

# Chapter **1**

## Background of the Studies

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# Chapter 1

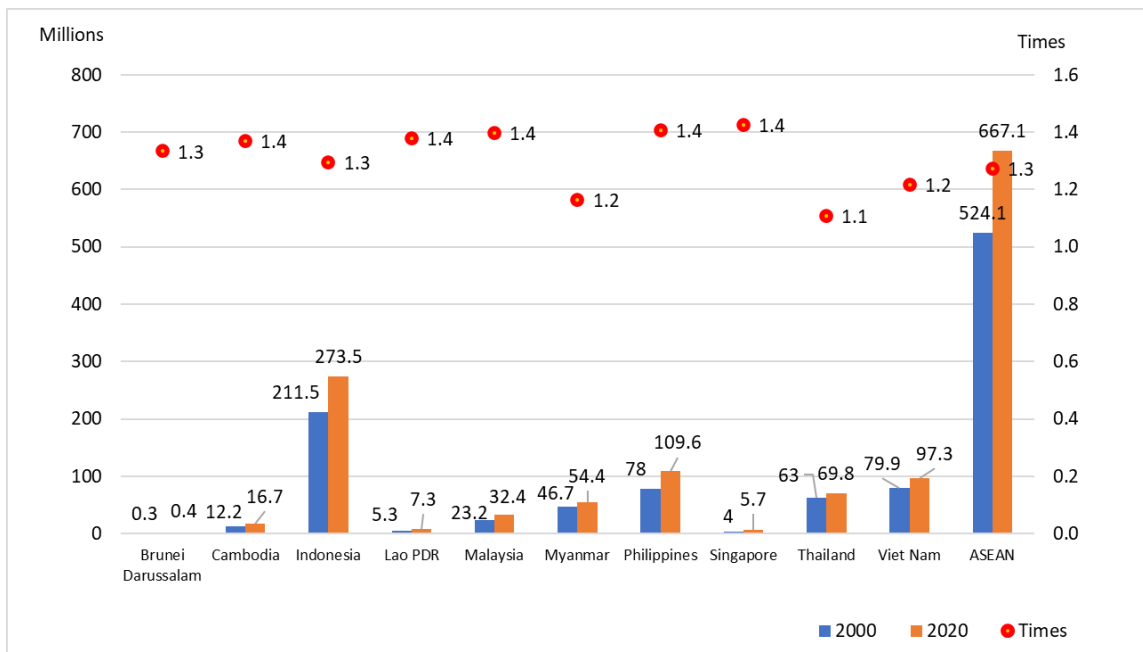
## Background of the Studies

This chapter provides an analysis of the Association of Southeast Asian Nations (ASEAN's) population, economy, energy, and CO<sub>2</sub> emissions situation. In addition, we will discuss the issues raised by the analysis.

### 1. Population and Economic Situation

ASEAN's population grew 1.3 times in 20 years, from 524.1 million in 2000 to 667.1 million in 2020 (Figure 1.1).

