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Economic and Energy Outlook of Japan for FY2019

Concerns over a slowdown could shadow stable economic growth. Energy demand will slightly rebound from this year's decline

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Summary of economic and energy outlook [Reference Scenario]

Macro economy and production activity | Growth will continue in FY2019 but will decelerate slightly

In FY2018, the Japanese economy slows down from the previous fiscal year to a moderate growth rate of 0.9%. Domestic demand is strong, but foreign demand does not contribute as in the past. In FY2019, the growth rate will be as much as the potential growth rate at 0.8%, reflecting a slowdown in private demand, while public demand will support the growth, in part because of measures to raise the VAT. Industrial production will increase at a much slower rate than in FY2017 at slightly less than 1% through FY2019. The trade surplus shrinks to JPY300 billion in FY2018 due to rises in energy prices but will recover to JPY800 billion in FY2019. As a result, the changes in the trade balance over the two years will be in line with changes in fossil fuel imports.

Energy supply and demand | Primary energy supply will increase slightly after a decrease in FY2018. CO_2 will decrease for its sixth consecutive year, but just a little

Primary energy supply decreases for the first time in two years in FY2018 due to a slowdown from the earlier higher economic growth and a milder winter compared to a record severe winter in FY2017 (-0.9%). In particular, oil and natural gas fall sharply. In FY2019, primary energy supply will return to a slight increase due to the expansion of basic materials production and a return to normal winter temperatures (+0.2%). The trend from fossil fuels to nuclear and renewable energy continues but will not accelerate in FY2019.

CO_2 emissions will be reduced to 1,069 Mt in FY2019, a reduction of -13.5% from FY2013. Although energy conservation and low-carbonisation progress every year, the degree of low carbon is still inferior to that before the Great East Japan Earthquake.

Energy sales | In FY2019, electricity and city gas sales will increase, whilst fuel oil sales will decline for a seventh consecutive year

In FY2018, overall electricity sales decline by 1.2%. Lighting services decrease sharply due to factors such as the impact of temperatures and the spread of residential solar PV power generation, while power services also decline slightly reflecting a slower growth in production activities on the back of a slowdown in exports. In FY2019, sales both for lighting services and for power services will increase, for an overall increase of 0.6%. That for lighting services will increase by 0.7% due to advances in electrification of water heating and cooking, despite the continued penetration of energy-efficient equipment. Sales for power services will increase by 0.6% due to the gradual expansion of production activities.

Although the sales of city gas for general industrial use increase in FY2018, total sales decrease for the first time in three years due to the influence of the severe winter of the previous fiscal year and the mild winter of this fiscal year, as well as the decrease of city gas for electric utility use (-2.3%). In FY2019, sales for industrial use will be driven by an increase for electric utility due to the operation of a new power plant, the continuous demand development for general industrial use, and sales for residential use will also return to increase. The overall figure will turn upward again, hitting a record high but only slightly higher than in FY2017 (+2.6%).

