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Impacts of COVID-19 on the Energy Demand Situation of East Asia Summit Countries

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Abstract: *The coronavirus disease (COVID-19) pandemic has brought us a 'New Normal' life style and the lockdown has severely harmed economic growth, with many countries estimated to record negative economic growth in 2020. Due to the high correlation between energy demand and economic growth, energy demand is also affected. Against this background, ERIA analyses how energy demand has decreased as a result of the COVID-19 pandemic using East Asia Summit (EAS) energy outlook models that are regularly updated by ERIA and apply an econometric approach. The outlook models cover the Association of Southeast Asian Nations (ASEAN) 10 countries plus seven countries – Australia, China, India, Japan, Republic of Korea, New Zealand, and the United States. According to gross domestic product (GDP) growth estimates for EAS countries in 2020, only three countries – China, Lao PDR, and Viet Nam – show positive growth, though less than 2%, and the others show negative growth. Total Final Energy Consumption (TFEC) of the EAS countries fell in 2020, but it is expected to rebound in 2021 and projected to return to the originally forecast trend of energy demand up to 2050. Once official energy statistics become available, a comparison between model results and actual statistics will be made to understand how the energy outlook models trace the impact of the pandemic on energy demand.*

Keywords: COVID-19, East Asia Summit, energy demand
JEL Classification: P18

1. Background and purpose

The COVID-19 pandemic started spreading around the world from January 2020 and still persists through its changing variants, despite dedicated efforts from national administrations. The pandemic has brought many inconveniences, such as stay-home/work-from-home measures; social distancing; the avoidance of crowds at restaurant and entertainment venues, such as theatres and sport event places; the use of face masks; and frequent washing hands and gargling, etc. It has also affected energy consumption, but with negative trends due to economic recession. So far, official energy statistics have not yet been released in many countries, but the Economic Research Institute for ASEAN and East Asia (ERIA), in collaboration with the ERIA Working Group for Energy Outlook and Energy Saving Potential in ASEAN and East Asia, aims to measure the negative impacts on energy demand brought by COVID-19 using the energy outlook models of 17 East Asia Summit (EAS) countries with a view of the short-term impacts focusing on 2020 and the long-term impacts up to 2050. For technical reasons, ERIA covers the energy outlook models of the 10 Association of Southeast Asian Nations (ASEAN) countries, whilst the Institute of Energy Economics, Japan (IEEJ) engages energy outlook modelling of the EAS+7 countries, which consist of Australia, China, India, Japan, the Republic of Korea (henceforth, Korea), New Zealand, and the United States. Consequently, impact analysis on the energy demand brought by COVID-19 consists of two parts: ASEAN and EAS+7 countries. For the ASEAN part, due to the availability of the energy outlook results, namely the COVID-19 scenario, this report just covers the following eight ASEAN countries: Cambodia, Indonesia, Lao PDR, Malaysia, the Philippines Singapore, Thailand, and Viet Nam. These eight ASEAN countries represented 86% of gross domestic product (GDP) and 91% of total final energy consumption (TFEC) of ASEAN's total in 2017.

2. Methodology

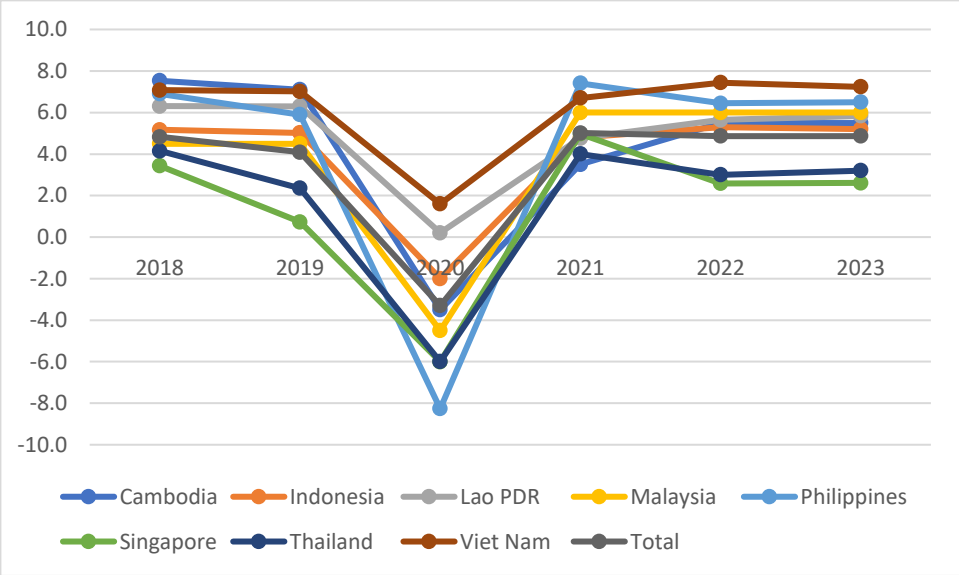
In 2019–1920, the members of the Working Group updated their energy outlook models to renew their EAS Energy Outlook and Energy Saving Potential results using the latest macroeconomic assumptions and energy development plans, including the energy saving and renewable energy (RE) deployment targets for analysing their energy saving potential defined as the Business As Usual (BAU) – Alternative Policy Scenario (APS) of energy demand. Based on the BAU, the members produced another APS, namely the COVID-19 scenario, which changed the GDP and international crude oil prices from the BAU because they were surely influenced by COVID-19. GDP was reviewed for 2020–2023, referring to economic-related sources, such as the International Monetary Fund, and the crude oil price was also reviewed for 2020 and after based on global oil market information.