**Figure 1.1. ASEAN Population (2000 vs 2020)**

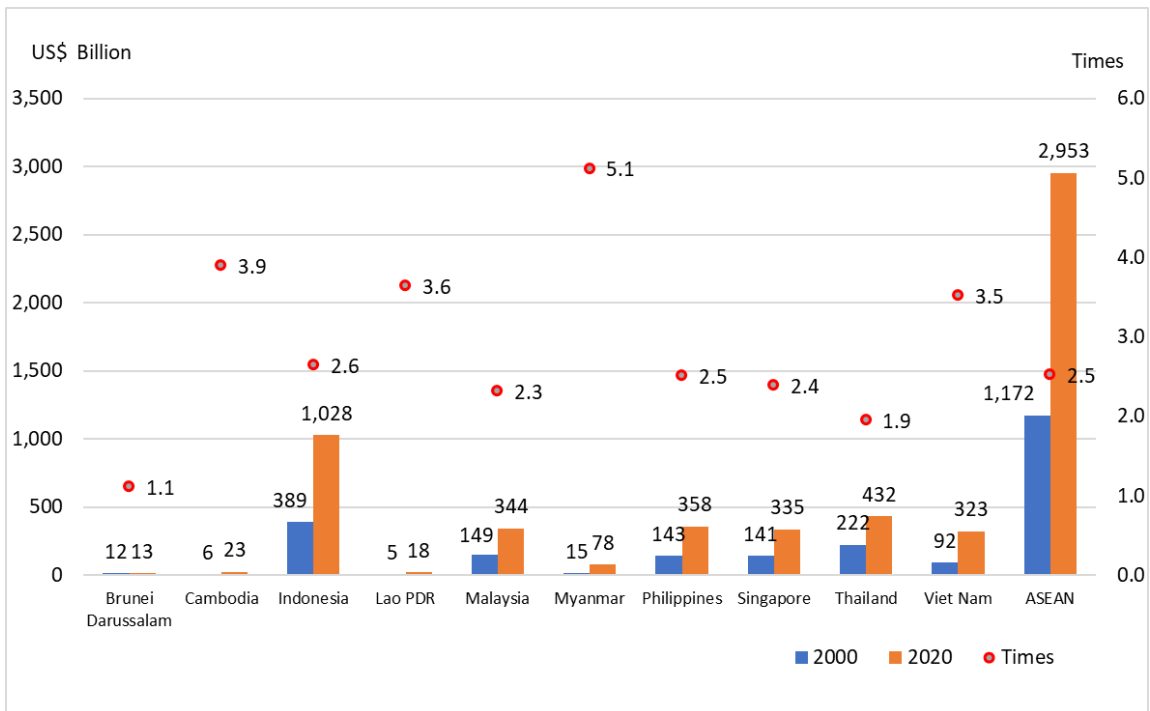


ASEAN = Association of Southeast Asian Nations.

Source: IEA (2022).

ASEAN's gross domestic product (GDP) has grown 2.5 times in 20 years, from \$1,172 billion in 2000 to \$2,953 billion in 2022 (Figure 1.2).