Table 1 | Summary of Reference Scenario

		Historical				Projection		Year-to-year changes		
		FY2010	FY2015	FY2016	FY2017	FY2018	FY2019	FY2017	FY2018	FY2019
Energy	Primary energy supply (Mtoe)[1]	514.5	466.2	463.0	464.9	460.6	461.6	0.4%	-0.9%	0.2%
	Oil[2] (GL)	232.3	211.6	205.1	202.6	194.7	193.5	-1.2%	-3.9%	-0.6%
	Natural gas[2] (Mt of LNG equiv.)	73.3	86.0	88.1	85.6	82.3	82.0	-2.8%	-3.9%	-0.3%
	Coal[2] (Mt)	184.7	190.1	188.0	192.2	191.6	191.9	2.2%	-0.3%	0.1%
	Nuclear (TWh)	288.2	9.4	17.3	31.3	61.2	65.4	80.8%	95.5%	7.0%
	Renewable electricity[3] (TWh)	111.2	149.0	150.8	163.8	175.7	183.7	8.6%	7.3%	4.5%
	FIT generation (TWh)	63.9	99.2	108.7	117.5	126.6	134.5	8.2%	7.7%	6.3%
	Self-sufficiency ratio	20.2%	7.4%	8.3%	9.5%	11.7%	12.3%	1.2p	2.2p	0.6p
	Electricity sales[4] (TWh)	(926.6)	(837.5)	850.5	863.2	853.1	858.4	1.5%	-1.2%	0.6%
	City gas sales[5] (Billion m^3)	39.28	39.91	41.53	42.48	41.52	42.61	2.3%	-2.3%	2.6%
	Fuel oil sales (GL)	196.0	180.5	176.9	174.7	167.7	166.7	-1.2%	-4.0%	-0.6%
	Energy-related CO_2 emissions (Mt)	1,138	1,148	1,128	1,112	1,073	1,069	-1.4%	-3.5%	-0.4%
	(FY2013=100)	92.1	92.9	91.3	90.0	86.8	86.5	..	..	..
Prices	Crude oil, import, CIF ($/bbl)	84	49	48	57	70	67	19.6%	22.0%	-3.8%
	LNG, import, CIF ($/MBtu)	11.3	8.7	7.0	8.5	10.9	10.4	20.5%	28.6%	-4.2%
	Steam coal, import, CIF ($/t)	114	76	81	102	117	103	26.4%	13.9%	-11.9%
	Coking coal, import, CIF ($/t)	175	88	111	146	161	143	31.8%	10.0%	-11.0%
Economy	Real GDP (JPY2011 trillion)	493.0	517.4	522.0	531.7	536.2	540.4	1.9%	0.9%	0.8%
	Industrial production (CY2010=100)	99.4	97.5	98.5	102.5	103.4	104.3	4.1%	0.8%	0.9%
	Balance of trade (JPY trillion)	5.3	-1.1	4.0	2.4	0.3	0.8	-38.6%	-88.7%	171%
	Fossil fuel imports (JPY trillion)	18.1	16.1	13.1	16.2	19.0	18.6	23.6%	17.0%	-2.3%
	Exchange rate (JPY/$)	86.1	120.4	108.4	111.1	111.2	114.8	2.4%	0.2%	3.2%
	Cooling degree days	560	322	431	397	489	381	-7.7%	23.2%	-22.2%
	Heating degree days	1,077	875	966	1,071	932	1,019	11.0%	-13.0%	9.3%

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.
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

Fuel oil sales in FY2018 continues to decline for many use, including a decline in naphtha due to periodic maintenance at petrochemical plants, a decline in the use of oil-fired power plants, and a decline in the demand for kerosene heating (-4.0%). In FY2019, the sales of naphtha will increase due to fewer periodic maintenance at ethylene plants. The sales of diesel oil will also increase in response to firm demand. The increase, however, will be more than offset by a drop in the operation of oil-fired power plants and a drop in gasoline sales, the result of continuous improvement in automobile fuel efficiency, marking the seventh consecutive year of decline (-0.6%).

Renewable power generation | The FIT power generation capacity will reach 73 GW at the end of FY2019

