Chapter 8

Japan Country Report

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Chapter 8
Japan Country Report

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1. Background

During the coronavirus disease (COVID-19) pandemic, the government declared in October 2020 that Japan would realize a carbon-neutral, decarbonized society by 2050, reducing total greenhouse gas emissions to zero. In 2020, how did the pandemic affect energy demand in Japan and how will it impact its energy situation? In 2050, will Japan be able to achieve its target? This chapter examines Japan's energy outlook in the short and long terms by comparing the COVID-19 and business-as-usual (BAU) scenarios.

2. Macro Assumptions of the COVID-19 Scenario

In the COVID-19 scenario, the economy declines sharply in 2020 because of the pandemic, gradually recovers by 2023, and returns to BAU levels after 2023 (Table 8.1). The COVID-19 scenario estimates that the gross domestic product (GDP) growth rate in 2020 drops to –5.3% (1.0% in BAU) and rebounds to 2.3% in 2021, 1.7% in 2022, and 1.2% in 2023. After recovery in 2021–2023, growth rates are the same as in BAU. GDP recovers to 2019 levels in 2023.

Table 8.1. Assumed Gross Domestic Product Annual Growth Rates, Business-as-Usual vs. COVID-19 Scenarios, 2018–2050

	2018	2019	2020	2021	2022	2023	2023–2030	2030–2040	2040–2050
COVID-19	0.5%	0.7%	–5.3%	2.3%	1.7%	1.2%	0.8%	0.8%	0.7%
BAU	0.5%	0.7%	1.0%	0.5%	0.5%	0.5%	0.8%	0.8%	0.7%

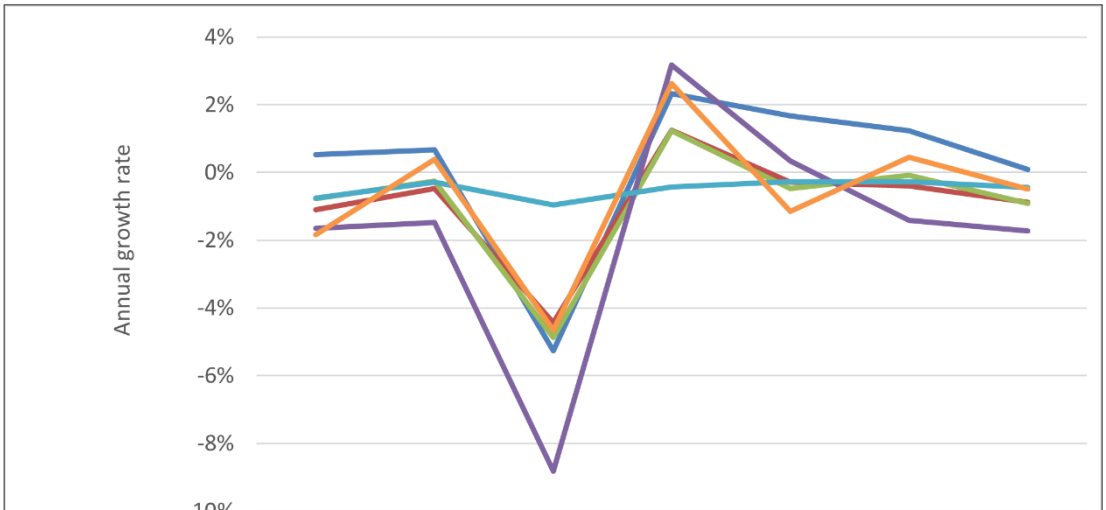
BAU = business as usual, COVID-19 = coronavirus disease.
Source: Authors, based on International Monetary Fund (2020).

3. Short-term Impact (2018–2023)

3.1. Final Energy Consumption

The COVID-19 pandemic affected the entire economy and energy demand in 2020 (Figure 8.1). However, after the pandemic, the relationship between economic growth and energy consumption returns to what it was before: negative energy consumption growth and positive economic growth.

