The Institute of Energy Economics, Japan

24 December 2020
The 437th Forum on Research Work

Economic and Energy Outlook of Japan for FY2021

On the way back to a normal energy situation while ending the COVID-19 pandemic

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Summary of economic and energy outlook [Reference Scenario]

Macro economy | GDP growth will be +3.4%, but GDP will be lower than FY2019

While real GDP growth in FY2021 will achieve a high growth rate of +3.4%, GDP will remain lower than before COVID-19 due to the large fall of FY2020. Industrial production will increase (+7.5%) in heavy electric machinery, automobile and other manufacturers with the recovery of world and domestic economy but the industrial production will be only higher than the level of FY 2009 after the Lehman shock.

Total energy consumption will increase while natural gas (LNG) will significantly fall

Total energy consumption will increase (+2.6%) with recoveries in industrial production and transportation demand. Except for the previous year, it will be the lowest level since FY1987. For the second consecutive year, improvements of total energy consumption per GDP will slow down to less than 1%. With an increase in nuclear generation, LNG imports will fall for the first time since the earthquake to the same level as in FY2010.

While CO_2 will increase to 955Mt (+1.6%) due to the recovery of economic activities, the reduction rate of CO_2 relative to FY2013 will be -22.7%, fulfilling more than 90% of the Paris commitment. Note that identifying progress toward achieving the Paris reduction target is difficult because of the energy consumption decrease due to temporal downturn of economic activities

Energy sales | Lighting services will remain high and power services will recover, city gas sales will be higher than in FY2019, fuel oil sales will increase for the first time in nine years but the long-term decrease trend continues

Although electricity sales in FY2021 will increase by 1.2%, it will be 0.4% lower than FY2019 before COVID-19. Sales for power services will grow with production recovery in machinery and other industries (+1.8%) but they will be 2.5% lower than FY2019. Sales for lighting services will slightly decrease due to less Working From Home and the diffusion of rooftop PV and energy efficient technologies such as LED (-0.1%) despite the higher electrification rate for cooking and heating water due to the increase of all-electric home.

Overall total city gas sales will be 40.6 billion m^3(+3.8%) in FY2021 and higher than FY2019. Note that the demand in FY2019 was lower due to the hottest winter since the availability of statistics in FY1897. While sales of general industry and commercial will increase in FY2021, they will be lower than FY2019.

Fuel oil sales in FY2021 will increase 3.1% with the recovery of industrial production and transportation demand from FY2020 but decrease 3.6% from FY2019. Sales of kerosene and heavy fuel oil A will fall due to energy saving and fuel switching with little effects from changes in temperature. Sales of naphtha will increase with less regular ethylene plant repairs. Sales of heavy fuel oil C will continuously decrease due to fuel switching, energy saving for industries and a lower availability of oil-fired power generation in Tokyo and Chubu area, the result of a long shut-off plan for after FY2020.

Renewable power generation | The FIT power generation capacity will reach 87 GW at the end of FY2021

The facilities under construction are expected to become operational, boosting installed renewable energy-based power generation capacity (including capacity subject to FIT contract expiration) to 86.8 GW by the end of FY2021. With a slowdown in the installation pace of solar PV, capacity will expand to 53.0 GW by the end of FY2021. Less opportunity to communicate with local people and difficulties in securing workers under COVID-19 will cause delays in construction work. Wind capacity will remain at 5.3GW because of the long time lead operation due to environmental assessment etc. Renewable energy-based power generation in FY2021 will total 166.2 TWh (including 79.8 TWh for solar PV, 39.9 TWh for small and medium-sized hydroelectric plants, 32.7 TWh for biomass, 10.1 TWh for wind etc.), accounting for 17% of Japan's total power generation.

Table 1 | Summary of Reference Scenario

		Historical				Projection		Year-over-year		
		FY2010	FY2017	FY2018	FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Energy	Primary energy supply (Mtoe)[1]	515.9	465.1	455.4	444.4	420.0	431.0	-2.4%	-5.5%	2.6%
	Oil[2] (GL)	232.3	202.8	192.8	186.1	170.8	176.0	-3.5%	-8.2%	3.1%
	Natural gas[2] (Mt of LNG equiv.)	73.3	85.6	81.6	78.3	77.5	73.1	-4.0%	-1.1%	-5.6%
	Coal[2] (Mt)	184.7	192.2	188.2	187.5	177.9	184.3	-0.3%	-5.1%	3.6%
	Nuclear (TWh)	288.2	31.3	62.1	61.0	44.2	79.7	-1.7%	-27.5%	80.0%
	Renewable electricity[3] (TWh)	111.2	169.4	177.1	187.9	197.8	205.6	6.1%	5.3%	3.9%
	FIT generation (TWh)	63.2	123.2	133.9	146.2	155.7	166.2	9.2%	6.5%	6.8%
	Self-sufficiency ratio	20.2%	9.4%	11.7%	12.1%	12.2%	14.4%	0.5p	0.1p	2.2p
	Electricity sales[4] (TWh)	(926.6)	863.2	852.6	836.0	823.1	832.7	-1.9%	-1.5%	1.2%
	City gas sales[5] (Billion m^3)	39.28	42.43	41.58	40.40	39.07	40.55	-2.8%	-3.3%	3.8%
	Fuel oil sales (GL)	196.0	174.7	167.7	161.6	151.2	155.9	-3.6%	-6.5%	3.1%
	Energy-related CO_2 emissions (Mt)	1,137	1,110	1,065	1,029	939	955	-3.4%	-8.8%	1.6%
	(Changes from FY2013)	-8.0%	-10.1%	-13.8%	-16.7%	-24.0%	-22.7%	-2.9p	-7.3p	1.3p
Prices	Crude oil, import, CIF ($/bbl)	84	57	72	68	43	52	-6.2%	-36.0%	19.4%
	LNG, import, CIF ($/MBtu)	11.3	8.5	10.5	9.5	6.8	7.3	-9.8%	-28.6%	8.1%
	Steam coal, import, CIF ($/t)	114	103	121	101	81	93	-16.2%	-20.4%	14.8%
	Coking coal, import, CIF ($/t)	175	147	160	137	102	115	-14.2%	-25.8%	12.3%
Economy	Real GDP (JPY2015 trillion)	512.1	553.1	554.8	552.9	522.4	540.4	-0.3%	-5.5%	3.4%
	Industrial production (CY2015=100)	101.2	103.5	103.8	99.9	90.1	96.8	-3.7%	-9.9%	7.5%
	Balance of trade (JPY trillion)	5.3	2.4	-1.6	-1.3	2.7	10.6	-20%	-311.0%	289.6%
	Fossil fuel imports (JPY trillion)	18.1	16.3	19.1	16.6	10.2	11.8	-13.2%	-38.4%	15.4%
	Exchange rate (JPY/$)	86.1	111.1	110.6	108.8	105.8	105.0	-1.7%	-2.7%	-0.8%
	Cooling degree days	559	397	489	439	442	383	-10.2%	0.6%	-13.5%
	Heating degree days	1,079	1,071	865	818	998	1,014	-5.5%	22.1%	1.6%

Notes:

1. Mtoe = 10^{13} kcal
2. Conversion factors for oil: 9,126 kcal/L; Natural gas: 13,043 kcal/kg; Steam coal: 6,139 kcal/kg; Coking coal: 6,928 kcal/kg until FY2012.
   Conversion factors for oil: 9,145 kcal/L; Natural gas: 13,016 kcal/kg; Steam coal: 6,203 kcal/kg; Coking coal: 6,877 kcal/kg since FY2013.
   Conversion factors for oil: 9,139 kcal/L; Natural gas: 13,068 kcal/kg; Steam coal: 6,203 kcal/kg; Coking coal: 6,866 kcal/kg since FY2018.
3. Including large hydro 30 MW or more. 4. Figures in parentheses are old statistical figures. 5. Conversion factor: 1 m^3 = 10,000 kcal

Topic |

1 Transportation energy consumption by mode

Transportation energy consumption in FY2020 is expected to fall by -10.2% the most largely since FY1953 when comparative data began to be statistically available. It will be lower than 70 Mtoe for the first time after 1988. This is due to the fact that passenger transportation sharply falls due to the popularity of Working From Home and the avoidance of unnecessary outings. Freight transportation also drops reflecting the lower activities in industrial production and the service industry affected by COVID-19. With some recovery of both passenger and freight transportation in FY2021, consumption will increase by 5.5% while remaining 5.2% below FY2019. It will be lower than 70 Mtoe for the second year in a row.