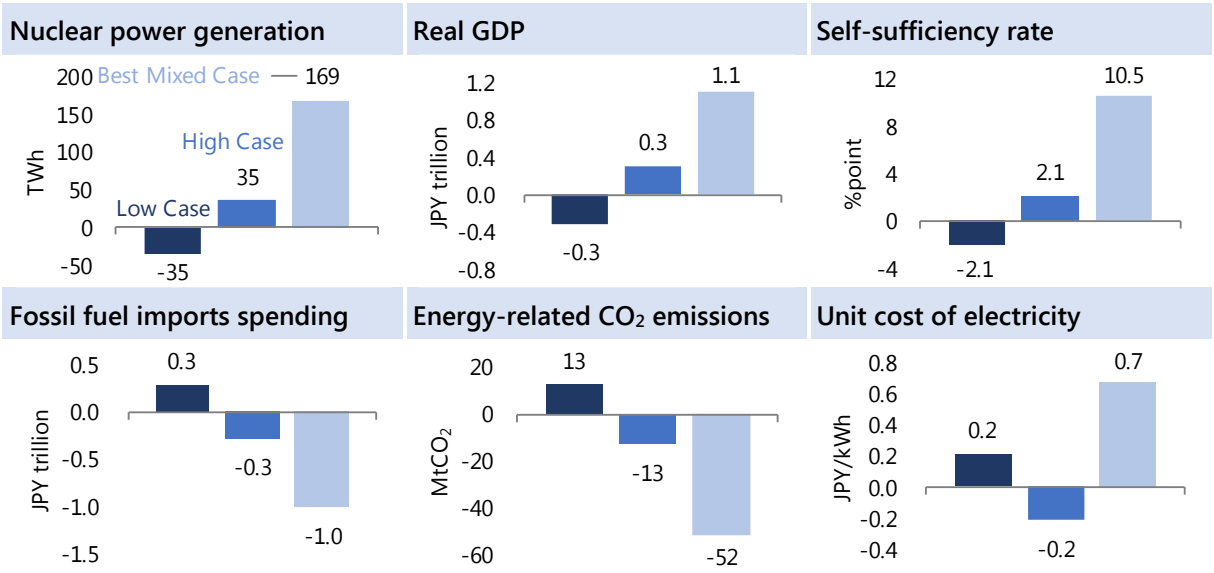
Regarding FIT power sources, more economical and reasonable promotion measures are pursued with the enforcement of the revised FIT Law in April 2017. The law is expected to be amended to further strengthen the revocation of accreditation of non-operating projects, however, plants under construction are expected to be operational, with a FIT capacity of 73 GW by the end of FY2019, including 43 GW for non-residential solar PV. The amount of electricity generated is 134.5 TWh in FY2019, accounting for 13% of Japan's total electricity generation (excluding pumped hydro). On the other hand, in exchange for promoting the introduction of the system, the burden on consumers is increasing. If all of the 86 GW of approved equipment as of March 2018 were in operation, the cumulative cost to consumers, including operating and transition

equipment, would be JPY61 trillion in the purchase period, equivalent to boosting electricity rates by JPY3,500/MWh – 15% for households and 21% for industries.

Topic | The effect of restarting nuclear power plants

We assessed the impact of nuclear power generation on 3Es – economy, energy security and environment. In the High Case, in which there are five more operating plants than in the Reference Scenario, the amount of fossil fuel imports would be reduced by JPY300 billion, the self-sufficiency rate would be improved by 2.1 points, and CO_2 emissions would be reduced by 13 Mt. The degree of utilisation of nuclear would greatly affect 3Es.

Figure 1 | Effect of the nuclear power generation [FY2019, compared with the Reference Scenario]



Overview

The Japanese economy in the third quarter of 2018 posted the steepest contraction in about four years due to natural disasters such as heavy rains and an earthquake. Basically, however, it maintained a moderate expansion. In the meantime, uncertainties such as the spread of the so-called "me-first" foreign policy, the deceleration of the Chinese economy and gepolitical risks in the Middle East have become matters of growing concern.

International crude oil prices gained $20/bbl in the first half of 2018 but lost more in two months from October on such developments as a U.S. announcement to waive an Iran oil embargo for some countries. In response, OPEC and some non-OPEC oil producing countries agreed on 7 December to cut their production by 1.2 Mb/d compared with October for six months from January 2019.

In Japan, applications have been filed for examinations of 25 nuclear power plants for conformity to regulatory standards. In September 2018, the Tokai No. 2 Power Station of the Japan Atomic Power Company became the 15th nuclear power plant to clear the examinations. However, the number of restarted nuclear power plants has been limited to nine. As for solar photovoltaics power generation, the government and private sectors are considering what to do after the 10-year period for electric utilities' mandatory purchases of surplus electricity from solar PV power generators under the feed-in tariff scheme begins to expire in 2019.

Key assumptions behind the Reference Scenario

Global economy

The global economy will grow, driven by the robust U.S. economy. However, growth will decelerate. In the U.S. economy, domestic demand will be robust on tax cuts, government spending expansion and a favourable employment and income environment. However, growth will slow down on interest rate hikes and trade disputes. In Europe, economic growth will decelerate on slowing exports, though being supported by brisk private consumption amid improvements in the employment and income environment. A focus of attention is the fate of Brexit. The Chinese economy will decelerate growth as the U.S.-China trade war affects exports. Other Asian economies will moderately decelerate growth despite expanding infrastructure investment as China's economic deceleration affects exports.