Figure 8.1. Annual Growth Rate of Total Final Energy Consumption, by Sector, COVID-19 Scenario, 2018–2023



	2018	2019	2020	2021	2022	2023	2018–2023
GDP Assumption	0.5%	0.7%	-5.3%	2.3%	1.7%	1.2%	0.1%
TFEC	-1.1%	-0.5%	-4.4%	1.2%	-0.3%	-0.4%	-0.9%
Industry	-0.8%	-0.3%	-4.9%	1.2%	-0.5%	-0.1%	-0.9%
Transportation	-1.6%	-1.5%	-8.8%	3.2%	0.3%	-1.4%	-1.7%
Others	-0.8%	-0.3%	-1.0%	-0.4%	-0.3%	-0.3%	-0.4%
Non-energy	-1.8%	0.4%	-4.7%	2.6%	-1.1%	0.5%	-0.5%

COVID-19 = coronavirus disease; GDP = gross domestic product; others = agricultural, commercial. and residential sectors; TFEC = total final energy consumption.
Source: Authors.

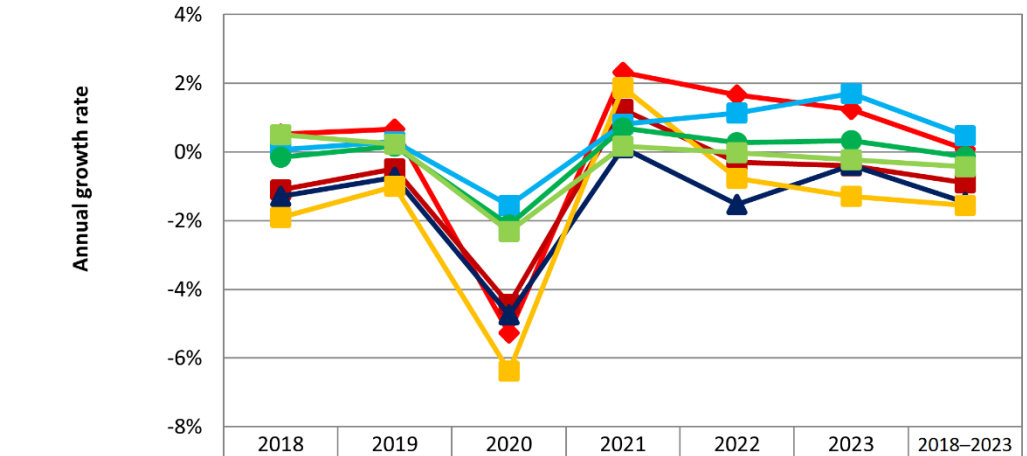
Economic growth rates were slightly positive in 2018 (0.5%) and 2019 (0.7%), but energy saving, mainly in transport and industry, led to negative growth of total final energy consumption (TFEC) in 2018 (–1.1%) and 2019 (–0.5%). In 2020, the economic growth rate is estimated to massively decrease to –5.3% and TFEC growth rate to drop to –4.4% because of all sectors' negative growth. In 2021, the economic growth rate rebounds to 2.3% and TFEC increases by 1.2%. In 2022 and 2023, GDP growth rates stay positive and TFEC growth rates become negative again.

In the COVID-19 scenario, economic growth and energy consumption decouple in 2018 and 2019 but move in the same direction in 2020 (negative) and 2021 (positive), but start decoupling again after 2021, suggesting that COVID-19's impact on TFEC is tentative only when COVID-19 infections are widespread.

In the COVID-19 scenario, transport energy demand drops the most, by 8.8%, in 2020 compared with the previous year. A state of emergency has been declared four times in Tokyo – April–May 2020 and January–March, April–June, and July–August 2021 – causing many people to work and study at home. They rarely drive cars; seldom use international and domestic airlines; and infrequently take commuter trains, subways, and buses.

In the COVID-19 scenario, oil final energy consumption is most drastically reduced, by 6.4%, in 2020 compared with the previous year mainly because energy demand drops in transport (Figure 8.2). In contrast, consumption of electricity and gas does not decrease as much because of higher residential demand, since people stay home, using lighting, cooking gas, and air conditioning.