3. ASEAN

3.1 Assumptions

The assumptions of the GDP growth rates of the eight ASEAN countries in 2020 are diverse; Lao PDR and Viet Nam may remain positive, but at less than 2%, and the other six countries may show negative economic growth, from –2.0% for Indonesia to –8.3% for the Philippines. The weighted average GDP growth rate of the eight ASEAN countries is estimated at –3.3% in 2020. Figure 1 shows historical assumptions of the GDP growth rates of the eight ASEAN countries.

Figure 1. GDP Growth Rate Assumptions for the COVID-19 Scenario, 2018–2023



Source: Authors.

In addition, the differences in the GDP growth rate assumptions between the BAU and COVID-19 scenarios for the ASEAN total are shown in Table 1. A rebound in economic growth from 2020 is indicated for 2020–2025 in the case of the COVID-19 scenario, but after that, the GDP growth rates in the COVID-19 scenario are lower than the BAU scenario because Malaysia, Singapore, and Thailand have revised their economic growth assumptions for after 2030. In 2017–2019, the GDP growth rate in the COVID-19 scenario is higher than in the BAU because the COVID-19 scenario reflects the observed GDP growth rates.

Table 1. Comparison of GDP Growth Rates between the BAU and COVID-19 Scenarios

	2017-2019	2020	2020-2025	2025-2030	2030-2040	2040-2050
BAU	3.6	3.6	4.6	4.6	4.3	4.0
COVID-19	4.4	-3.3	4.8	4.4	4.1	3.8

Source: EAS Energy Outlook and Energy Saving Potential (2019); authors.

In 2020, the international crude oil price declined sharply, and, therefore, the crude oil assumption for the COVID-19 scenario was revised up until 2050 as shown in Table 2.

Table 2. Crude Oil Price Assumptions (Nominal Price)

	2018	2020	2030	2040	2050
BAU	75.1	87.7	126.9	187.2	248.1
COVID-19	72.9	42.5	110.1	157.9	202.2

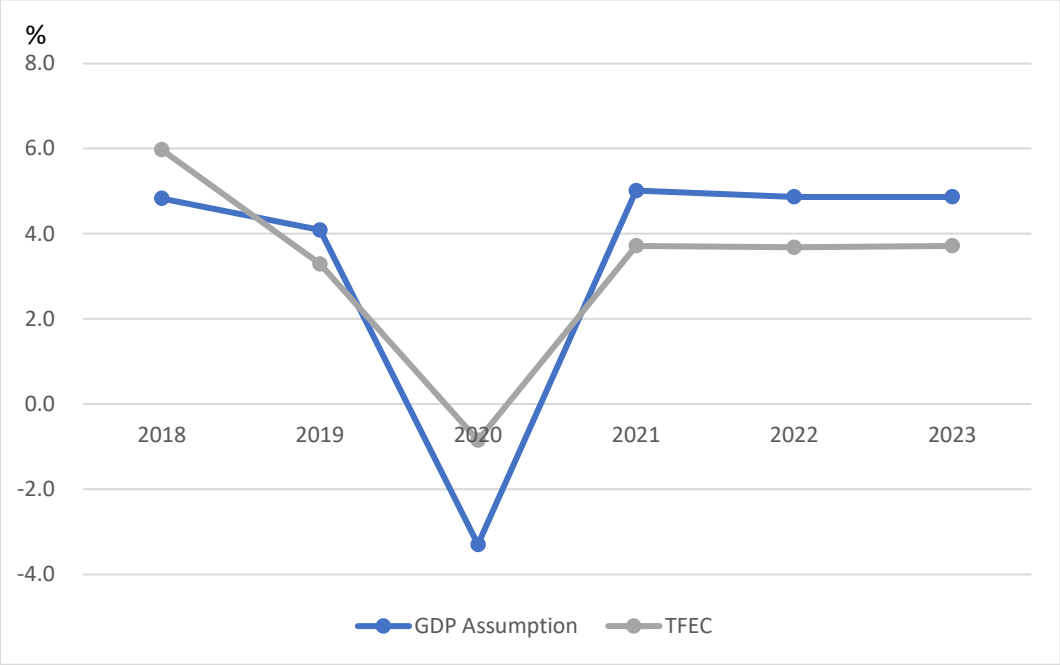
Source: EAS Energy Outlook and Energy Saving Potential (2019); authors.