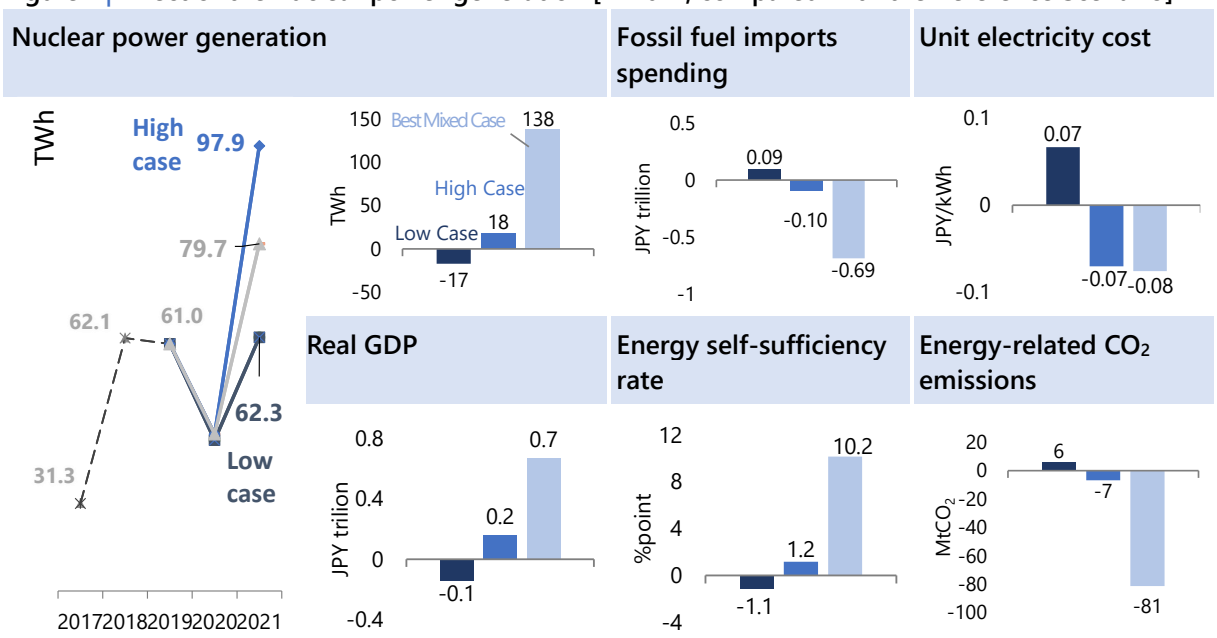
2 Impacts of fading-out inefficient coal-fired power plants

The Energy Basic Plan outlines the main policies and measures the government should take, including considering a mechanism to encourage efficiency by fading out the coal-fired power plants with the generation efficiency below-Ultra-Supercritical by FY2030. If the 30GW of inefficient coal capacities are removed, that would be equivalent to reduce generation by 165 TWh. As generation from renewables and the nuclear restarts is assumed constant, any loss of coal-fired power generation would be substituted by gas-fired power generation. As joint thermal power plant and plants owned by manufacturers consume heat from power plants, gas-fired power generation will be assumed to be newly built to replace of coal-fired power generation. CO_2 emissions would fall by 87Mt, the equivalent of 7.1% of 2013 while only fuel costs would rise JPY0.23/kWh (6.7%).The construction costs of 1.8 trillion for gas-fired power generation are added separately and costs for processing byproducts in another way will be plus. As this fading-out should be considered as one of the measures to reduce CO_2 emissions, the condition of each plant should be taken into account. Setting targets for coal-fired power generation efficiency including biomass, heat utilization and byproducts as well as regular reporting are required. Evaluating and preparing fading-out plans by operators are required irrespective of FY 2030. Reviewing in the macro view is important with whole CO_2 reduction progress and the impacts of fade-out based on the reports and plans.

3 Impacts of the completion of counterterrorism facilities and of the delays in nuclear plant restarts

We assessed the impacts of nuclear power generation on 3Es – economy efficiency, energy security and environment. In the High Case, where more plants would be in full operation with their counterterrorism facilities completed within their respective deadlines, the cost of fossil fuel imports would be reduced by JPY100 billion, the self-sufficiency rate would be improved by 1.2 points, and CO_2 emissions would be reduced by 7 Mt. The number of plants which have a deadline for the completion of their counterterrorism facilities after FY2021 will increase. Smoothing the restart of the nuclear power generation with the consideration of each plant contributes to achieving 3Es.

Figure 1 | Effect of the nuclear power generation [FY2021, compared with the Reference Scenario]



Introduction

The Japanese economy in the third quarter of 2020 posted a growth rate of 5.3% in gross domestic product, the first positive growth in four quarters, in response to economic reopening following the lifting of a state of emergency declaration. Domestic demand contributed 2.6 percentage points to the growth and external demand 2.7 points. The Japanese economy and the world economy are moderately recovering from a plunge triggered by COVID-19 and are expected to recover further amid efforts to promote economic activities while preventing COVID-19 from spreading.

The average crude oil import price for Japan fell to $25 per barrel in June due to a global oil demand decline. It rallied later as COVID-19 constraints on economic activities decreased gradually despite a damper from concern about the resurgence of COVID-19. Currently, it is staying above $40/bbl.

Applications have been filed for examinations of 27 nuclear power plants for conformity to new regulatory standards in Japan. Of them, 16 have cleared the examinations, including nine that have restarted. However, five of the nine restarted plants have suspended operation beause of judicial problems or a delay in the completion of counterterrorism facilities.

As the feed-in tariff (FIT) scheme for solar photovoltaics power generation at households began to expire in November 2019, the tariff plunged from JPY48/kWh in FY2009 to a JPY8-12/kWh range, with storage batteries failing to diffuse due to their lack of economic efficiency.

Key assumptions behind the Reference Scenario

COVID-19

While knowledge about COVID-19 treatments and countermeasures has deepened, 95% effective COVID-19 vaccines have been made available in Europe and the United States. We assume that new COVID-19 infections will gradually decrease from January 2021, with the number of seriously ill patients being held down to avoid healthcare collapse, a state of emergency declaration, or social unrest growth. In FY2021, we assume that the situation will improve due to the promotion of COVID-19 vaccination and treatments, while social distancing and other COVID-19 countermeasures are retained, with time taken for confirming vaccination effects and developing vaccination arrangements.

Global economy

Global economic growth is assumed at -4.4% for 2020, the lowest since the end of World War II, and at 5.2% for 2021. In 2020, the global economy contracted substantially due to social distancing practices and lockdowns under the COVID-19 pandemic. In 2021, consumption and investment are assumed to gradually recover, though with global GDP managing to grow by 0.6% from 2019 before the COVID-19 outbreak.

Crude oil/LNG/coal import CIF prices

Crude oil import prices for Japan are assumed to average $43/bbl in FY2020 ($36/bbl in the first half and $50/bbl in the second) and $52/bbl in FY2021, based on the international crude oil price outlook below, rising from the second half of FY2020. The average LNG import price for Japan is assumed to rise from $6.8/MBtu in FY2020 to $7.3/MBtu in FY2021, reflecting earlier crude oil price rises. Steam coal import prices are projected to gradually rise from the second half of FY2020 to FY2021. Coking coal import prices are also assumed to increase as steel demand grows due to China's economic recovery. Steam coal import prices are assumed to average $81/t in FY2020 and $93/bbl in FY2021. Coking coal import prices are projected to average $102/t in FY2020 and $115/t in FY2021. (IEEJ Hashizume "Outlook and Challenges for Oil Market," Hashimoto "Outlook and Challenges for Gas Market," Ito "Outlook and Challenges for International Coal Market.")

Exchange rate

We assume the dollar's average exchange rate with the yen to stand at JPY105.8/USD in FY2020 and at JPY105.0/USD in FY2021.

Air temperature

According to the Japan Meteorological Agency's three-month weather forecast, we assume that winter in FY2020 will be slightly warmer than normal before temperatures restore normal levels in FY2021. FY2020 summer was as warm as the previous summer (+0.0 °C). FY2020 winter will be colder (-1.2 °C) than the previous winter that was far warmer than normal. Summer in FY2021 will be cooler (-0.5°C) than the previous summer. Winter in FY2021 will be slightly colder (-0.2°C).

Nuclear power generation

Given progress in regulatory standards conformity examinations for nuclear power plants, more plants are assumed to restart. Two nuclear power plants were to restart within FY2020, bringing the cumulative number of restarted plants to 11 at the end of the fiscal year. As five restarted plants have been suspended due to judicial problems or a delay in the completion of counterterrorism facilities, the 11 plants in FY2020 will operate for an average five months and generate 44.2 TWh, down 27.5% from the previous year. Two nuclear power plants will restart in FY2021, bringing the cumulative number of restarted plants to 13 at the end of the fiscal year. However, four restarted plants will be suspended due to judicial problems or a delay in the completion of counterterrorism facilities. In FY2021, the 13 restarted plants will operate for an average eight months and generate 79.7 TWh, up 80.0% from the previous year.