Figure 8.2. Annual Growth Rate of Total Final Energy Consumption, by Source, COVID-19 Scenario, 2018–2023



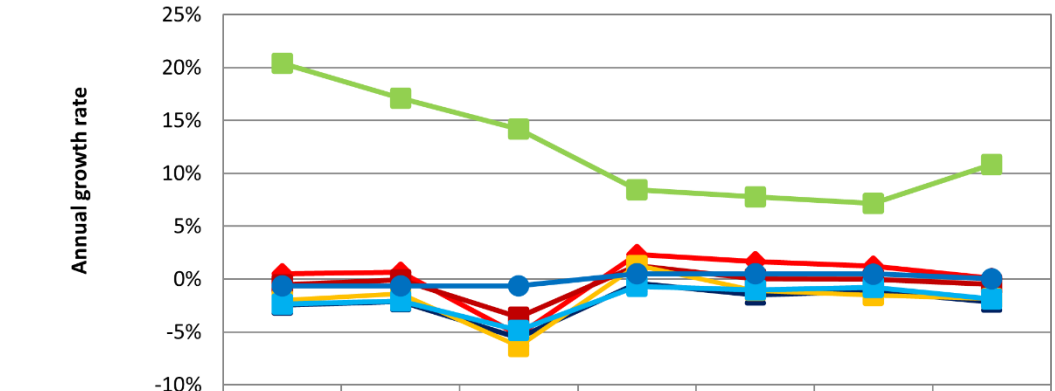
	2018	2019	2020	2021	2022	2023	2018–2023
GDP Assumption	0.5%	0.7%	-5.3%	2.3%	1.7%	1.2%	0.1%
TFEC	-1.1%	-0.5%	-4.4%	1.2%	-0.3%	-0.4%	-0.9%
Coal	-1.3%	-0.7%	-4.7%	0.1%	-1.5%	-0.4%	-1.5%
Oil	-1.9%	-1.0%	-6.4%	1.9%	-0.8%	-1.3%	-1.6%
Natural gas	0.1%	0.3%	-1.6%	0.8%	1.1%	1.7%	0.5%
Electricity	-0.2%	0.2%	-2.1%	0.7%	0.3%	0.3%	-0.1%
Others	0.5%	0.2%	-2.3%	0.2%	0.0%	-0.2%	-0.4%

COVID-19 = coronavirus disease, GDP = gross domestic product; others = heat, renewables, etc.; TFEC = total final energy consumption.
Source: Authors.

3.2. Primary Energy Supply

In the COVID-19 scenario, GDP drops in 2020 and rebounds in 2021, and total primary energy supply (TPES) decreases by 3.6% in 2020 compared with the previous year and recovers by 1.3% in 2021 (Figure 8.3). Although GDP growth rates in 2022 and 2023 are positive, TPES is unchanged, with an annual growth rate of 0.0% in both years.

Figure 8.3. Annual Growth Rate of Primary Energy Supply by Source, COVID-19 Scenario, 2018–2023



	2018	2019	2020	2021	2022	2023	2018–2023
GDP Assumption	0.5%	0.7%	-5.3%	2.3%	1.7%	1.2%	0.1%
TPES	-0.5%	-0.1%	-3.6%	1.3%	0.0%	0.0%	-0.5%
Coal	-2.4%	-2.1%	-5.6%	-0.4%	-1.5%	-1.2%	-2.2%
Oil	-2.0%	-1.4%	-6.4%	1.3%	-1.1%	-1.5%	-1.9%
Natural gas	-2.4%	-2.1%	-4.9%	-0.7%	-1.0%	-0.8%	-1.9%
Hydro	-0.6%	-0.6%	-0.6%	0.5%	0.5%	0.5%	0.0%
Others	20.4%	17.1%	14.2%	8.4%	7.7%	7.2%	10.9%

COVID-19 = coronavirus disease; GDP = gross domestic product; others = geothermal, solar, wind, biomass, waste, etc.; TPES = total primary energy supply.
Source: Authors.