3.2 Impacts on final energy consumption

(1) Short-term impacts

Due to the negative GDP growth in 2020, the total final energy consumption (TFEC) of the eight ASEAN countries may reach –0.8%, but after that return to the original trend of around 4% per annum from 2021 (Figure 2). This is because the elasticity defined as the growth rate of TFEC / growth rate of the GDP of the 10 ASEAN countries for 1990–2017 is 0.77 and the elasticity after 2021 is 0.74–0.76.

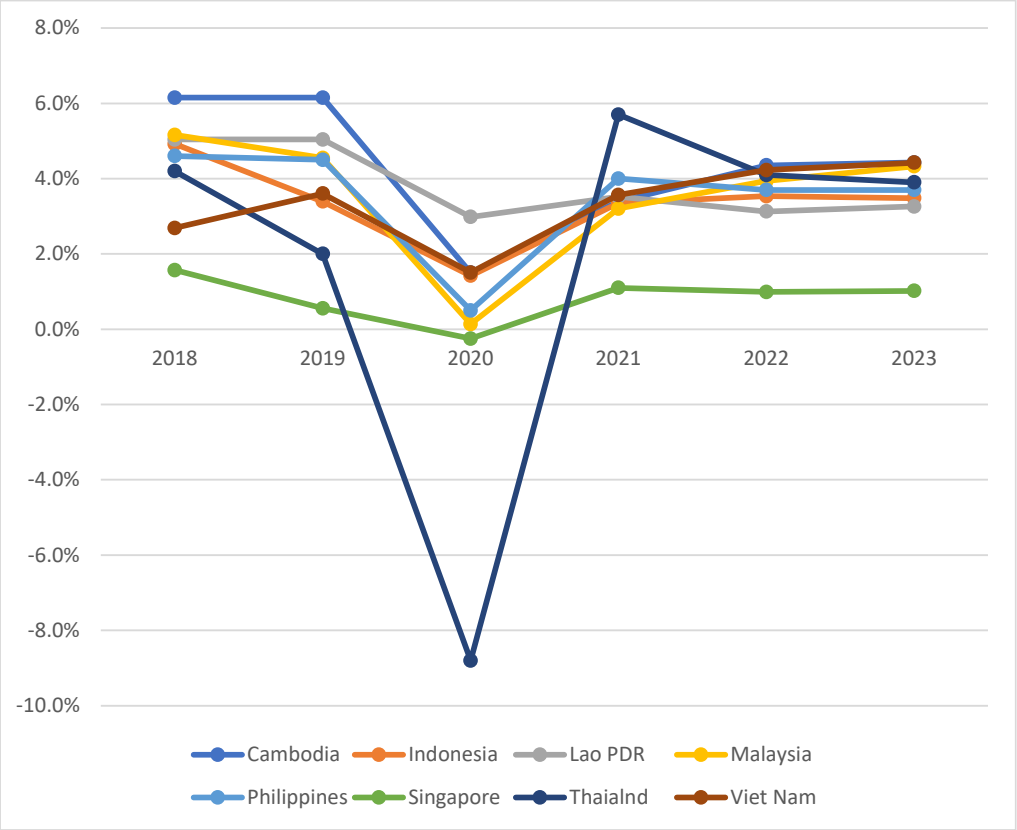
Figure 2. Comparison of the GDP and TFEC for ASEAN in the COVID-19 Scenario, 2018–2023



Source: Authors.

According to this trial calculation based on the assumed GDP growth rate for 2020–2030, the impact of the COVID-19 pandemic on energy demand for ASEAN countries might be not serious, except for Thailand. ASEAN 6 countries except Lao PDR and Viet Nam assume negative GDP growth, but only two countries, Singapore and Thailand, show a negative TFEC growth rate in 2020. Malaysia shows no increase in its TFEC. However, the TFEC of all eight ASEAN countries shows a rebound due to the recovery of economic growth, and the TFEC in the COVID-19 scenario returns to the original energy increase trend as in the BAU (Figure 3).

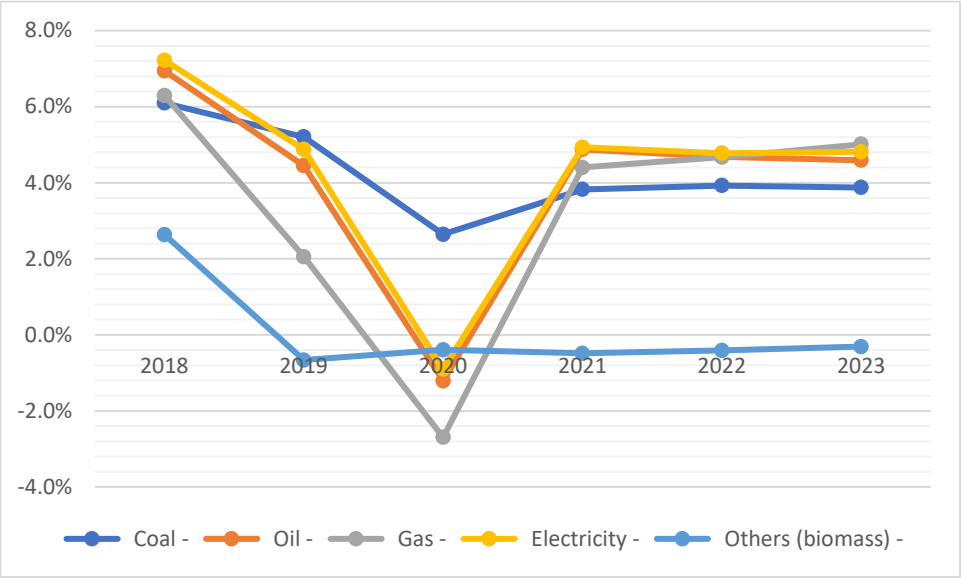
Figure 3. COVID-19 Impacts on the TFEC of the Eight ASEAN Countries, 2018–2023



Source: Authors.