**Figure 1.2. ASEAN GDP (2000 vs 2020) (2015 prices, exchange rate)**

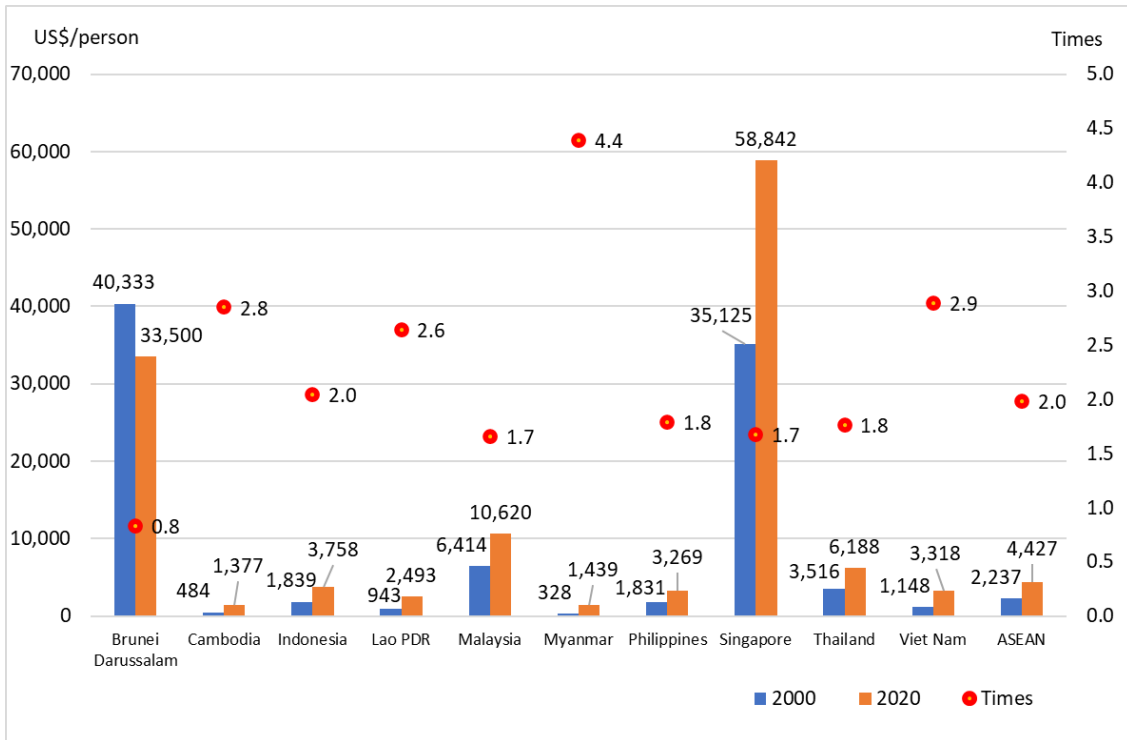


ASEAN = Association of Southeast Asian Nations.  
 Source: IEA (2022).

ASEAN's GDP per capita was \$2,237 in 2000; in 2020, it was \$4,427, doubling over 20 years (Figure 1.3).

History has proven that there is a strong correlation between economic growth and energy demand. The increase in total energy supply (TES) is also due to the improvement in the standard of living in ASEAN as a result of the growth in GDP per capita.

**Figure 1.3. ASEAN GDP per Capita (2000 vs 2020)**

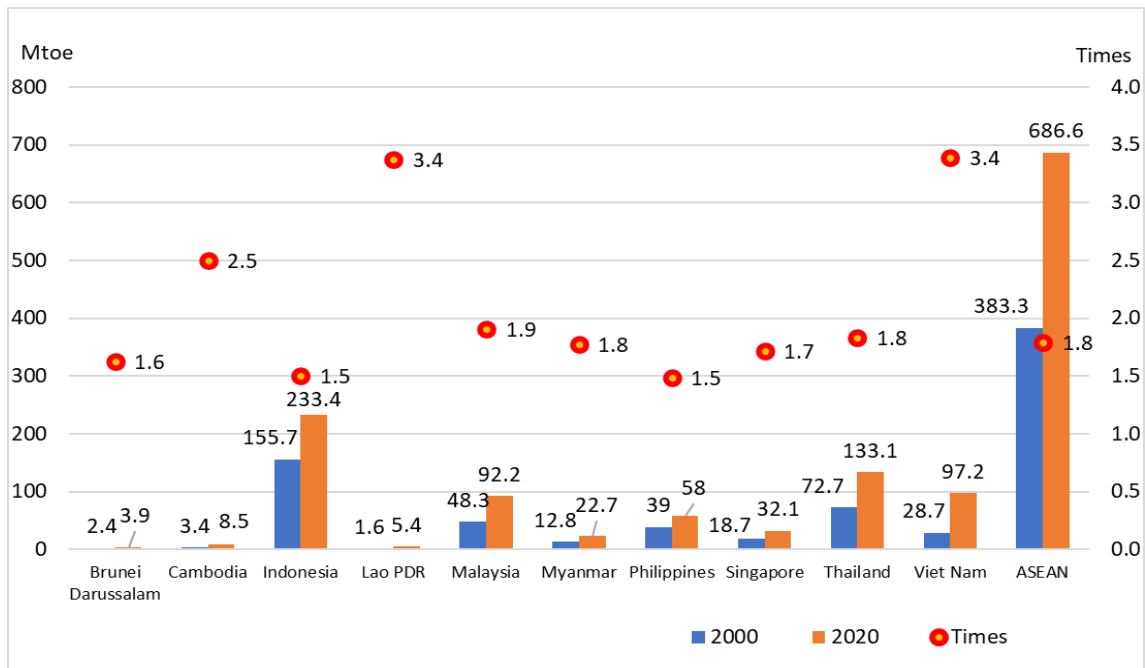


ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product.  
Source: IEA (2022).