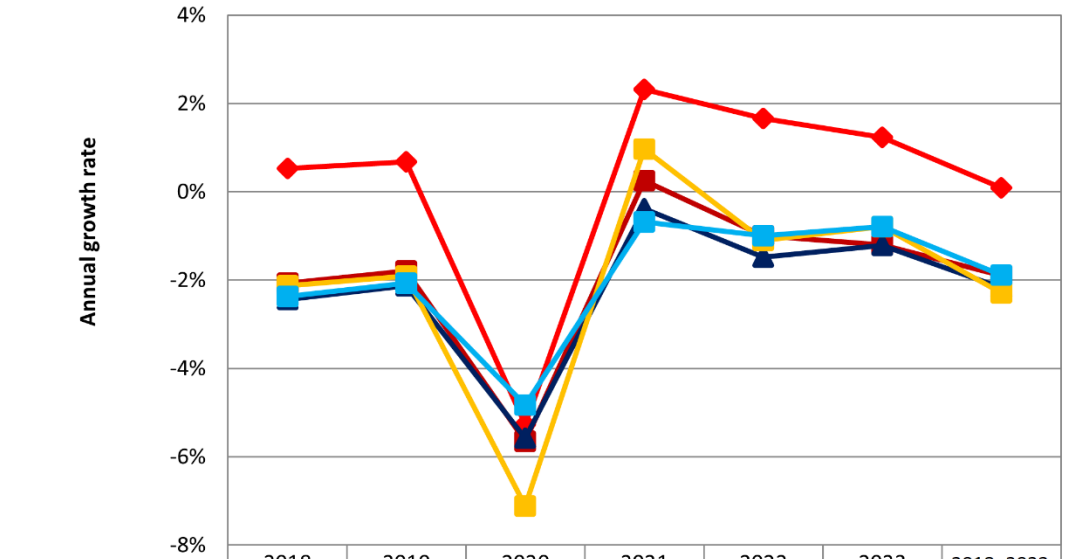
Annual growth rates of TPES are estimated to be always higher than those of TFEC in 2018–2023 mainly because the electrification rates gradually rise.

Among energy sources in 2020, oil supply reduces most sharply along with TFEC mainly because of the drop in transport demand. Coal decreases since industrial demand falls. Natural gas significantly declines because demand for electricity and non-energy decreases. Others' growth rate, however, is positive because renewables and nuclear grow even during the COVID-19 pandemic.

3.3. CO_2 Emissions

CO_2 emission growth rates in 2018 and 2019 are about –2.0%, –5.6% in 2020, and 0.2% in 2021 (Figure 8.4), then about –1.0% in 2022 and 2023.

Figure 8.4. CO_2 Emissions by Source, COVID-19 Scenario, 2018–2023



	2018	2019	2020	2021	2022	2023	2018–2023
GDP Assumption	0.5%	0.7%	-5.3%	2.3%	1.7%	1.2%	0.1%
Total	-2.1%	-1.8%	-5.6%	0.2%	-1.0%	-1.2%	-1.9%
Coal	-2.4%	-2.1%	-5.6%	-0.4%	-1.5%	-1.2%	-2.2%
Oil	-2.1%	-1.9%	-7.1%	1.0%	-1.1%	-0.8%	-2.3%
Natural gas	-2.4%	-2.1%	-4.8%	-0.7%	-1.0%	-0.8%	-1.9%

COVID-19 = coronavirus disease, GDP = gross domestic product.
Source: Authors.

CO_2 emission growth rates are negative except in 2021 and always much lower than GDP growth rates in 2018–2023 because of decreasing use of fossil fuels such as coal, oil, and natural gas, which are partially replaced with non-fossil fuels such as renewable energy, including solar, wind, and biomass.

Nonetheless, as of 1 April 2021, Japan's existing official target of energy-originated CO_2 emission reduction by 2030, which is 25% reduction compared with the 2013 level, would be still challenging. This chapter shows that CO_2 is reduced by more than 28 million tonnes, and the reduction rate is 5.6% in 2020 compared with the previous year. However, the reduction rate in 2020 compared with the 2013 level is only 18%. Japan's new 2050 carbon neutrality target is, therefore, ambitious.