By energy source, oil and electricity are severely impacted, falling to –1.2% and –0.9%, respectively, in 2020. Gas consumption also may decrease largely, but its amount is very small, and the main final use of gas consumption is as a feedstock of fertiliser in Indonesia (Figure 4).

Figure 4. COVID-19's Impact by Energy Source

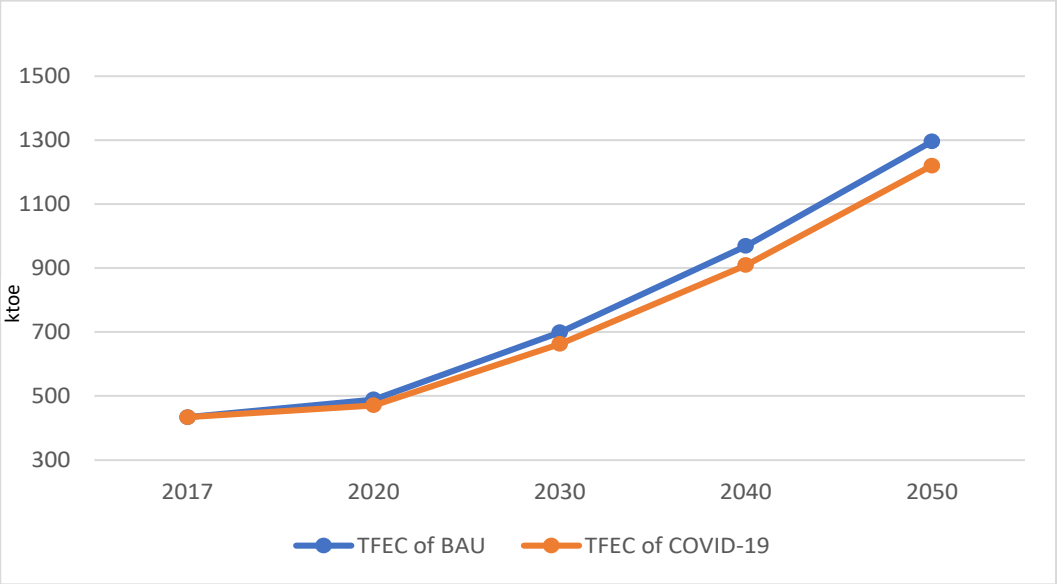


Source: Authors.

(2) Long-term impacts

A comparison of the TFEC in the COVID-19 and BAU scenarios up to 2050 is shown in Figure 5. The TFEC in the COVID-19 scenario is lower than in the BAU scenario from 2020 to 2050. This is because some countries, such as Malaysia and Thailand, assume a higher GDP growth rate than the BAU due to the rebound in economic growth in 2021–2030, but after that, their GDP growth assumptions are lower than the BAU for 2030–2050. However, the difference between the COVID-19 and BAU scenarios is around 4%; thus, after COVID-19, the TFEC of the eight ASEAN is projected to come back to the same trend as the BAU.

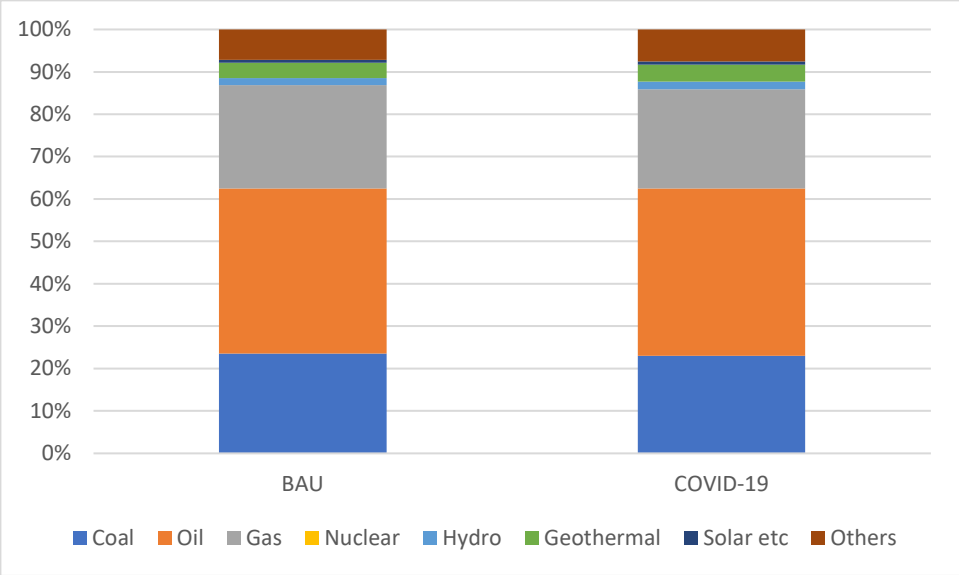
Figure 5. Comparison of the TFEC between the BAU and COVID-19 Scenarios to 2050



Source: Authors.