## 2. Energy Situation

Due to population growth, significant economic growth, and improved living standards, ASEAN's TES has grown 1.8 times in 20 years, from 383.3 million tonnes of oil equivalent (Mtoe) in 2000 to 686.6 Mtoe in 2020 (Figure 1.4).

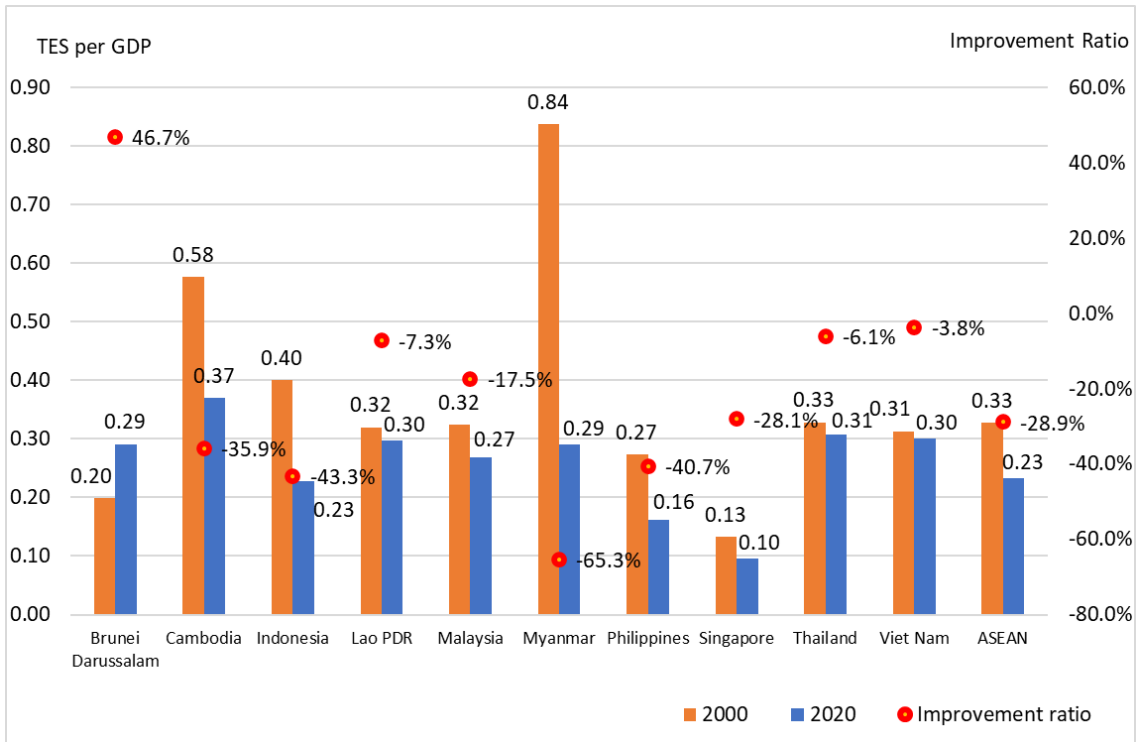
**Figure 1.4. ASEAN Total Energy Supply (2000 vs 2020)**



ASEAN = Association of Southeast Asian Nations.  
 Source: IEA (2022).

ASEAN's TES per GDP (one of the indicators of energy efficiency) improved by 28.9% from 0.33 in 2000 to 0.23 in 2020. All the ASEAN member countries, except Brunei Darussalam, made progress in energy efficiency (Figure 1.5).