Crude oil / LNG / coal import CIF prices

The crude oil supply-demand balance will ease on growing production by some non-OPEC oil producing countries in the first half of 2019 before supply slips below demand on a decline in Iraninan exports in the second half. LNG will remain in oversupply. Oil import CIF prices for Japan are assumed to average $70/bbl in FY2018 and $67/bbl in FY2019. LNG import CIF prices are assumed to average $10.9/MBtu in FY2018 and $10.4/MBtu in FY2019. Steam coal prices rose on an increase in Chinese imports to meet growing electricity demand amid sluggish hydro power generation in the first half of FY2018 but will stabilise through FY2019. China will stabilise coking coal imports on slower economic growth. Steam coal import CIF prices are assumed to average $117/t in FY2018 and $103/t in FY2019. Coking coal import CIF prices are assumed to average $161/t in FY2018 and $143/t in FY2019 (IEEJ Hashizume "Oil Market Outlook," IEEJ Morikawa "Gas Market Outlook" and IEEJ Sagawa "Coal Market Outlook").

Exchange rate

We assume the dollar's average exchange rate with the yen to rise slightly from current levels to JPY115/USD FY2019 on widening gaps between Japanese and U.S. interest rates.

Tax

We assume that the Japanese standard VAT rate will be raised to 10% in October 2019, with a lower rate introduced for some goods, and that the government will come up with measures to mitigate a rapid consumption increase before and a fast consumption decline after the tax hike.

Air temperature

Summer in FY2018 was warmer (+0.6°C) than the previous summer. According to the Japan Meteorological Agency's three-month weather forecast, we assume that winter in FY2018 will also be warmer than normal. This means that FY2018 winter will be far warmer (+0.9°C) than the previous winter that was severely cold. Air temperatures will return to normal levels later. Summer in FY2019 will be far cooler (-0.9°C) than in the previous summer. Winter will be colder (-0.4°C).

Nuclear power generation

We assume that nuclear power plants will be restarted depending on progress in regulatory standards conformity examinations, with no judicial action being taken to halt any plant. However, no more will be restarted by the end of FY2018. We expect a total of nine plants to be operational at the end of FY2018. In the year, they will operate for an average nine months and generate 61.2 TWh. A total of 11 plants will be operational at the end of FY2019. In the year, they will operate for an average eight months and generate 65.4 TWh (accounting for 7% of total power generation).

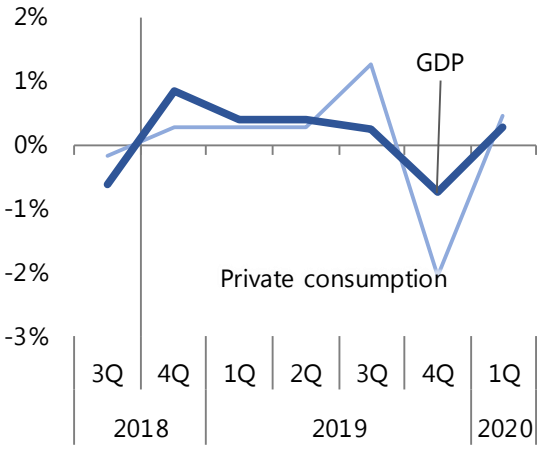
The macroeconomic situation

The Japanese economy will avoid any substantial contraction for the whole of FY2019 despite concerns about trade disputes and a value added tax hike, posting a growth rate of 0.8%, close to potential.

Private consumption will be robust in the favourable employment and income environment. Non-residential investment will decelerate on worries about the future course of the economy and a peaking-out in some areas, despite robust investment in productivity improvements such as automation to respond to labour shortages, as well as in Olympic-related and urban redevelopment projects. Private demand will contribute 0.6 percentage points to the total economic growth. Public demand will rise on brisk government investment and consumption to finance post-disaster reconstruction, national resilience enhancement and VAT hike countermeasures. Exports will gradually slow down growth, reflecting an overseas economic deceleration trend. Imports will grow slightly faster than exports. External demand will thus make a small negative contribution to the total economic growth.