In addition, the energy share of the total primary energy supply (TPES) of the eight ASEAN countries in 2050 is the same in the BAU and COVID-19 scenarios. This is because the COVID-19 scenario only changes the GDP and crude oil assumptions of the BAU. Thus, the share of fossil oil in the COVID-19 scenario is 86%, the same as in the BAU (Figure 6).

Figure 6. Energy Share of the TPES in 2050 for the BAU and COVID-19 Scenarios



Source: Authors.

3.3 Key findings

a. Oil and electricity comprise the main energy consumption in the final energy consumption sectors and, thus, their energy consumption is highly correlated with GDP as an overall economic activity indicator. Therefore, oil and electricity consumption in 2020 decreases due to the economic recession influenced by the COVID-19 pandemic. On the other hand, the consumption amounts of coal and gas in final energy consumption sectors are very small, and, thus, there is no correlation between coal and gas consumption and GDP found so far.

b. ASEAN 6 countries assume negative GDP growth in 2020, but only two countries show negative growth for their TFEC. One reason is the structure of the energy demand formulas being applied for the

production of the EAS Energy Outlook models. The formulas basically consist of the following variables: GDP, relative energy prices defined as Pe/PGDP (energy price/GDP deflator), and lag (–1). If the coefficient of the lag is significant, an economic recession does not bring a direct reduction in the energy consumption of oil and electricity. In addition, the slightly lower crude oil price assumption than in the BAU also moderates the oil consumption reduction.

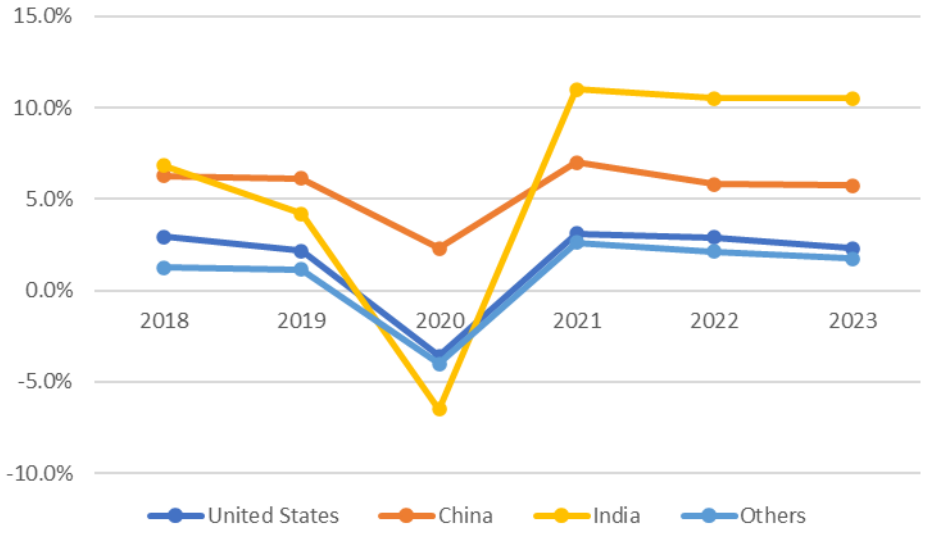
c. We analyse the impact on energy consumption brought by the economic recession due to the COVID-19 pandemic using an econometrics approach, but the econometrics approach might not be appropriate for the analysis of an economic shock such as the COVID-19 pandemic, theoretically. However, energy consumption shows the same trend as GDP, which decrease from 2019, but the rate of decrease rate may be more moderate than the actual impact as energy consumption influenced by lockdown could not be traced using econometrics. The official energy statistics of these ASEAN countries, in other words the energy balance tables for 2020, will be released hopefully around June–July 2021. After that, we can compare the actual energy consumption with the model results to assess the characteristics of the EAS energy outlook models.

4. EAS+7 countries

4.1 Assumptions

The assumptions for the economic damage in the +7 countries are quite different, in consideration of the COVID-19 effects (Figure 7). In 2020, only China maintains positive economic growth (2.3%). On the other hand, other countries experience negative growth. Remarkably, India's GDP is estimated to experience the largest drop amongst the +7 countries as the country suffers significantly from COVID-19. In the next year (2021), the economies of all of +7 countries are assumed to recover owing to vaccine penetration.

Figure 7. GDP Growth Rate Assumptions for the COVID-19 Scenario, 2018–2023



Source: Authors' estimations based on International Monetary Fund (2020).