4. Long-term Impact (2023–2050)

4.1. Final Energy Consumption

In the long term, the COVID-19 pandemic has a limited impact on GDP and TFEC. In the COVID-19 scenario, the GDP growth rate is 0.6% annually on average in 2017–2050 (0.7% in BAU). The TFEC annual growth rate is –0.8% during the same period in both scenarios. In 2050, GDP decreases by 2.6% from the BAU level while TFEC declines by 1.2%.

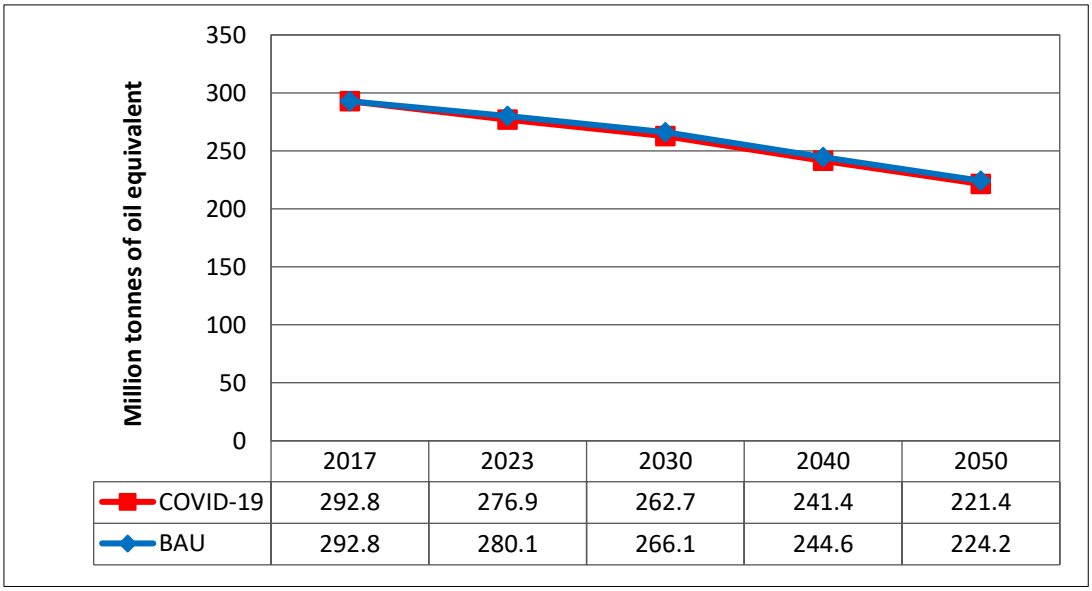
Table 8.2. Gross Domestic Product and Total Final Energy Consumption, Business-as-Usual vs. COVID-19 Scenarios, 2017–2050

		2017	2023	2030	2040	2050	AAGR (2017–2050)
GDP (US$ billion, 2010)	COVID-19	6,157.7	6,215.7	6,588.6	7,103.9	7,586.4	0.6%
	BAU	6,157.7	6,395.9	6,762.4	7,291.3	7,786.5	0.7%
	COVID-19 vs. BAU	-	–2.8%	–2.6%	–2.6%	–2.6%	-
TFEC (Mtoe)	COVID-19	292.8	276.9	262.7	241.4	221.4	–0.8%
	BAU	292.8	280.1	266.1	244.6	224.2	–0.8%
	COVID-19 vs. BAU	-	–1.1%	–1.3%	–1.3%	–1.2%	-

AAGR = average annual growth rate, BAU = business as usual, COVID-19 = coronavirus disease, GDP = gross domestic product, Mtoe = million tonnes of oil equivalent, TFEC = total final energy consumption.
Source: Authors.

Figure 8.5 shows that the pandemic has only slight impacts on TFEC in the long term. In the COVID-19 scenario, TFEC declines by 1.1% in 2023, by 1.3% in 2030, by 1.3% in 2040, and by 1.2% in 2050 from BAU levels.