Fossil fuel imports will decline from FY2018, contributing much to a trade balance improvement. However, their value will still be as high as JPY18.6 trillion.

Figure 2 | Changes in GDP and private consumption



Notes: Seasonally adjusted. Compared with the previous quarter.

Table 2 | Macroeconomic indicators

	Historical				Projection		Year-over-year		
	FY2010	FY2015	FY2016	FY2017	FY2018	FY2019	FY2017	FY2018	FY2019
Real GDP (JPY2011 trillion)	493.0	517.4	522.0	531.7	536.2	540.4	1.9%	0.9%	0.8%
Private demand	369.0	392.6	395.3	400.1	404.4	407.5	(1.3%)	(0.8%)	(0.6%)
Private consumption	286.6	295.8	295.8	298.9	300.6	302.4	1.0%	0.6%	0.6%
Private residential investment	13.9	15.2	16.2	16.0	15.3	15.5	-0.7%	-4.4%	1.1%
Private non-residential investment	67.6	81.2	80.7	84.4	87.6	89.1	4.6%	3.7%	1.7%
Public demand	122.6	130.9	131.7	132.5	132.8	134.1	(0.1%)	(0.1%)	(0.2%)
Government consumption	98.1	105.2	106.0	106.4	107.1	107.9	0.4%	0.7%	0.7%
Public investment	24.7	25.7	25.8	26.0	25.7	26.1	0.5%	-1.1%	1.8%
Net exports of goods and services	1.3	-7.0	-3.2	-1.4	-1.4	-1.5	(0.4%)	(0.0%)	(-0.0%)
Exports of goods and services	74.7	82.9	85.9	91.4	93.0	94.4	6.4%	1.8%	1.5%
Imports of goods and services	73.4	89.9	89.1	92.8	94.4	95.9	4.1%	1.8%	1.6%
Nominal GDP (JPY trillion)	499.4	533.0	536.8	547.4	553.3	565.7	2.0%	1.1%	2.2%
Balance of trade (JPY trillion)	5.3	-1.1	4.0	2.4	0.3	0.8	-38.6%	-88.7%	171%
Exports	67.8	74.1	71.5	79.2	82.3	85.2	10.8%	3.9%	3.5%
Imports	62.5	75.2	67.5	76.8	82.0	84.4	13.7%	6.8%	2.9%
Fossil fuels	18.1	16.1	13.1	16.2	19.0	18.6	23.6%	17.0%	-2.3%
Oil	12.3	9.6	7.8	9.6	11.1	11.0	22.1%	15.5%	-0.7%
LNG	3.5	4.5	3.3	4.1	5.0	4.9	22.1%	23.5%	-1.9%
Current account (JPY trillion)	18.3	18.0	20.7	21.4	20.4	21.7	3.2%	-4.7%	6.4%
Domestic corporate goods price index (2015=100)	97.6	99.1	96.7	99.3	101.9	103.4	2.7%	2.6%	1.5%
Consumer price index (2015=100)	96.4	100.0	100.0	100.7	101.5	103.1	0.7%	0.8%	1.6%
GDP deflator (2011=100)	101.3	103.0	102.8	103.0	103.2	104.7	0.1%	0.2%	1.4%
Unemployment rate (%)	5.0	3.3	3.0	2.7	2.4	2.5	[-0.3%]	[-0.3%]	[0.0%]

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 will expand on robust domestic demand through FY2019. However, growth will substantially decelerate from FY2017.

The industrial production index will score an increase of 0.8% in FY2018 from the previous year thanks to robust domestic demand including demand related to the Olympic Games Tokyo 2020 and a rise of 0.9% in FY2019 on continuous growth in domestic demand. However, the FY2018 and FY2019 growth will be far slower than 4.1% in FY2017.

Crude steel production will slightly decrease due to natural disasters and equipment troubles in FY2018 before rebounding on robust demand in FY2019.