Table 3 shows the differences in the GDP growth rates for all the +7 countries in the COVID-19 and BAU (pre-COVID-19 outlook) scenarios in the covered regions. The BAU scenario projected economic growth of 2.6% in 2020, but this was revised downward hugely to –2.3% in the COVID-19 scenario. In the next 5 years, greater growth rates are expected in the COVID-19 scenario due to the rebound from the economic crisis. After 2025, economic growth is assumed to continue at the same rate in both scenarios. The oil price assumption is the same as for ASEAN (see Table 2). The model analysis is based on historical energy data (International Energy Agency, 2019) and historical macroeconomic data (World Bank, 2019).

Table 3. Comparison of GDP Growth Rates between the BAU and COVID-19 Scenarios

	2017-2019	2020	2020-2025	2025-2030	2030-2040	2040-2050
BAU	3.4%	2.6%	3.5%	3.3%	3.1%	2.4%
COVID-19	3.4%	-2.3%	3.9%	3.4%	3.1%	2.4%

Source: Authors.

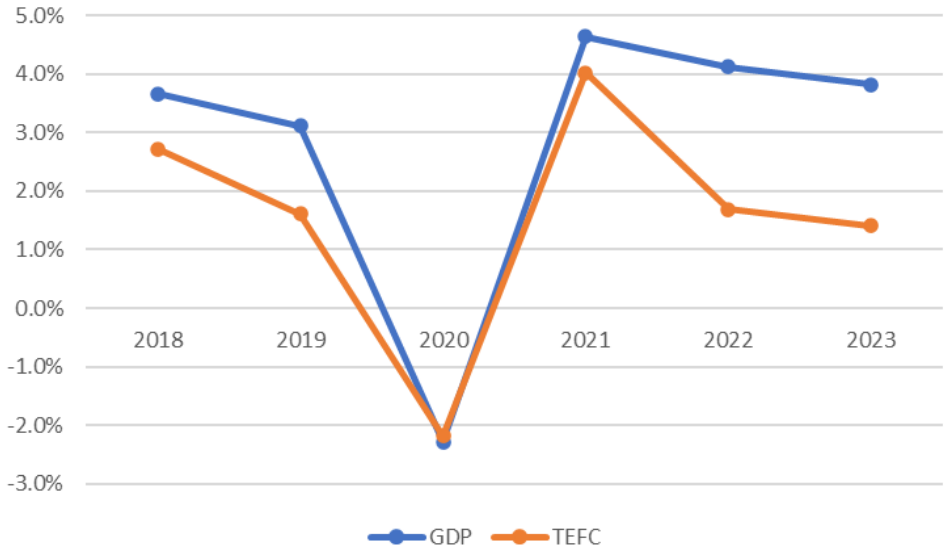
4.2 Impacts on final energy consumption

(1) Short-term impacts

The worldwide economic deterioration led to a sharp drop in the TFEC in 2020 in the +7 countries, but a strong rebound in economic growth is expected to help the TFEC recover in 2021 (Figure 8). The GDP growth rate in 2020 would have been -2.3%, leading to a TFEC growth rate of –2.2%. However, with a 4.6% GDP growth rate, the TFEC is projected to rebound to 4.0% in 2021. Thus, the

short-term impacts of COVID-19 on the TFEC would be drastic, especially in 2020 and 2021, but in opposite ways.

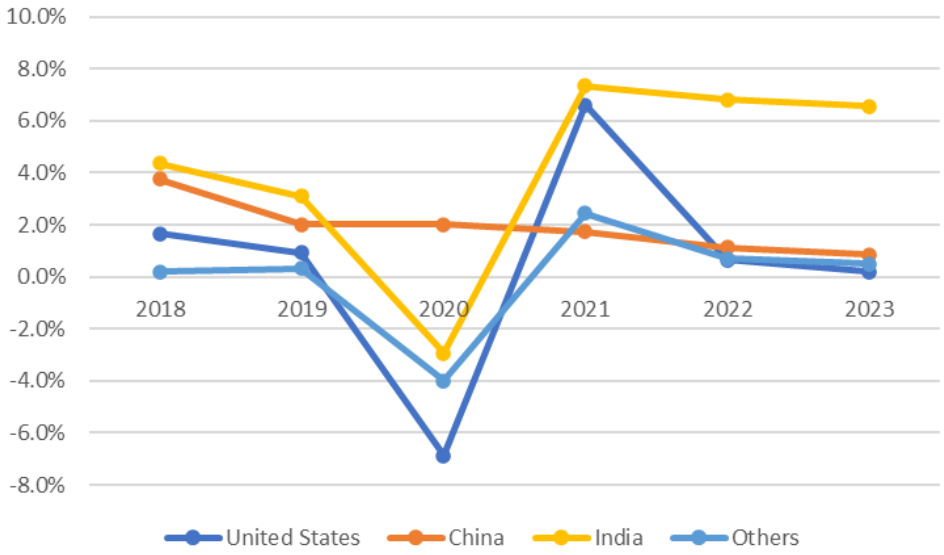
Figure 8. GDP and TFEC Growth Rates in the +7 Countries, 2018–2023



Source: Authors' calculations based on International Monetary Fund (2020).