**Figure 1.5. ASEAN TES per GDP (2000 vs 2020)**

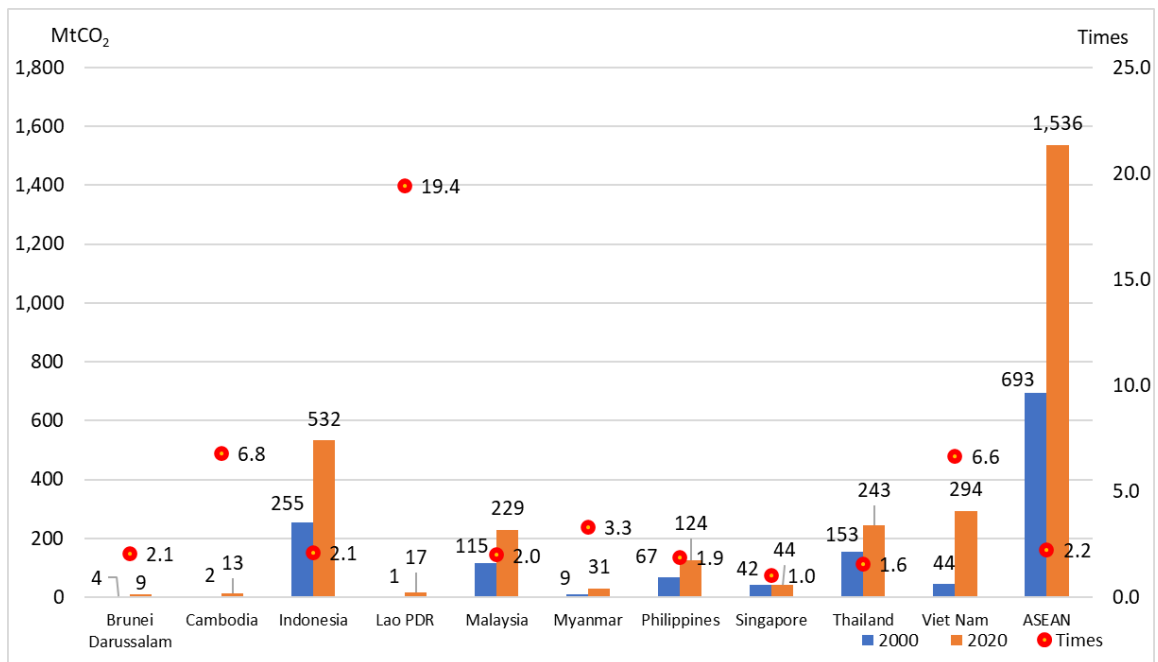


ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product, TES = total energy supply. Source: IEA (2022).

### 3. Status of CO<sub>2</sub> Emissions

With the increase in population, significant economic growth, and improved standard of living, CO<sub>2</sub> emissions from fuel combustion has increased, as has energy consumption. ASEAN's CO<sub>2</sub> emissions increased by 2.2 times from 693 metric tonnes of CO<sub>2</sub> (MtCO<sub>2</sub>) in 2000 to 1,536 MtCO<sub>2</sub> in 2020 (Figure 1.6).

**Figure 1.6. ASEAN CO<sub>2</sub> Emissions from Fuel Combustion (2000 vs 2020)**



ASEAN = Association of Southeast Asian Nations.  
Source: IEA (2022).

Here we look at the relationship between the increase in TES and the increase in CO<sub>2</sub> emissions. Table 1.1 summarises the growth rates of CO<sub>2</sub> emissions and TES for the 10 ASEAN member countries over 2000–20. Average of Organisation for Economic Co-operation and Development (OECD) and non-OECD figures are also included for comparison.

In ASEAN, TES has increased by a factor of 1.8 over the 20 years, while CO<sub>2</sub> emissions has increased by a factor of 2.2, exceeding the growth rate of TES. In contrast, OECD saw a decrease by a factor of 0.9 in TES over the same period, while CO<sub>2</sub> emissions decreased by a factor of 0.8, which is less than the rate of decrease in TES. In non-OECD, TES increased by a factor of 2.0 and CO<sub>2</sub> emissions increased by a factor of 2.1 over the same period.