Macro economy

GDP will score a real growth rate of 3.4% in FY2021 but remain below the FY2019 level before the COVID-19 pandemic due to a steep contraction in FY2020

Japan's gross domestic product in FY2020 will post the largest post-war contraction of 5.5%, despite a rebound in the second half. Private consumption will decline by 5.8% as voluntary restrictions remain in the second half. Private non-residential investment will decrease by 7.2% due to deterioration in earnings and uncertainties. Private demand will thus contribute -5.2 points to the contraction. Public demand will contribute 0.7 points due to economic stimulus measures such as a special fixed-sum cash handout. External demand will make a contribution of -1.0 points to the contraction as manufacturers' exports drop due to stagnant European and American economies.

In FY2021, Japan's GDP will score a 3.4% increase covering a little more than half of the contraction in the previous year. Private consumption will rise by 3.4% as consumer sentiment improves under the easing impacts of the COVID-19 pandemic. Given continuous efforts to prevent COVID-19 infections, as well as income and employment environment deterioration, any recovery in spending on eating-out, travelling, and leisure will be limited. Private non-residential investment will grow by 2.4% as a decline in uncertainties and a rebound in business earnings encourage companies to implement investment carried over from the previous year in equipment to enhance business efficiency and cope with labour shortages, as well as in information facilities for telework and other infection prevention measures. Private demand's contribution to the growth will be limited to 2.1 points, less than in FY2012 after the Great East Japan Earthquake. Public demand will contribute 0.4 points to the growth and hit a record high due mainly to an increase in public investment related to the National Resilience Plan and healthcare expenditure growth. External demand's contribution to the GDP growth will be limited to 0.9 points as export growth amid a moderate global economic recovery is countered by import growth.

Japan's fossil fuel imports will plunge by 38.4% in FY2020 due to a demand fall and drops in all fossil fuel prices. In FY2021, they will increase by 15.4% due to a demand recovery and price hikes but be limited to the lowest level in 17 years excluding FY2020.

Table 2 | Macroeconomic indicators

	Historical				Projection		Year-over-year		
	FY2010	FY2017	FY2018	FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Real GDP (JPY2015 trillion)	512.1	553.1	554.8	552.9	522.4	540.4	-0.3%	-5.5%	3.4%
Private demand	383.7	415.2	416.1	412.9	384.1	395.0	(-0.6%)	(-5.2%)	(2.1%)
Private consumption	290.5	302.2	302.7	299.8	282.5	292.0	-0.9%	-5.8%	3.4%
Private residential investment	18.2	20.9	19.9	20.4	19.0	19.2	2.5%	-6.9%	1.1%
Private non-residential investment	73.7	90.2	91.1	90.5	84.0	86.0	-0.6%	-7.2%	2.4%
Public demand	124.2	135.0	136.2	138.9	143.1	145.1	(0.5%)	(0.7%)	(0.4%)
Government consumption	98.1	107.5	108.7	110.9	113.9	115.3	2.0%	2.8%	1.2%
Public investment	26.2	27.4	27.6	28.0	29.1	29.8	1.5%	3.9%	2.3%
Net exports of goods and services	4.7	3.3	2.7	1.2	-5.1	-0.1	(-0.2%)	(-1.0%)	(0.9%)
Exports of goods and services	83.8	103.0	105.1	102.4	89.5	98.4	-2.6%	-12.6%	10.0%
Imports of goods and services	79.2	99.7	102.5	101.2	94.6	98.5	-1.2%	-6.5%	4.2%
Nominal GDP (JPY trillion)	504.9	555.7	556.8	559.7	532.5	551.4	0.5%	-4.9%	3.5%
Balance of trade (JPY trillion)	5.3	2.4	-1.6	-1.3	2.7	10.6	-19.8%	-311.0%	289.6%
Exports	67.8	79.2	80.7	75.9	65.5	72.7	-6.0%	-13.7%	11.0%
Imports	62.5	76.8	82.3	77.2	62.8	62.1	-6.3%	-18.7%	-1.1%
Fossil fuels	18.1	16.3	19.1	16.6	10.2	11.8	-13.2%	-38.4%	15.4%
Oil	12.3	9.6	11.3	10.1	5.7	6.9	-11.0%	-43.1%	20.2%
LNG	3.5	4.1	4.9	4.1	2.7	2.9	-15.8%	-33.0%	3.9%
Current account (JPY trillion)	18.3	22.4	19.6	20.1	21.1	31.1	2.8%	5.0%	47.0%
Domestic corporate goods price index (2015=100)	97.6	99.3	101.5	101.6	99.8	100.6	0.1%	-1.7%	0.7%
Consumer price index (2015=100)	96.4	100.7	101.4	102.0	101.5	101.7	0.5%	-0.5%	0.2%
Unemployment rate (%)	5.0	2.7	2.4	2.3	3.1	3.3	[-0.1%]	[0.8%]	[0.1%]

Notes: GDP components may not add up to the total GDP due to stock changes and minor data deviations.
( ) stands for contributions. [ ] stands for changes from the previous year.

Production activities

Industrial production mainly heavy electrical machinery and automobiles will increase in FY2021 against the backdrop of global and Japanese economic recovery but be limited to a level just above the FY2009 result after the global financial crisis.

In FY2020, the industrial production index will plunge by 9.9% from the previous year due to global and domestic economic stagnation, although demand for home electrical appliances and information equipment such as personal computers will increase because of stay-home and telework practices for avoiding COVID-19 infections. The index will slip to 90.1 below 91.6 for FY1987. As a wide range of industries mainly heavy electric machinery and automobile sectors expand production on the calming-down of the COVID-19 pandemic in FY2021, the index will rise by 7.5%, managing to surpass 93.0 for FY2009 after the global financial crisis.

Crude steel production in FY2020 will post a substantial decline of 15.6% as both domestic and overseas demand decreases on a steep global fall in machinery production and construction under the COVID-19 pandemic, slipping below 90 million tons for the first time since FY1971. In FY2021, crude steel production will score a sharp increase of 6.9% thanks to a recovery in domestic demand for machinery and building materials and in exports to ASEAN but remain below 90 million tons for the second straight year.

Ethylene production in FY2020 will decline by 7.5% from the previous year due to a fall in exports amid frequent regular ethylene plant repairs and a plunge in synthetic resin demand amid a decline in automobile and other domestic production, slipping below 6 million tons for the first time since FY1993. In FY2020, ethylene production will rise by 4.9% thanks to an overall industrial production recovery and an export increase amid a decrease in regular ethylene plant repairs, managing to surpass 6 million tons.

Cement production in FY2020 will decrease by 2.9% to 56.5 million tons due to the postponement of construction for avoiding COVID-19 infections, although exports will rise thanks to supply shortages under environmental regulations in China. The production level is close to 56.1 million tons in FY2010, the lowest since FY1970. In FY2021, exports will increase as demand in Southeast Asia and Oceania recovers after a decline under the COVID-19 pandemic. Domestic demand will also grow as construction of disaster prevention and reduction facilities under the National Resilience Plan is normalised. Cement production in FY2021 will thus rise by 1.2% to 57.1 million tons, still the third lowest level since FY1970.

Paper and paperboard production in FY2020 will nose-dive by 8.5% from the previous year as rapid computerisation is coupled with a drop in printing paper demand through increasing telework, a fall in advertisement paper demand through decreasing events, and a decrease in paperboard demand through falling souvenir demand amid sluggish industrial activities and tourism demand, although electronic commerce expansion will work to boost paperboard production. In FY2021, paper and paperboard production will rise by 5.5% as electronic commerce expansion coincides with a recovery in industrial activities and tourism demand. However, a long-term downtrend will be sustained.

Automobile production in FY2020 will post a steep decline of 19.8% and slip below 80 million units for the first time since FY1976 as car purchase opportunities decrease due to income drops and stay-home campaigns in the world. In FY2021, automobile production will increase by 16.4% in line with a global economic recovery. As export growth is limited due to a slow recovery in overseas markets, the production will be lower than 88.65 million units in FY2009 after the global financial crisis.