In terms of each country, the energy demand in the United States, India, and Others (Australia, Japan, Korea, and New Zealand) in 2020 decreases but increases in China (Figure 9). The TFEC growth rates of the United States, Others, and India are –6.9%, –4.0% and –2.9%, respectively, whereas China has a positive rate of 2.0%. This is because only China was successful in keeping positive economic growth in 2020, at 2.3%, through strict measures against COVID-19, such as hard lockdowns.

Figure 9. TFEC of the +7 Countries, 2018–2023



Source: Authors.

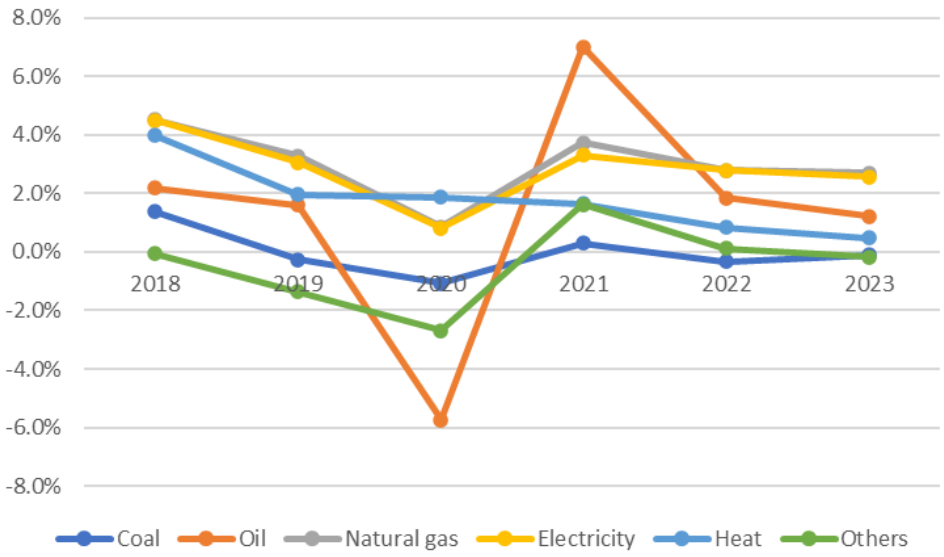
In contrast, in 2021, all the TFEC growth rates of the countries are expected to be positive: 7.3% in India, 6.6% in the United States, 2.4% in Others, and 1.7% in China.

Since many developing countries, including ASEAN countries, would have experienced negative economic growth rates and positive energy demand at the same time in 2020 due to an inevitable rapid increase in energy demand, India's TFEC drop in 2020 may have been significant. The drop in India may tell how harsh the impacts of COVID-19 have been on the economy and the energy consumption situation.

In terms of energy sources, the oil and coal consumption growth rates would have been considerably negative, whereas the natural gas and electricity growth rates would have been significantly positive in 2020 (Figure 10). Oil would have decreased to –5.7% in the +7 countries because the transportation sector's demand

would have dropped due to lockdowns and teleworks. Coal would have declined to –1.1% due to the industry sector's demand decrease. On the other hand, natural gas would have increased due to the residential and non-energy sectors' demand increase. Electricity would also have increased mainly because of a hike in residential sector demand due to the stay-home policies.

Figure 10. TFEC by Energy Source, 2018–2023



Source: Authors.

In 2021, oil and coal are expected to rebound to 7.0% and 0.3%, respectively, whereas natural gas and electricity will expand to 3.7% and 3.3%, respectively, based on the +7 countries' economic recovery assumptions.

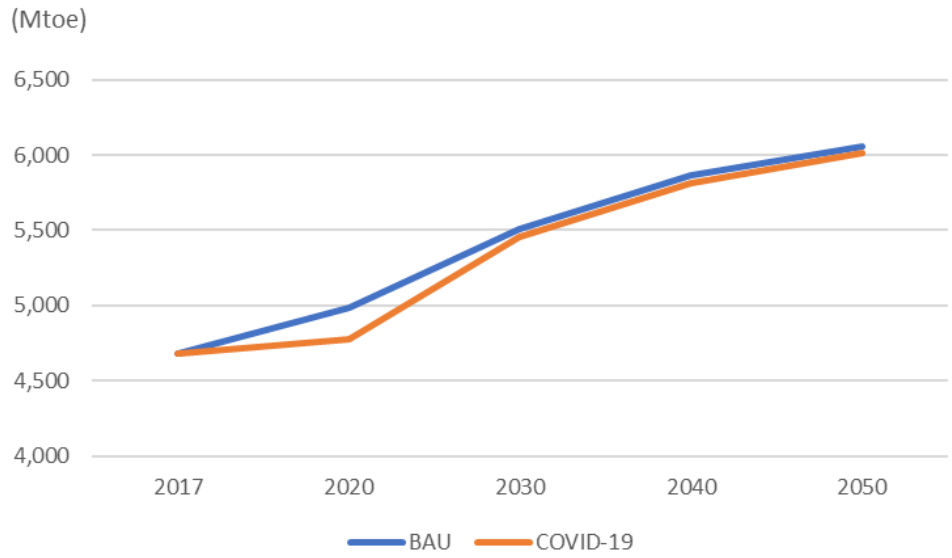
(2) Long-term impacts

In the long term, the pandemic may affect energy demand in the +7 countries only slightly compared to the short-term impacts (Figure 11). In 2020, the COVID-19 scenario shows that the demand of the countries would have been 4.1% smaller

than in the BAU. However, in 2050, the demand in the COVID-19 scenario would have been only 0.9% smaller than in the BAU. The energy demand between the two scenarios would converge towards 2050.