**Table 1.1. Increased Multiples of CO<sub>2</sub> Fuel Combustion and TES**

Country	TES	CO <sub>2</sub> Fuel Emissions
	(a)	(b)
Brunei Darussalam	1.6	2.1
Cambodia	2.5	6.8
Indonesia	1.5	2.1
Lao PDR	3.4	19.4
Malaysia	1.9	2.0
Myanmar	1.8	3.3
Philippines	1.5	1.9
Singapore	1.7	1.0
Thailand	1.8	1.6
Viet Nam	3.4	6.6
ASEAN	1.8	2.2
OECD	0.9	0.8
Non-OECD	2.0	2.1

ASEAN = Association of Southeast Asian Nations, OECD = Organisation for Economic Co-operation and Development.

Source: Author.

#### **4. Energy Efficiency and Carbon Intensity**

Figure 1.7 shows TES per GDP (energy efficiency) on the horizontal axis and CO<sub>2</sub> per TES (carbon intensity) on the vertical axis.

Comparing OECD average and ASEAN member countries in 2020, only Singapore is more energy-efficient and decarbonised, with both TES per GDP and CO<sub>2</sub> per TES being lower than those of OECD average.

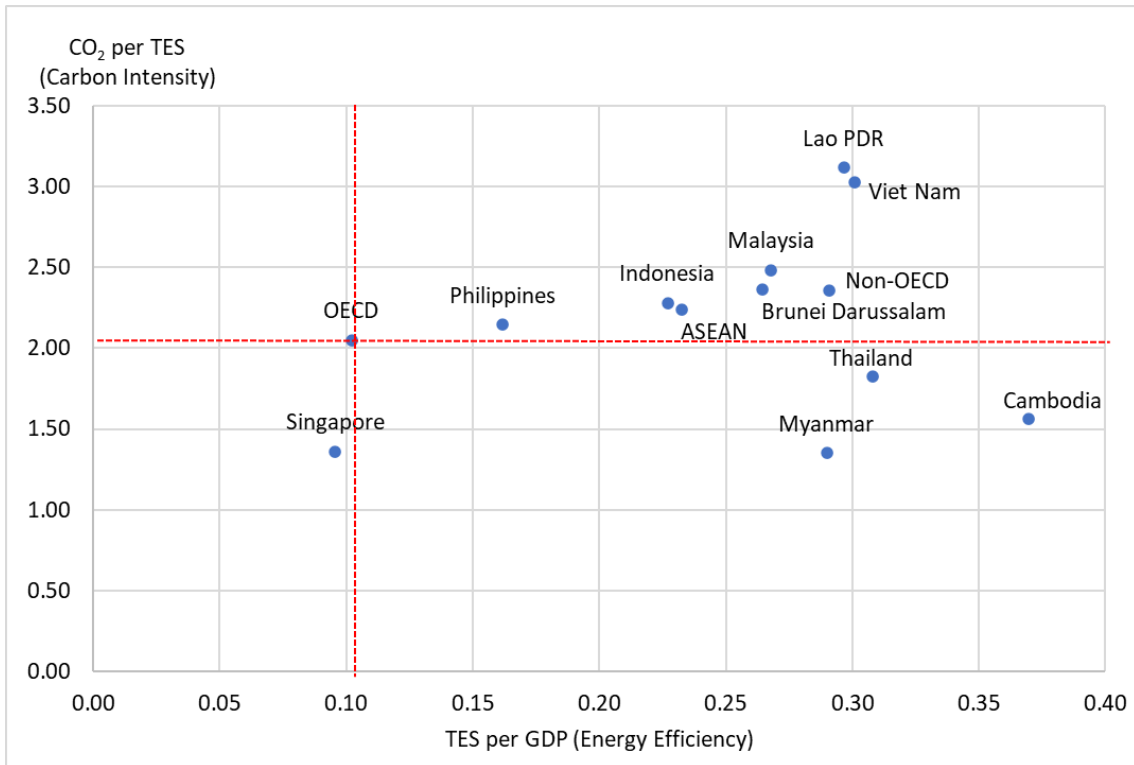
On the other hand, Cambodia, Myanmar, and Thailand have lower carbon intensity than the OECD countries, but are not as energy-efficient as OECD.