Table 3 | Production activities

		Historical				Projection		Year-over-year		
		FY2010	FY2017	FY2018	FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Production	Crude steel (Mt)	110.8	104.8	102.9	98.4	83.0	88.8	-4.3%	-15.6%	6.9%
	Ethylene (Mt)	7.00	6.46	6.19	6.28	5.81	6.09	1.5%	-7.5%	4.9%
	Cement (Mt)	56.1	60.4	60.2	58.1	56.5	57.1	-3.5%	-2.9%	1.2%
	Paper and paperboard (Mt)	27.3	26.4	26.0	25.0	22.9	24.1	-3.8%	-8.5%	5.5%
	Automobiles (Million units)	8.99	9.68	9.75	9.49	7.61	8.85	-2.7%	-19.8%	16.4%
Production indices	Mining and manufacturing (2015=100)	101.2	103.5	103.8	99.9	90.1	96.8	-3.7%	-9.9%	7.5%
	Food and tobacco	100.7	100.2	99.6	100.5	97.1	99.7	0.9%	-3.4%	2.6%
	Chemicals	99.6	105.4	107.5	104.5	98.8	103.0	-2.8%	-5.4%	4.3%
	Non-ferrous metals	100.0	103.5	104.3	99.2	88.4	94.7	-4.8%	-10.9%	7.2%
	Machinery	99.4	105.0	105.6	100.3	87.9	97.2	-5.1%	-12.3%	10.5%
Tertiary industry activity index (2015=100)		97.6	101.9	103.0	102.3	95.4	99.6	-0.7%	-6.8%	4.5%

Notes: Chemicals include chemical fibers.
Machinery includes general machinery, electrical machinery, information and telecommunications equipment, electronic parts and devices, precision machinery and metal products.

Primary energy supply

As energy consumption increases substantially in FY2021, nuclear energy supply will rise, with LNG Imports falling to the FY2010 level before the Great East Japan Earthquake impact. CO_2 emission cuts will achieve more than 90% of the Paris Agreement target for the second straight year.

In FY2020, primary energy supply in Japan will plunge by 5.5% from the previous year due to production cuts by machinery and other manufacturers and a transportation volume decline under the COVID-19 pandemic, despite a reactionary energy supply rise after the previous year's warmer winter. In FY2021, energy supply will increase by 2.6% thanks to a recovery in industrial activities and transportation volume but still be the second lowest since FY1987. Energy consumption per GDP will improve by less than 1% for the second straight year, indicating a far slower improvement than in earlier years.

New energy supply including solar, wind and biomass energies will decelerate growth to 2.2% due to the pandemic in FY2020. In FY2021, growth will accelerate to 3.8% as more new capacity including non-residential solar PV plants will be launched.

Nuclear power generation in FY2020 will decline by 26.5% from the previous year as the suspension of restarted plants is prolonged, despite the restart of two more plants. In FY2021, two more plants will be restarted, but four restarted plants will halt operation due to judicial problems and a delay in the completion of counterterrorism facilities. Nuclear power generation growth will be limited to 75.6%.

Oil supply will post an 8.2% plunge from the previous year, the largest fall since FY1980, due to sharp drops in production activities, transportation volume, and petroleum products exports including jet fuel. In FY2021, oil supply will increase by 3.1% thanks to a recovery in production activities and transportation volume as well as a rise in ethylene production. Note that a rise in oil's share of Japan's total primary energy supply will be limited to 0.2 percentage points due to energy efficiency improvement and fuel switching.

Coal supply will decline by 5.4% in FY2020 due to sharp falls in crude oil and cement production, although coal for power generation will increase on the launch of new capacity. In FY2021, coal supply will rise by 3.4% as coal for both power generation and industrial production expands on the launch of new power generation capacity and a recovery in industrial materials production.

Natural gas supply will decrease for both power generation and city gas production in FY2020, posting a decline of 1.1% from the previous year. In FY2021, natural gas supply will fall by 5.6% for the fifth straight year of decline despite an increase in supply for city gas production as supply for power generation decreases in line with an increase in nuclear power generation. LNG imports will decline to the FY2010 level for the first time since the Great East Japan Earthquake.

Japan's energy self-sufficiency rate in FY2020 will increase by 0.1 percentage points due to a drop in fossil fuel demand, despite the nuclear power generation fall. In FY2021, the rate will rise by 2.2 points to 14.4% for the seventh straight year of increase, covering 60% of the target of 24.3% for FY2030.

Japan's energy-related CO_2 emissions in FY2020 will decrease by 8.8% to 939 Mt, down 24.0% from the standard year of FY2013 for the Paris Agreement. Japan will thus almost accomplish the target cut of 25.0% from FY2013 for FY2030. In FY2021, emissions will increase by 1.6% to 955 Mt on an increase in fossil fuel demand under an economic recovery. The emissions represent a 22.7% decline from FY2013, covering more than 90% of the target. However, the low emission levels are attributable primarily to an energy demand decline under a temporary economic slowdown. A future challenge for Japan will be how to secure progress toward the achievement of the target.

Table 4 | Primary energy supply

	Historical				Projection		Year-over-year		
	FY2010	FY2017	FY2018	FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Primary energy supply (Mtoe)	515.9	465.1	455.4	444.4	420.0	431.0	-2.4%	-5.5%	2.6%
Coal	119.1	123.7	121.5	120.4	113.9	117.8	-0.9%	-5.4%	3.4%
Oil	212.0	185.5	176.2	170.1	156.1	160.8	-3.5%	-8.2%	3.1%
Natural gas	95.7	111.4	106.7	102.4	101.2	95.6	-4.0%	-1.1%	-5.6%
LNG imports (Mt)	70.6	83.9	80.6	76.5	74.9	71.3	-5.0%	-2.1%	-4.8%
Hydro	17.7	17.5	16.7	16.5	16.7	16.6	-1.1%	1.2%	-0.6%
Nuclear	60.7	6.8	13.3	13.0	9.6	16.8	-1.8%	-26.5%	75.6%
New energy, etc.	10.7	20.2	21.1	22.1	22.5	23.4	4.4%	2.2%	3.8%
Self-sufficiency rate	20.2%	9.4%	11.7%	12.1%	12.2%	14.4%	0.5p	0.1p	2.2p
Energy intensity (FY2013=100)	104.9	87.8	85.8	84.0	83.9	83.3	-2.1%	-0.1%	-0.8%
Energy-related CO_2 emissions ($MtCO_2$)	1,137	1,110	1,065	1,029	939	955	-3.4%	-8.8%	1.6%
Change from FY2013	-8.0%	-10.1%	-13.8%	-16.7%	-24.0%	-22.7%	-2.9p	-7.3p	1.3p

Notes: New energy includes solar photovoltaics, wind, biomass, solar heat, and geothermal, etc.
Self-sufficiency rate is based on IEA standard.

Electricity sales and power generation mix (electric utilities)

Electricity sales in FY2021 will increase as industrial sales rise on a manufacturing production recovery, with residential sales remaining high after a sharp expansion in the previous year. Fossil electricity sources' share of the power generation mix will slip below 70% for the first time since FY2011, though with the coal share increasing.

In FY2020, electricity sales will fall by 1.5%. Sales to power service users will decline by 4.3% due to sluggish production in steel and machinery industries, although space and water heating demand will increase in reaction to warmer winter weather in the previous year. Sales to lighting service users will increase by 4.3% due to a colder winter than in the previous year as well as spreading telework and stay-home campaigns.

In FY2021, electricity sales will increase by 1.2% from FY2020 but fall by 0.4% from FY2019 before the COVID-19 pandemic. Sales to power service users will rise by 1.8% on a production recovery in steel and machinery industries. From FY2019, however, they will decrease by 2.5%. Sales to lighting service users will fall by 0.1% due to the stay-home rate's decline in reaction to stay-home campaigns in the previous year and the diffusion of light-emitting diode lamps and other energy-efficient equipment and solar PV power generation, although the electrification of water heating and cooking equipment will make progress on an increase in all-electric homes.

The electricity retail deregulation led power producer/supplier companies' share of total electricity sales to rise from 5.1% in April 2016 to 19.7% in August 2020. Such share rose to 21.5% for lighting service users and 17.3% for low voltage users, indicating a steady uptrend. It also increased for high and extra-high voltage users despite an overall electricity demand decline in FY2020. PPS companies' share expanded from 10.5% in April 2016 to 26.2% in August 2020 for high-voltage users and from 5.3% to 8.5% for extra-high voltage users. High voltage users have switched to PPS companies as much as low voltage users.

