvements have been made in the past, but some continuous efforts might be required related to energy security.

**Table 3-16: Major Indices in Vietnam in comparison with the OECD average**

	1970s	1980s	1990s	00-05	00-09
TPES Self-sufficiency (including Nuclear)	1.2	1.3	1.6	1.8	1.7
Natural Resources Reserve/ Production Years		-	0.6	0.5	0.4
Diversity in TPES	0.4	0.4	0.4	0.6	0.7
Diversity in Generation	0.4	0.7	0.5	0.7	0.7
Reserve Margin of Generation Capacity		0.8	1.1	0.6	0.5
Commercial energy access ratio	0.3	0.3	0.3	0.5	0.6
TPES/GDP	0.1	0.1	0.2	0.2	0.2

**Figure 3-17: Major Indices in Vietnam in comparison with the OECD average**