Brunei Darussalam, Indonesia, Lao People's Democratic Republic, Malaysia, the Philippines, and Viet Nam are also less energy-efficient and decarbonised than OECD.

Both energy conservation and carbon intensity are often influenced by a country's industrial structure and policies. For example, countries with a large share of manufacturing have larger energy consumption and CO<sub>2</sub> emissions, while countries with a smaller share have smaller values for these figures. Therefore, it is necessary to analyse the industrial structure of each country and the status of energy conservation and CO<sub>2</sub> emissions reduction policies.



**Figure 1.7. Energy Efficiency and Carbon Intensity (2020)**



ASEAN = Association of Southeast Asian Nations, Lao PDR = Lao People’s Democratic Republic, OECD = Organisation for Economic Co-operation and Development, TES = total energy supply.  
Source: Author.

## 5. Elasticity

To understand the relationship between CO<sub>2</sub> emissions and TES, elasticity is calculated and compared.

The elasticity is the growth in CO<sub>2</sub> emissions over the 20-year period from 2000 to 2020 divided by the growth in TES. The formula is as follows:

$$\frac{\text{CO}_2 \text{ emissions in 2020} / \text{CO}_2 \text{ emissions in 2000}}{\text{TES in 2020} / \text{TES in 2000}} = \chi$$

If the growth of CO<sub>2</sub> emissions is greater than the growth of TES, the elasticity X will be greater than 1. If the growth of CO<sub>2</sub> emissions is smaller than the growth of TES, the elasticity X will be smaller than 1.

The elasticities for ASEAN, OECD, and non-OECD are calculated and plotted in Table 1.2 and Figure 1.8.

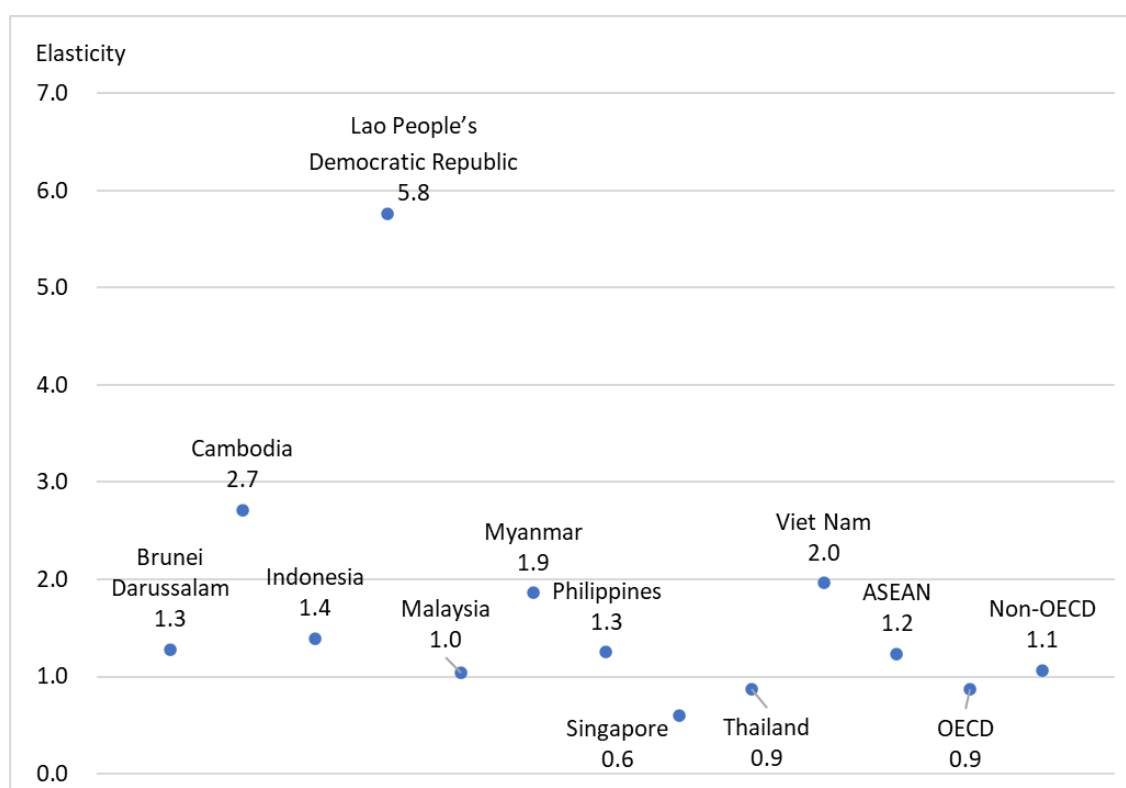
**Table 1.2. Change of TES and CO<sub>2</sub> Emissions and Elasticity**