Nuclear energy's share of total power generation will fall by 1.8 points due to prolonged regular plant checks in FY2020 but increase by 3.8 points thanks to the restart of more nuclear plants and fewer regular checks in FY2021. The share for non-hydro renewables will rise by 1.2 points due to a fall in electricity demand, although less new capacity is launched. In FY2021, the share will increase by 1.0 points as more new non-residential solar PV capacity is launched. Although hydro's share will shrink by 0.1 points due to the retirement of the 20,000 kW Kamiiwamatsu Unit-1 plant in July 2021, non-fossil electricity sources' share will rise to 30.6%, topping 30% for the first time since the Great East Japan Earthquake. However, the share will still be 7.6 points lower than 38.2% in FY2010, being required to rise further.

New coal-fired power plants went on stream one after another in the first half of FY2020 and will do so in and after the second half. Three plants (Kushiro, Hitachinaka Kyodo Unit 1, and Kaita) with capacity at 0.87 GW will launch commercial operation in the second half of 2020 and three more (Hirono IGCC, Taketoyo, and Kobe) with capacity at 2.26 GW in FY2021. Coal's share of total power generation will thus rise by 1.4 points in FY2020 and by 0.7 points in FY2021, reaching 30.8%. The share for power plants fired by fuel oil C and crude oil will drop by 0.6 points in FY2021. The LNG share will decline by 4.7 points to 32.5% in FY2021, still 3.2 points higher than 29.3% for FY2010 before the Great East Japan Earthquake affected nuclear power generation and led to a sharp rise in LNG-fired power generation.

Table 5 | Electricity sales and power generation mix (electric utilities)

	Historical				Projection		Year-over-year		
	FY2010	FY2017	FY2018	FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Electricity sales (TWh)	(926.6)	863.2	852.6	836.0	823.1	832.7	-1.9%	-1.5%	1.2%
Lighting service	304.2	279.3	270.3	266.7	278.1	277.7	-1.4%	4.3%	-0.1%
Power sercice	(622.4)	583.9	582.2	569.4	545.0	555.0	-2.2%	-4.3%	1.8%
Extra-high and High voltage	(576.5)	544.9	544.6	533.2	508.7	518.6	-2.1%	-4.6%	1.9%
Low voltage	(45.9)	39.0	37.6	36.2	36.3	36.4	-3.7%	0.1%	0.2%
Electricity generated and purchased (TWh)	(1,028)	966.4	949.0	923.5	909.3	919.5	-2.7%	-1.5%	1.1%
Hydro	(8.5%)	9.3%	9.2%	9.4%	9.7%	9.5%	0.2p	0.3p	-0.1p
Fossil fuels	(61.7%)	79.5%	75.2%	73.8%	74.1%	69.4%	-1.4p	0.3p	-4.7p
Coal	(25.0%)	29.5%	28.7%	28.7%	30.1%	30.8%	-0.0p	1.4p	0.7p
LNG	(29.3%)	41.1%	39.6%	38.4%	37.2%	32.5%	-1.2p	-1.2p	-4.7p
Oil, etc.	(7.5%)	8.9%	6.9%	6.7%	6.8%	6.1%	-0.2p	0.1p	-0.6p
Nuclear	(28.6%)	3.2%	6.5%	6.6%	4.9%	8.7%	0.1p	-1.8p	3.8p
Renewables (excluding hydro), etc.	(1.1%)	7.9%	9.0%	10.2%	11.4%	12.4%	1.2p	1.2p	1.0p

Notes: Figures in brackets are based on old statistical definitions, and discontinuous with other values.
"Electricity sales" is for electricity utility use, and does not include own use and specified supply.
"Electricity generated and purchased" is only for general electric utilities in FY2010, and its figures since FY2016 are estimated values.
Hydro includes pumped, and LNG includes city gas.

City gas sales (gas utilities)

City gas sales in FY2021 will rise from FY2019 but those to industrial and commercial users will fall short of covering a plunge in FY2020 due to temperature changes

City gas sales[1] in FY2020 will decline by 3.3% from the previous year and slip below 40 billion m^3 for the first time in five years due to drops in those to industrial and commercial users, despite increases in those to residential users, power utilities, and others. In FY2021, city gas sales will expand by 3.8% to 40.6 billion m^3, topping the FY2019 level. However, the rise from FY2019 will reflect a sharp increase in sales to power utilities in FY2020, as well as sluggish gas demand in FY2019's winter that was the warmest since FY1897 when the temperature survey started. Sales to industrial and commercials users in FY2021 will slip below the 2019 levels.

Of residential sales, those for cooking had continued to structurally decrease due to the spread of induction heating cookers. Those for water and space heating had also structurally declined on the diffusion of more energy efficient water heaters and all-electric homes. In FY2020, however, residential sales increased by 4.7% thanks to a rise in those for water and space heating after the previous year's warm winter, as well as a higher stay-home rate caused by voluntary restrictions on outing and growing telework. In FY2021, residential sales will decline by 1.4% due to the year's slightly warmer winter and a stay-home rate fall in reaction to the voluntary restrictions on outing in the previous year.

Regarding business sales (commercial and other sales) in FY2020, water and space heating demand will increase due to a colder winter, despite continued energy efficiency improvement that works to cut gas sales. However, commercial sales will plunge by 10.0% and slip below 4 billion m^3 for the first time in 21 years as providers of accommodation, food, living-related and personal, and amusement services are hard hit by voluntary restrictions on outing and social distancing campaigns to avoid COVID-19 infections. The other sales, though being affected by school closure and online classes, will increase by 4.2% due to the winter temperature change. In FY2021, accommodation, food, living-related and personal, and amusement services will recover, but social distancing campaigns will continue in a manner to force these services to remain less brisk than in FY2019 before the COVID-19 pandemic. Furthermore, cooler summer weather will work to cut air-conditioning demand. Commercial sales, though rising by 6.5% from FY2020, will fall short of reaching 4 billion m^3 and post a 4.2% decrease from FY2019 including a warmer winter. The other sales will expand by 3.5% on the normalisation of schools and healthcare providers, despite the diffusion of remote medical care and online classes and a decline in air-conditioning demand.

Industrial sales in FY2020 will decrease by 6.2%. Those to manufacturing users will plunge by 9.2% on the stagnation of automobile and other machinery production. As the Mooka thermal power station's Unit 1 and 2 (each with capacity at 620 MW) started operation in September 2019 and March 2020, respectively, those to power utilities will expand by 8.2%. In FY2021, industrial sales will expand by 5.6%. Those to manufacturing users will rise by 7.1% on a production recovery. Those to power utilities will remain almost unchanged in the absence of major thermal power plants launching operation.

Under the full deregulation of city gas retail sales, new gas suppliers' share of city gas sales rose from 8.2% in April 2017 to 15.9% in August 2020. Their share came to 11.6% for residential sales in three years and a half after the full deregulation and to 5.1% for commercial sales. The share for residential sales has been firmly rising. New gas suppliers' share for industrial sales levelled off before starting an uptrend in the second half of FY2019. It rose from 12.6% in April 2017 to 20.1%, rising more rapidly than for the share for commercial sales.

Table 6 | City gas sales (gas utilities)

	Historical				Projection		Year-over-year		
	FY2010	FY2017	FY2018	FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Total (Billion m^3)	39.28	42.43	41.58	40.40	39.07	40.55	-2.8%	-3.3%	3.8%
Residential	9.79	9.87	9.24	9.38	9.81	9.67	1.4%	4.7%	-1.4%
Commercial	4.75	4.36	4.26	4.16	3.74	3.99	-2.3%	-10.0%	6.5%
Industrial	21.61	24.49	25.03	23.82	22.34	23.60	-4.8%	-6.2%	5.6%
Manufacturing	(20.28)	20.19	20.51	19.66	17.85	19.11	-4.1%	-9.2%	7.1%
Electric utilities	(1.34)	4.29	4.52	4.15	4.49	4.49	-8.0%	8.2%	0.0%
Others	3.13	3.71	3.05	3.05	3.18	3.29	0.2%	4.2%	3.5%

Notes: Converted at 1 m^3 = 41.8605 MJ (10,000 kcal). Figures in brackets are earlier statistical definitions.

[1] Sales by gas utilities excluding former community gasutilities

Fuel oil/LPG sales and crude oil throughput

Fuel oil sales including those for transportation in FY2021 will increase from the previous year for the first time in nine years but retain a long-term downtrend.

Fuel oil sales in FY2020 will post a substantial decline of 6.5% from the previous year as those for transportation and industrial use decrease sharply due to COVID-19 countermeasures despite a colder winter. The decline will be the largest since FY2008. In FY2021, fuel oil sales will increase by 3.1% from FY2020 for the first rise in nine years as those for transportation and industrial use recover. From FY2019, however, they will show a 3.6% decrease, prolonging a long-term downtrend.