In FY2018, crude steel production will log a slight decrease of 0.3% from the previous year on blast furnace troubles as well as heavy rains in western Japan and a large earthquake in Hokkaido, with exports dropping. In FY2019, crude steel production will rise by 0.2% to the FY2017 level as exports turn upward despite a pause in growth in domestic demand related to the Tokyo Olympics.

Ethylene production will decrease on more regular production equipment repairs in FY2018 before its recovery is suppressed by U.S. product exports made from shale gas in FY2019.

Ethylene production in FY2018 will decrease by 5.5% from the previous year due to more regular production equipment repairs. In FY2019, production will rebound due to fewer production equipment repairs. However, the gain will be limited to 2.5%, less than a half of the FY2018 loss, because of competition intensifying from U.S. ethylene products made from shales gas in the international market.

Annual cement production will remain above 60 Mt in FY2018 and FY2019, supported by robust domestic demand.

Cement production in FY2018 will decrease by 0.2% as an export decline on typhoons is mostly offset by growth in domestic demand related to the Tokyo Olympics and urban redevelopment. In FY2019, production will level off as export growth is offset by a private investment slowdown. However, annual production will remain above 60 Mt for the third straight year, for the first time since FY2008.

Paper and paperboard production will decrease in FY2018 and FY2019 due to structural factors such as a switch to electronic media and a population fall.

While paperboard production will increase due to export growth supported by increasing sales via the internet in China, paper production will decline on a switch to electronic media. Paperboard and paper production will drop by 0.5% in FY2018 and by 0.8% in FY2019. Although some companies are replacing plastics with paper for environmental reasons, such move's effect on paper production is limited.

Automobile production will almost level off in FY2018 as a rise in exports to emerging countries is offset by a decline in domestic shipments. Production will remain unchanged along with domestic and external demand in FY2019.

In FY2018, automobile production will level off with an increase of a mere 0.1% from the previous year as an increase in exports to emerging countries covers a drop in domestic shipments. In FY2019, production will remain almost unchanged with a gain of only 0.1% as a slower domestic shipment fall is coupled with flat exports amid a pause in growth in replacement demand in the United States and sluggish sales in China.

Table 3 | Production activities

		Historical				Projection		Year-over-year		
		FY2010	FY2015	FY2016	FY2017	FY2018	FY2019	FY2017	FY2018	FY2019
Production	Crude steel (Mt)	110.8	104.2	105.2	104.8	104.5	104.8	-0.3%	-0.3%	0.2%
	Ethylene (Mt)	7.00	6.78	6.29	6.46	6.10	6.25	2.7%	-5.5%	2.5%
	Cement (Mt)	56.1	59.2	59.3	60.4	60.2	60.2	1.8%	-0.2%	0.0%
	Paper and paperboard (Mt)	27.3	26.2	26.3	26.4	26.3	26.1	0.2%	-0.5%	-0.8%
	Automobiles (Million units)	8.99	9.19	9.36	9.68	9.67	9.69	3.5%	-0.1%	0.1%
Production indices	Mining and manufacturing (2010=100)	99.4	97.5	98.5	102.5	103.4	104.3	4.1%	0.8%	0.9%
	Food	98.2	96.9	96.8	96.7	96.5	95.6	-0.2%	-0.2%	-0.9%
	Chemicals	99.7	98.0	100.8	106.1	107.5	109.8	5.3%	1.3%	2.2%
	Non-ferrous metals	98.9	96.5	98.9	101.5	102.3	103.1	2.6%	0.8%	0.8%
	Machinery	99.3	98.4	99.4	104.9	106.3	107.7	5.6%	1.3%	1.3%
Tertiary industry activity index (2010=100)		99.9	103.5	103.9	105.0	105.8	106.3	1.0%	0.8%	0.4%

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

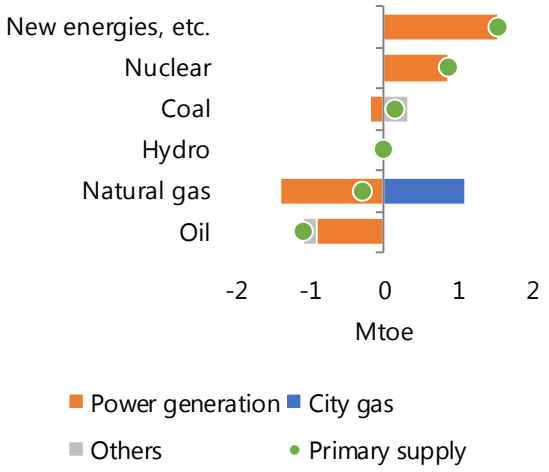
Primary energy supply will decrease in FY2018 before increasing slightly in FY2019. As nuclear power plants are restarted with renewable energy expanding, fossil fuel consumption for power generation will decline. LNG imports will post the first ever three-year consecutive decrease.