Figure 8.5. Total Final Energy Consumption, Business-as-Usual vs. COVID-19 Scenarios, 2017–2050



BAU = business as usual, COVID-19 = coronavirus disease.
Source: Authors.

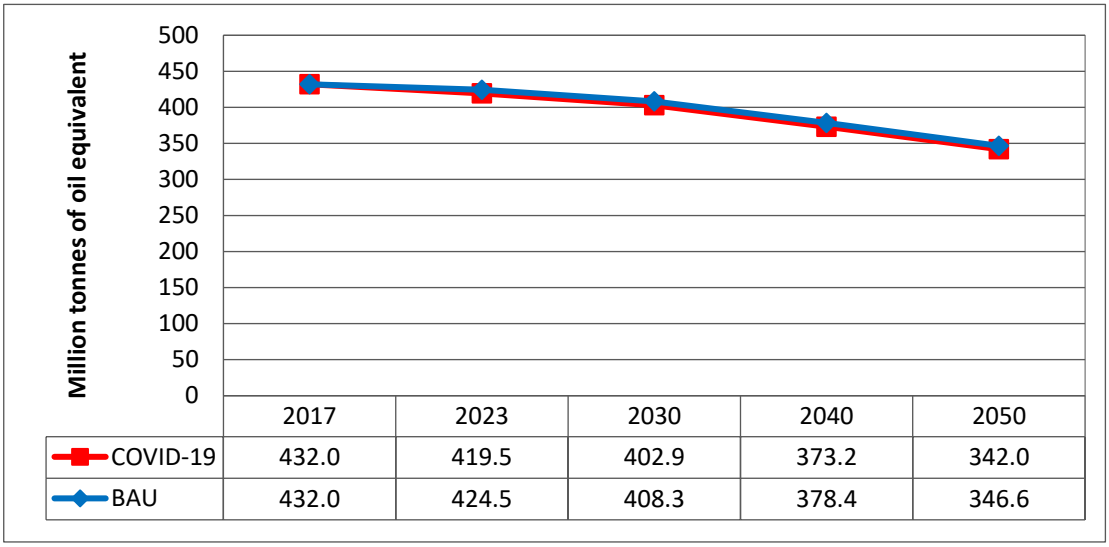
Demand in industry declines by 1.9%, in transport by 0.6%, in 'others' (residential, commercial, agricultural, etc.) by 1.1%, and in the non-energy sector by 1.3% from BAU levels in 2050.

Demand for coal decreases by 1.0%, for oil by 1.3%, and for electricity by 1.6%, while demand for natural gas slightly increases by 0.1% because of a small rise in residential demand from BAU levels in 2050.

4.2. Primary Energy Supply

Like TFEC, TPES is not much affected by the pandemic in the long term (Figure 8.6). In the COVID-19 scenario, TPES decreases by 1.2% in 2023, by 1.3% in 2030, by 1.4% in 2040, and by 1.3% in 2050 from BAU levels. The annual growth rate of TPES in 2017–2050 is –0.7% on average in both COVID-19 and BAU scenarios.

Figure 8.6. Total Primary Energy Consumption, Business-as-Usual vs. COVID-19 Scenarios, 2017–2050