Gasoline sales in FY2020 will record the largest post-war annual decline of 4.8 million kL or 9.8% as passenger car transportation volume plunges on COVID-19 countermeasures. In FY2021, gasoline sales will increase by 4.8% for the first rise in six years as transportation volume recovers. From FY2019, however, they will fall by 5.4%, indicating a long-term downtrend.

Naphtha sales in FY2020 will decrease by 5.9% due to frequent regular checks on ethylene plants, hitting the lowest level since FY1993 along with ethylene production. In FY2021, they will increase by 4.1% thanks to longer ethylene plant operation.

Kerosene sales in FY2020 will increase by 12.8% due to a rise in the stay-home rate and a colder winter. In FY2021, they will drop by 1.7% due to fuel switching, despite an increase in space heating demand. Among fuel oil products, however, kerosene alone will score a sales increase from FY2019.

Diesel oil sales in FY2020 will drop by 6.1% from the previous year and slip below 32 million kl for the first time in 33 years. In FY2021, they will increase by 3.5% on a recovery in transportation demand but stand at the second lowest level since FY2009.

Heavy fuel oil A sales in FY2020 will drop by 1.8% on a plunge in industrial production and slip below 10 million kl for the first time in 51 years, although space and water heating demand in buildings, hospitals and schools will increase because of a colder winter. In FY2021, they will decline by 1.3% due to energy efficiency improvement and fuel switching, despite an industrial production recovery and a rise in space and water heating demand.

Heavy fuel oil B/C sales for industrial use will increase by 0.4% in FY2021 on a production recovery, despite fuel switching and energy efficiency improvement. Those for power generation will decline as oil-fired power plants' operation factor declines on the shutdown of such power plants in Tokyo and Chubu regions from FY2020. Total heavy fuel oil B/C sales will plunge by 13.1% in FY2020 and by 10.0% in FY2021, reaching 20% of the FY2012 level, the highest since the Great East Japan Earthquake.

In FY2020, LPG sales in the buildings sector will rise for space heating but decrease for cooking due to the reduced operations of restaurants. Those in the industry sector will decline on a production slowdown and the reduced operations of ethylene plants. Those for commercial passenger transportation will also decrease. Total LPG sales in FY2020 will decline by 6.2%. In FY2021, they will increase by 4.3% on a rebound in restaurant operations, industrial production, and commercial passenger transportation.

Crude oil throughput will post a substantial decrease of 16.3% due to a steep fall in transportation fuel exports including jet fuel, declining faster than fuel oil sales. In FY2021, crude oil throughput will score a 2.8% increase, rising slower than fuel oil sales in the absence of any recovery in transportation fuel exports.

Table 7 | Fuel oil/LPG sales and crude oil throughput

	Historical				Projection		Year-over-year		
	FY2010	FY2017	FY2018	FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Fuel oil sales (GL)	196.0	174.7	167.7	161.6	151.2	155.9	-3.6%	-6.5%	3.1%
Gasoline	58.2	51.8	50.6	49.1	44.3	46.4	-3.0%	-9.8%	4.8%
Naphtha	46.7	45.1	43.9	42.5	40.0	41.7	-3.1%	-5.9%	4.1%
Jet fuel	5.2	5.0	5.0	5.1	3.5	4.3	3.5%	-32.9%	25.3%
Kerosene	20.3	16.6	14.5	13.6	15.4	15.1	-6.3%	12.8%	-1.7%
Diesel oil	32.9	33.8	33.8	33.7	31.6	32.7	-0.4%	-6.1%	3.5%
Heavy fuel oil A	15.4	11.5	11.1	10.2	10.0	9.8	-8.2%	-1.8%	-1.3%
Heavy fuel oils B and C	17.3	10.8	8.8	7.4	6.4	5.8	-16.3%	-13.1%	-10.0%
For electric utilities	7.7	6.0	4.0	2.6	2.2	1.6	-33.3%	-15.9%	-29.7%
For other users	9.7	4.8	4.9	4.7	4.2	4.2	-2.5%	-11.5%	0.4%
LPG sales (Mt)	16.5	14.8	14.2	14.1	13.3	13.8	-0.5%	-6.2%	4.3%
Crude oil throughput (GL)	208.9	184.2	176.7	174.0	145.6	149.6	-1.5%	-16.3%	2.8%

Renewable power generation (FIT power source)

Installed renewable power generation capacity will expand to 87 GW, though with growth decelerating on COVID-19.

Renewable power generation capacity approved under the FIT scheme reached 105 GW in March 2017. As approval for some capacity before installation was cancelled, however, the capacity subject to existing approval now remains around 90 GW. At the end of June 2020, approved renewable power generation capacity stood at 93.1 GW (including 74.3 GW for solar PV, 9.0 GW for wind and 8.3 GW for biomass).

If all the approved capacity of 93.1 GW, including already operational and transferred facilities [2], is operational, the cumulative burden on consumers will reach an estimated JPY60 trillion [3]. The estimated burden amounts to an electricity rate hike of JPY3,400/MWh, or 15% for residential users and 21% for industrial users. However, the estimated burden represents a substantial fall from JPY70 trillion for the peak approved capacity including a cancelled portion, indicating that the revised FIT Act for such cancellation has made some achievement. If about 2 GW in approved biomass capacity expected to be cancelled due to barriers to long-term stable fuel supply is excluded, however, the estimated burden may be lowered to JPY46 trillion.

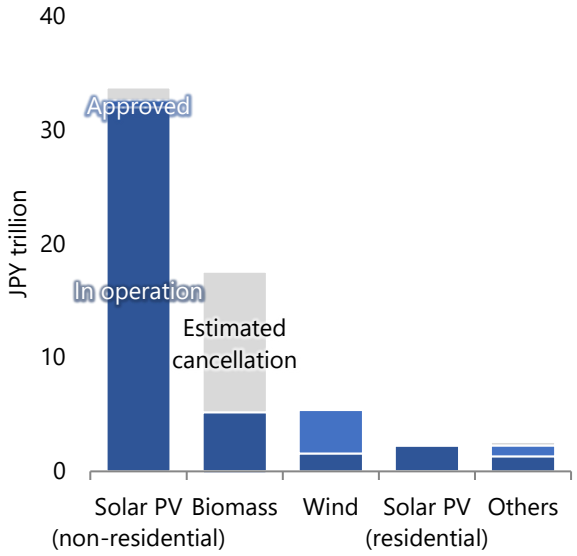
Installed renewable power generation capacity (including capacity for which the FIT scheme has expired) will reach 86.8 GW at the end of FY2021. Non-residential solar PV capacity will expand to 53.0 GW by the end of FY2021, although the COVID-19 spread delays installation by restricting solar PV plant builders' communications with residents near plant sites and making it difficult to secure construction workers. As a long time is required for launching wind power generation after approval because of environment assessment and other procedures, wind generation capacity will be limited to 5.3 GW. Renewable power generation in FY2021 will total 166.2 TWh (including 79.8 TWh for solar PV, 39.9 TWh for small and medium-sized hydroelectric plants, 32.7 TWh for biomass and 10.1 TWh for wind), accounting for 17% of Japan's total power generation.

A government advisory panel on the fundamental revision of the FIT Act by the end of FY2020 is considering integrating large solar PV and wind power plants into the electricity market based on the feed-in premium (FIP). The connect and manage system to overcome constraints on renewable energy facilities' connection to the grid will be enhanced under the revised act. It will be important to make renewable energy competitive and a major power source that would remain stable over a long time.

[2] Transferred facilities are those that were installed before the introduction of the FIT scheme and later subjected to the scheme.

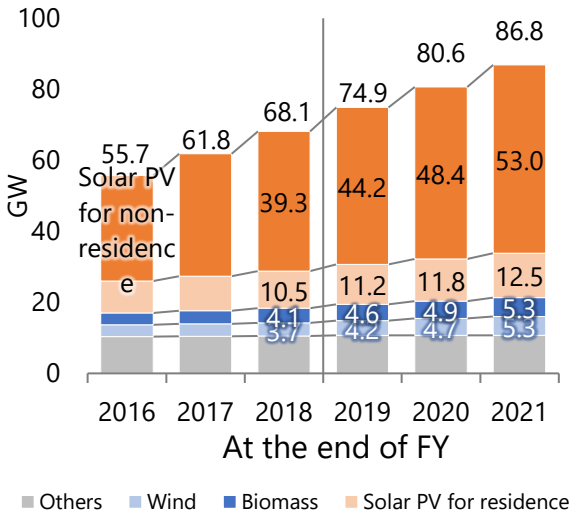
[3] The remaining FIT periods for transferred facilities are taken into consideration. The avoidable cost has been estimated by the IEEJ, based on various documents. The capacity factor is assumed at 24.8% for wind, 13.7% for solar PV, 70% for geothermal energy, 45% for hydro and 70% for biomass.