Country	TES	CO <sub>2</sub> Fuel Emissions	Elasticity
	(a)	(b)	(b)÷(a)
Brunei Darussalam	1.6	2.1	1.3
Cambodia	2.5	6.8	2.7
Indonesia	1.5	2.1	1.4
Lao PDR	3.4	19.4	5.8
Malaysia	1.9	2.0	1.0
Myanmar	1.8	3.3	1.9
Philippines	1.5	1.9	1.3
Singapore	1.7	1.0	0.6
Thailand	1.8	1.6	0.9
Viet Nam	3.4	6.6	2.0
ASEAN	1.8	2.2	1.2
OECD	0.9	0.8	0.9
Non-OECD	2.0	2.1	1.1

ASEAN = Association of Southeast Asian Nations, OECD = Organisation for Economic Co-operation and Development, TES = total energy supply.

Source: Author.

**Figure 1.8. Elasticity (2000 vs 2020)**



ASEAN = Association of Southeast Asian Nations, OECD = Organisation for Economic Co-operation and Development.

Source: Author.

The elasticity of total ASEAN is 1.2. This means that the growth of CO<sub>2</sub> emissions is larger than the growth of TES.

The countries where elasticities are greater than 1, namely Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, and Viet Nam, the growth of CO<sub>2</sub> emissions is larger than the growth of TES. For example, the elasticity of 2.0 for Viet Nam means that the growth of CO<sub>2</sub> emissions is twice that of TES.

In contrast, the elasticities for Singapore and Thailand are 0.6 and 0.9, respectively. In these countries, the growth of CO<sub>2</sub> emissions is smaller than the growth of TES.

For comparison, the OECD and non-OECD elasticities are 0.9 for OECD and 1.1 for non-OECD. The elasticity for ASEAN is higher than that for non-OECD.

Singapore's elasticity is lower than that of OECD, while Thailand's is at the same level as that of OECD.

## **6. Discussions**

Many ASEAN countries have elasticities greater than 1, despite progress in energy efficiency (TES per GDP). Except for Singapore and Thailand, the increase in CO<sub>2</sub> emissions is greater than the growth in TES in many ASEAN countries.

There are three possible reasons for this:

- Changes in the energy mix (underlying energy policy)
- Energy efficiency policy
- CO<sub>2</sub> emissions reduction policy

For more detailed analysis, it is necessary to examine changes in energy use, energy efficiency, CO<sub>2</sub> emissions status, and policies in countries with large and influential shares of TES and CO<sub>2</sub> emissions in the ASEAN region.

## Reference

IEA (2022), *IEA World Energy Balance*. Paris: IEA.