	2017	2023	2030	2040	2050
COVID-19	432.0	419.5	402.9	373.2	342.0
BAU	432.0	424.5	408.3	378.4	346.6

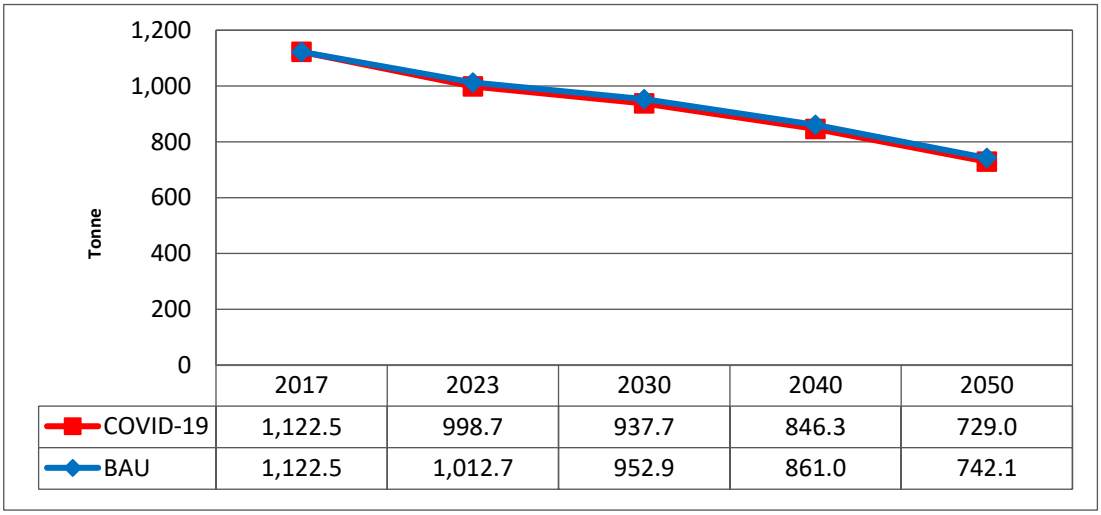
BAU = business as usual, COVID-19 = coronavirus disease.
Source: Authors.

The pandemic reduces coal by 2.3%, oil by 1.3%, natural gas by 1.9%, and others (solar, wind, biomass, waste, etc.) by 0.3% from BAU levels in 2050.

4.3. CO_2 Emissions

The COVID-19 pandemic decreases energy-related CO_2 emissions only slightly from BAU levels in the long term (Figure 8.7). Energy-related CO_2 emissions decrease by an average rate of 1.3% per year in 2017–2050 (1.2% in BAU).

Figure 8.7. Total CO_2 Emissions, Business-as-Usual vs. COVID-19 Scenarios, 2017–2050



	2017	2023	2030	2040	2050
COVID-19	1,122.5	998.7	937.7	846.3	729.0
BAU	1,122.5	1,012.7	952.9	861.0	742.1

BAU = business as usual, COVID-19 = coronavirus disease.
Source: Authors.

As a result, energy-related CO_2 emissions in 2050 are reduced by 41% in the COVID-19 scenario from the 2013 CO_2 emission level (40% in BAU). The long-term effect of the pandemic is only a 1 percentage point reduction. Japan's carbon neutrality will not be achieved only because of the pandemic.

5. Implications and Policy Recommendations

In 2020, the COVID-19 pandemic had a huge impact on GDP, TFEC, TPES, and CO_2 emissions, especially in transport, leading to massive oil demand reduction. In the short-term COVID-19 scenario, the economy recovers to pre-pandemic levels by 2023 and energy consumption levels approach BAU. In the long term, by 2050, the COVID-19 pandemic does not much affect the economy and energy demand. In both BAU and COVID-19 scenarios, therefore, CO_2 emission reduction levels in 2050 are insufficient to realize Japan's new carbon-neutral target.

Japan relies heavily on fossil fuels that cause CO_2 emissions, but its way of consuming energy is starting to change. Japan aims to save more energy on the demand side and to enhance decarbonization of energy sources on the supply side.

On the demand side, further energy efficiency improvements are being pursued in all sectors. Japan already has one of the best energy intensities per unit of GDP.

On the supply side, Japan has started to decarbonize the economy and society. First, Japan is considering introducing renewables and nuclear energy as much as possible, especially in the power sector, since they do not emit CO_2. Second, Japan has started to plan to import decarbonized fossil fuels such as blue hydrogen and blue ammonia with carbon capture and storage, carbon capture, and utilisation, and enhanced oil recovery, which can be used not only in the power sector but also in industry and transport. Third, Japan is considering

introducing CO_2 transport to inject captured CO_2 into underground wells inside and outside the country, and introducing methanation, a method of producing carbon-free natural gas by synthesizing carbon with hydrogen.

Its carbon-neutral policy is challenging, but Japan is determined to do all it can to mitigate climate change while promoting energy security and economic efficiency.

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