In FY2018, primary energy supply in Japan will decrease by 0.9% from the previous year for the first fall in two years due to slower economic growth and a warmer winter after rapid growth and a severely cold winter in the previous year. In FY2019, supply will increase by 0.2% as a general increase in industrial material production is combined with a colder winter. As growth in non-fossil fuel supply exceeds an overall energy supply increase, Japan's rate of dependence on fossil fuels, which had shot up after the Great East Japan Earthquake, will fall back to 88%, the level in FY1980 when the Act on the Promotion of the Development and Introduction of Alternative Energy was enacted.

Among primary energy supply in FY2019, oil as the largest energy source will decline by 0.6%. Oil-fired power plant operation will decrease as nuclear power plants are restarted, with solar PV expanding. Natural gas supply will drop by 0.3% for the first ever three-year consecutive fall. Supply for LNG-fired power generation will record a faster decrease than an increase in that for city gas-fired power generation. LNG imports will slip below 80 Mt, a yardstick after the Great East Japan Earthquake. In contrast, coal supply will change little.

While two nuclear power plants will be restarted in FY2019, nuclear energy supply growth will be the lowest in five years due to regular check-ups on some restarted nuclear power plants. New energies including solar PV, wind and biomass will log an increase of 1.5 Mtoe, the largest among energy categories. The expansion of non-fossil fuel supply will allow Japan's energy self-sufficiency rate to rise to 12%.

Figure 3 | Changes in primary energy supply and contribution [FY2019]



A decline in Japan's energy-related CO_2 emissions will be the slowest in six years due partly to a smaller increase in nuclear. From FY2013, a base year for cutting emissions under the Paris Agreement, FY2019 emissions will post a 13.5% decrease. CO_2 emissions per primary energy consumption will fall for the sixth straight year, though still being 5% higher than before the Great East Japan Earthquake. Energy consumption reduction and low-carbonisation are expected to make balanced contributions to cutting CO_2 emissions.

Table 4 | Primary energy supply

	Historical				Projection		Year-over-year		
	FY2010	FY2015	FY2016	FY2017	FY2018	FY2019	FY2017	FY2018	FY2019
Primary energy supply (Mtoe)	514.5	466.2	463.0	464.9	460.6	461.6	0.4%	-0.9%	0.2%
Coal	119.1	123.7	121.9	123.7	123.3	123.5	1.5%	-0.3%	0.1%
Oil	212.0	193.5	187.6	185.3	178.1	177.0	-1.2%	-3.9%	-0.6%
Natural gas	95.7	111.9	114.7	111.4	107.1	106.8	-2.8%	-3.9%	-0.3%
LNG imports (Mt)	70.6	83.6	84.7	83.9	79.9	79.7	-1.0%	-4.7%	-0.2%
Hydro	17.7	18.1	16.8	17.8	18.1	18.1	5.4%	1.8%	0.0%
Nuclear	60.7	2.0	3.7	6.8	12.7	13.6	82.2%	86.2%	6.8%
New energy, etc.	9.3	16.9	18.3	19.9	21.2	22.8	8.7%	6.7%	7.3%
Self-sufficiency rate	20.2%	7.4%	8.3%	9.5%	11.7%	12.3%	1.2p	2.2p	0.6p
Energy intensity (FY2011=100)	105.1	90.8	89.4	88.1	86.5	86.1	-1.4%	-1.8%	-0.6%
Energy-related CO_2 emissions ($MtCO_2$)	1,138	1,148	1,128	1,112	1,073	1,069	-1.4%	-3.5%	-0.4%
(FY2013=100)	92.1	92.9	91.3	90.0	86.8	86.5	..	..	..