Figure 1 | Cumulative burden of FIT scheme over purchasing period (capacity approved or in operation at the end of June 2020)



Note: The purchasing period is 10 years for solar PV (residential), 15 years for geothermal, and 20 years for others.

Figure 2 | Installed FIT power generation capacity (based on operation)



Note: Including capacity subject to FIT contract expiration

Topic [1] Transportation energy demand by mode

Transportation energy demand will substantially decline as transportation demand plunges for all modes due to COVID-19. In FY2021, the sector's energy demand will increase moderately and fall short of reaching 70 Mtoe

The transportation energy demand in the 2010s followed a downtrend as downside pressure from energy intensity declines through vehicle fuel efficiency improvement and switching to energy-efficient aircraft, ships, and railroad outdid upside pressure from transport volume growth. Affected by a steep decline in passenger transport volume through growing telework and a fall in non-essential outings and a drop in cargo transport volume through a plunge in demand from manufacturing and services industries under the COVID-19 pandemic, the transportation energy demand in the FY2020 will post a 10.2% drop from the previous year, the largest since FY1953 when comparable data began to be compiled, slipping below 70 Mtoe for the first time in 32 years. In FY2021, transport sector energy demand will increase by 5.5% from FY2020 on a transport volume recovery but post a 5.2% decrease from FY2019, remaining below 70 Mtoe for the second straight year.

Passenger vehicles account for more than a half of the transport sector's energy demand. Despite private passenger car ownership and travel distance growth in recent years, their energy demand has continued a downtrend due to fuel efficiency improvement and the diffusion of hybrid and other next-generation cars. In FY2020, their energy demand will decrease by 10.5% due to voluntary restrictions on non-essential outings. This will be the first double-digit fall since FY1965 when comparable data began to be compiled. In FY2021, passenger vehicles' energy demand will rise by 5.4% from FY2020 but stand at the lowest level in 32 years excluding FY2020.

Freight vehicles account for 30% of the transport sector's energy demand and are more vulnerable to economic fluctuations than passenger vehicles. In recent years, their energy demand has levelled off as growth in cargo transport demand through online shopping has offset the effects of transport and fuel efficiency improvement. In FY2020, their energy demand declined by 5.2% as a rise in cargo transport demand through growing online shopping under stay-home campaigns was much more than offset by a plunge in demand from manufacturing and services industries. In FY2021, freight vehicles' energy demand will rise by 2.8% on a transport volume rebound amid an economic recovery but stand at the lowest level in 33 years excluding FY2020.

Domestic aviation demand, of which passenger transport accounts for nearly 90%, has increased in recent years as travel demand growth through a rise in personal income and an increase in foreign visitors to Japan combined with an aviation capacity expansion and cost cuts. Domestic aviation energy consumption has levelled off as aviation demand growth has been countered by switching to fuel efficient aircraft. In FY2020, domestic aviation energy consumption will post a sharp decline of 32.9% from the previous year due to flight reductions, topping an 18.5% decline in FY2011, which was the largest fall since comparative data began to be compiled in FY1965. In FY2021, it will increase by 25.3% from the previous year on a passenger transport demand recovery but be limited to the lowest level in 32 years excluding FY2020.

As for internal navigation, transport volume, of which freight accounts for 70%, has followed a downtrend along with energy consumption. As freight centres on production and construction goods, transport volume is vulnerable to their production fluctuations. In FY2020, energy consumption for internal navigation will decline by 2.9% as transport volume decreases on sluggish industrial production. As navigation is less affected by human travel restrictions, the energy consumption fall will be less than for other transport modes. In FY2021, energy consumption for internal navigation will rise by 0.4% on an industrial production recovery, the first increase in five years, but retain a long-term downtrend.

Railway transport volume, of which passengers account for more than 90%, has followed an uptrend thanks to travel demand growth in recent years. Energy consumption has remained almost unchanged in line with energy intensity improvement through the introduction of energy efficient railroad, switching to more efficient equipment, and energy-saving efforts. In FY2020, energy consumption for railway transport will record a 20.4% plunge from the previous year, the largest drop since FY1965 when comparable data began to be compiled. In FY2021, it will increase by 17.2% on a transport demand recovery but be limited to the lowest level in 33 years excluding FY2020.

Table 8 | Transport sector energy demand by mode

	Historical				Projection		Year-over-Year		
	FY2010	FY2017	FY2018	FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Transportation (Mtoe)	82.43	75.43	74.33	73.07	65.64	69.26	-1.7%	-10.2%	5.5%
Passenger Vehicle	48.69	42.03	41.15	39.99	35.78	37.71	-2.8%	-10.5%	5.4%
Freight Vehicle	24.42	24.78	24.63	24.37	23.10	23.74	-1.1%	-5.2%	2.8%
Domestic Aviation	4.52	4.35	4.31	4.46	3.00	3.75	3.5%	-32.9%	25.3%
Internal Navigation	2.70	2.15	2.12	2.13	2.06	2.07	0.3%	-2.9%	0.4%
Railway	2.11	2.12	2.12	2.12	1.69	1.98	0.1%	-20.4%	17.2%

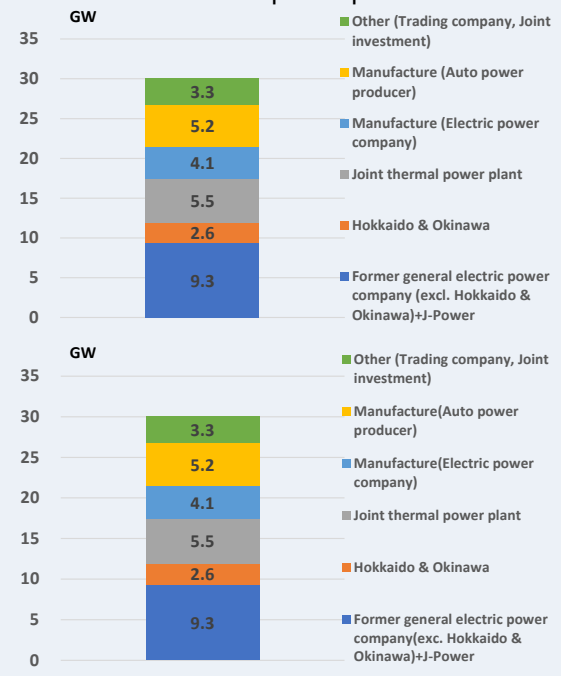
Topic [2] Impacts of fading out inefficient coal-fired power plants

The fade-out of inefficient coal-fired power plants will reduce CO_2 emissions by 7.1% from FY2013 but boost fuel costs by JPY0.21/kWh. Construction costs will emerge for manufacturers that use coal-fired power plants for heat supply and other non-power generation purposes.

Coal-fired power plants, which are designed in the Long-term Energy Supply and Demand Outlook to account for about 26% of the power generation mix in FY2030, captured 31.9% of the mix in FY2019. Electric utilities' installed coal-fired power generation capacity is expected to increase by 3.14 GW by the end of FY2021 from 49.44 GW in August 2020 and by 5.05 GW later. Coal-fired power plants feature relatively lower operation costs and new capacity is expected to operate at the present factor. Coal-fired power plants' share of the power generation mix is thus expected to rise further.

While planned new coal-fired power plants are expected to go on stream, the Strategic Energy Plan decided on by the cabinet in July 2018 calls for promoting more efficient next-generation plants and fading out supercritical or less efficient ones. At present, the total capacity of supercritical or less efficient coal-fired power plants stands at 30.03 GW[4].

Figure 3 | Installed capacity of supercritical or less efficient coal-fired power plants



Inefficient coal-fired power plants are owned not only by former general electric utilities and Electric Power Development Co. but also by manufacturers and other business operators that do not need any larger plants.

This paper virtually analyses the impacts of fading out all inefficient (supercritical or less efficient) coal-fired power plants by FY2030, based on the FY2021 picture of the economy, and energy supply and demand.

Given that coal-fired power plants owned by joint ventures or manufacturers are required to provide heat as well as electricity, we here assume that all inefficient coal-fired power plants will be replaced with LNG-fired plants. We also assume that any decline in coal-fired power generation capacity will be covered by an increase in LNG-fired capacity without exerting any effects on the diffusion of renewable power generation capacity or the restart of nuclear power plants and that the retirement of inefficient coal-fired power plants will work to raise the efficiency of Japan's overall coal-fired power generation capacity by 1.2%[5].

If all supercritical or less efficient coal-fired power plants are closed, coal-fired power generation will decrease by 165.0 TWh and the decrease will be covered by an increase of 164.7 TWh in LNG-fired power generation.