In both scenarios, the total TFEC of all the +7 countries in 2050 is expected to reach more than 6,000 million tonnes of oil equivalent (Mtoe), which means almost half of the world's final energy demand in 2050 according to the *IEEJ Outlook* (IEEJ, 2020).

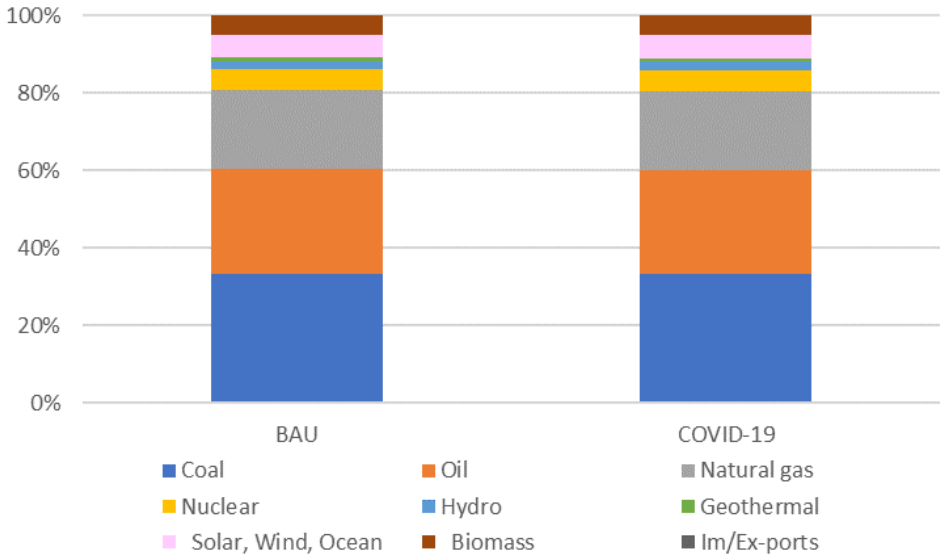
Figure 11. TFEC in the BAU and COVID-19 Scenarios, 2017–2050



Source: Authors.

The breakdown of the TPES in 2050 is almost the same between the BAU and COVID-19 scenarios (Figure 12).

Figure 12. TPES Breakdown in 2050 for the BAU and COVID-19 Scenarios



Source: Authors.

4.3 Key findings

a. In 2020, the COVID-19 pandemic had a huge impact on GDP, TFEC, and TPES in the +7 countries. In particular, oil demand would have dropped substantially due to lockdowns in major cities and the rapid diffusion of work-from-home measures in the countries.

b. In the short term, however, the economy will rebound, especially in 2021, and the GDP annual average growth rates between 2020 and 2025 in the COVID-19 scenario exceed those in the BAU. Thus, the difference in energy consumption in both scenarios becomes smaller and smaller after 2021.

c. In the long term, until 2050, the impacts of the pandemic on the economy, energy demand, and the demand breakdown are very limited. Accordingly, both scenarios imply that the energy consumption in the +7 countries will approach half of the total final energy demand in the world in 2050 regardless of the COVID-19 pandemic.

5. Recommendations

5.1 ASEAN

According to the results of this trial analysis to measure how the COVID-19 pandemic impacts the energy consumption of ASEAN countries using energy outlook models of the econometric type, it is shown that the pandemic brings a negative impact on energy consumption through economic recession. In addition, after COVID-19, energy consumption will rise due to the economic rebound and gradually catch up with the energy consumption trend of the BAU scenario. As a result, the fossil fuel share in 2050 will be still more than 80%, and, thus, the promotion of Energy Efficiency and Conservation (EEC) and the deployment of affordable RE, such as hydropower, geothermal, and solar/PV, will be important energy policies for ASEAN countries. In terms of carbon dioxide (CO_2) emissions, coal-to-gas policy will be an option for ASEAN countries to mitigate emissions, and therefore an integrated liquefied natural gas supply chain in ASEAN, such as the Trans ASEAN Gas Pipeline (TAGP), will be indispensable.

5.2 EAS+7 countries

Some may argue that the COVID-19 pandemic will contribute to CO_2 emissions reductions in the future; however, this will not be true. As described previously, the pandemic will have a huge impact on decreasing CO_2 emissions in the short term. However, the pandemic is projected to have little impacts in the long term. This study shows that the pandemic itself will not have the impact of sustainably reducing CO_2 emissions. Therefore, we need to take action if we want to reduce CO_2 emissions in the long run.

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