CO_2 emissions will fall by 87 Mt, 7.1% from FY2013

As coal-fired power generation declines, CO_2 emissions will fall by 87 Mt. amounting to 7.1% of energy-related CO_2 emissions in FY2013. Given the target of cutting emissions by 25% in 17 years, all inefficient coal-fired power plants' closure will cover about five years' emission cuts. Coal consumption will decrease by 64 Mt or 33.8%, while LNG consumption rises by 22 Mt or 30.0%. The decline in inefficient coal power generation will bring about a primary energy supply fall of 11.2 Mtoe or 3.0%.

Fuel costs will increase by JPY0.23/kWh and JPY1.8 trillion in construction costs will be added

However, fuel costs will increase by JPY0.23/kWh due to switching from coal to higher-priced LNG. If the fuel cost hike is passed on to electricity prices, the unit electricity price will rise by 0.9% for residential and by 1.2% for industries. If LNG prices' deviation from coal prices expands further, fuel costs will rise further. In addition, construction of substitute LNG-fired power plants will cost manufacturers JPY1.8 trillion[6]. Furthermore, by-products that are mixed with

[4] Data for electric utilities are from a document at the first meeting of a working group on coal-fired power generation under the Advisory Committee for Natural Resources and Energy. Data for manufacturers are from Documents 7 and 8 at the second meeting and Documents 7 and 8 at the third meeting.

[5] Computed based on theoretical efficiency.

[6] Estimated based on the unit cost of JPY121,000/kW for

coal for coal-fired power plants will have to be disposed separately, boosting manufacturers' overall production costs.

Based on conditions of each power plant, a macro approach should be taken for cutting CO_2 emissions

The fade-out of inefficient coal-fired power plants is estimated to cut CO_2 emissions by 7.1% from FY2013. However, energy-intensive manufacturers own coal-fired power plants for meeting their heat demand, making effective use of by-products, and securing stable 24-hour plant operations. Thus, coal-fired power plants have non-power generation roles. Coal-fired power plants owned joint thermal power plants have the same functions as manufacturers' auto coal-fired power plants. Numerous business operators have recently launched coal-fired power plants and have yet to recover investment. Furthermore, there are geographical constraints on the fade-out of coal-fired power plants in Hokkaido and Okinawa. Given these points, the fade-out of inefficient coal-fired power plants should be promoted as one of various CO_2 emission reduction measures in line with the conditions of each plant. From the viewpoint of CO_2 emission cuts, benchmark indicators for coal-fired power plants should be developed with consideration given to the computation of power generation efficiency covering biomass and heat use and by-products. Furthermore, coal-fired power plant operators should be asked to develop plans to fade out their plants irrespective of the target year of FY2030. Progress in overall CO_2 emission cuts through renewable energy and energy efficiency promotion and the restart of nuclear power plants should be considered along with the impacts of the fade-out based on reported data and plans to ensure cost-effective CO_2 emission cuts.

Table 9 | Impacts of fading out inefficient coal-fired power plants [FY2021]

		Reference	Fade-out of coal-fired	Changes from
Economy	Electricity unit cost1 (JPY/kWh)	3.34	3.57	+0.23
	Total fossil fuel imports (JPY trillion)	11.77	11.99	+0.22
Energy	Primary energy supply	374.2	363.0	-11.2
	Coal (Mt)	189.0	125.0	-64.0
	Oil (GL)	176.0	176.0	-0.03
	Natural gas (Mt of LNG eq.)	73.13	95.11	+22.0
Environment	Energy-related CO_2 (Mt)	954.5	867.1	-87
	FY2013比	-22.7%	-29.8%	-7.1p

LNG-fired power plant construction given by the Power Generation Cost Verification Working Group of the Advisory Committee for Natural Resources and Energy.

Topic [3] Impacts of the completion of counterterrorism facilities and of the delays in nuclear plant restarts

Nuclear contributing to achieving 3Es

This chapter assesses the impacts of changes in nuclear power generation on the so-called 3Es – economic efficiency, energy security, and environment.

In the Reference Scenario, four nuclear power plants will be restarted by the end of FY2021 in addition to the nine that have already been restarted, with four restarted plants being shut down due to delays in the completion of their counterterrorism facilities. As a result, nine will be in operation at the end of FY2021. In the High Case, the four restarted plants will avoid their shutdown with their counterterrorism facilities completed by their respective deadlines. In the Low Case, the four plants planned to be restarted in the Reference Scenario will fail to be restarted. Referring to the 2030 target power generation mix in the Long-term Energy Supply and Demand Outlook by the Ministry of Economy, Trade and Industry, we have also assumed the virtual Best Mix Case in which nuclear will account for 21% of Japan's total power generation, renewable energy for 23%, and fossil fuels for 56%.

Table 10 | Impacts of changes in nuclear power generation [FY2021]

		Low Case	Reference Scenario	High Case	Best Mixed Case	Changes from Reference		
						Low	High	Best Mixed
Nuclear assumptions	Restarted nuclear reactors	5	9	13	..	-4	+4	..
	Power generation (TWh)	62.3	79.7	97.9	218.0	-17.4	+18.3	+138.4
	Share in generation and purchases	6.0%	7.7%	9.4%	21%	-1.7p	+1.8p	+13p
Economy	Electricity unit cost[1] (JPY/kWh)	6.56	6.49	6.42	6.41	+0.07	-0.07	-0.08
	Fuel cost	3.41	3.34	3.27	2.89	+0.07	-0.07	-0.46
	FIT purchasing cost	3.15	3.15	3.15	3.53	-	-	+0.38
	Total fossil fuel imports (JPY trillion)	11.86	11.77	11.68	11.08	+0.09	-0.10	-0.69
	Oil	6.90	6.90	6.89	6.87	+0.01	-0.01	-0.03
	LNG	2.94	2.85	2.76	2.41	+0.08	-0.09	-0.44
	Trade balances (JPY trillion)	10.54	10.61	10.69	11.20	-0.07	+0.08	+0.58
	Real GDP (JPY2015 trillion)	539.83	539.97	540.13	540.64	-0.14	+0.16	+0.67
Energy and environment	Primary energy supply							
	Oil (GL)	176.2	176.0	175.8	175.1	+0.2	-0.2	-0.9
	Natural gas (Mt of LNG eq.)	75.2	73.1	70.9	62.2	+2.1	-2.2	-10.9
	Self-sufficiency rate	13.4%	14.5%	15.7%	24.9%	-1.1p	+1.2p	+10.4p
	Energy-related CO_2 (Mt)	961	955	948	873	+6	-7	-81
	Changes from FY2013	-22.2%	-22.7%	-23.3%	-29.3%	+0.5p	-0.5p	-6.6p

1. Sum of fuel cost, FIT purchasing cost and grid stabilising cost divided by total power generation.

Regarding economic efficiency, fossil fuel import value in the High Case will be reduced by JPY100 billion from the Reference Scenario and those in the Best Mix Case by JPY690 billion. If crude oil and LNG prices increase from assumed levels due to international situation changes, the import value fall or the effects of fossil fuel-fired power generation cuts will be greater. Disposable income will increase through the fall in payments for fossil fuel imports and real GDP will rise by JPY160 billion in the High Case and by JPY670 billion in the Best Mix Case from the Reference Scenario.

The unit power generation cost will decrease by JPY0.07/kWh in the High Case and by JPY0.08/kWh in the Best Mix Case. The decline in the Best Mix Case will be limited as an increase in costs for purchasing renewable electricity partially offsets the effects of fuel cost cuts.

Given growing geopolitical risks in the Middle East, energy security is attracting interests. Japan's energy self-sufficiency rate as a representative energy security indicator will improve by 1.2 points in the High Case and by 10.2 points in the Best Mix Case.

CO_2 emissions as an environment indicator will decline by 7 Mt in the High Case and by 81 Mt in the Best Mix Case. From FY2013 as the standard year for Japan's CO_2 emission reduction target under the Paris

Agreement, emissions will decrease by 23.3% in the High Case and by 29.3% in the Best Mix Case[7].

Given that deadlines for completing counterterrorism facilities will expire for an increasing number of nuclear power plants after FY2021, it is important for Japan's 3Es to facilitate the restart of nuclear power plants through adequate examinations with consideration given to the conditions of each plant.

[7] The Japanese target calls for cutting GHG emissions in FY2030 by 26% from FY2013 and energy-related CO_2 emissions by 25%. In addition to the low-carbonisation of power generation discussed here, energy efficiency improvement and the low-carbonisation of final energy consumption are planned to be mobilised to achieve the target.

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