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 utility use)

Residential electricity sales will fluctuate on temperature changes while industrial sales will remain steady. Oil-fired power generation capacity totalling more than 13 GW will be idled or retired, bringing about a plunge in oil-fired power generation.

In FY2018, electricity sales will decrease by 1.2% from the previous year due partly to temperature changes. Sales to lighting service users will drop by 3.2% due to a consumption fall after a severely cold winter in the previous year and the diffusion of residential solar PV power generation, despite an increase in air-conditioning demand in the warmer summer. Sales to power service users will decline by 0.2% as machinery production growth slackens on an export slowdown.

In FY2019, electricity sales will increase by 0.6% as sales to both lighting and power service users expand. Sales to lighting service users will expand by 0.7% due to temperature changes as well as progress in the electrification of heating and cooking, despite the diffusion of energy-saving products such as light-emitting diode lamps and solar PV panels. While the period for utilities' purchase of electricity from renewable energy under the feed-in tariff (FIT) scheme will begin to expire for some residential customers, the expiration's effect on electricity sales to lighting service users will still be limited. Electricity sales to power service users will increase by 0.6% in line with a moderate increase in industrial production, despite a reactionary fall in air-conditioning demand, hitting the highest level since the full electricity retail deregulation in April 2016.

Because of the electricity retail deregulation, power producer and supplier companies' share of total electricity sales rose from 5.2% in April 2016 to 14.2% in September 2018. Such share rose beyond 10% to 12.0% for lighting service users and increased to 21.8% for high voltage users (6.7% for extra-high voltage users).

In FY2018, nuclear energy's share of total power generation and purchases will double from the previous year to 6% due to progress in the restart of nuclear power plants. Backed by the FIT scheme, the share for renewables, etc. (excluding hydro) will rise steadily to 9% (up 1.0 percentage points from the previous year). Fossil fuels' share will decline by 4.5 points including 3.1 points for LNG. Oil-fired power generation will decline as oil-fired power plants totalling more than 13 GW are subjected to idling or retirement.

In FY2019, nuclear's share will rise only by 0.4 points to 7% despite the restart of two nuclear power plants as some restarted plants are subjected to regular check-ups. The share for renewables, etc. (excluding hydro) will increase by 0.8 points to 10%. The combined share for hydro, nuclear and renewables, etc. (excluding hydro), known as zero-emission power sources, will increase above 25% for the first time since the Great East Japan Earthquake. LNG's share will fall from the present level to 40% for FY2018 and FY2019.

Table 5 | Electricity sales and power generation and purchases mix (electric utility use)

	Historical				Projection		Year-over-year/changes		
	FY2010	FY2015	FY2016	FY2017	FY2018	FY2019	FY2017	FY2018	FY2019
Electricity sales (TWh)	(926.6)	(837.5)	850.5	863.2	853.1	858.4	1.5%	-1.2%	0.6%
Lighting service	304.2	266.9	272.9	281.3	272.4	274.3	3.1%	-3.2%	0.7%
Power sercice	(622.4)	(570.7)	577.6	581.9	580.8	584.1	0.7%	-0.2%	0.6%
Extra-high voltage	(246.1)	(229.3)	231.5	233.8	235.7	238.3	1.0%	0.8%	1.1%
High voltage	(330.3)	(303.7)	308.3	309.6	307.9	308.6	0.4%	-0.6%	0.2%
Low voltage	(45.9)	(37.7)	37.8	38.4	37.2	37.3	1.6%	-3.1%	0.3%
Electricity generated and purchased (TWh)	(1,028)	(920.1)	960.0	971.9	959.9	965.4	1.2%	-1.2%	0.6%
Hydro	(9%)	(10%)	9%	9%	10%	9%	+0.5p	+0.4p	-0.0p
Fossil fuels	(62%)	(85%)	83%	80%	75%	74%	-3.0p	-4.5p	-1.2p
Coal	(25%)	(31%)	29%	29%	30%	30%	+0.1p	+0.4p	+0.1p
LNG	(29%)	(46%)	46%	44%	40%	40%	-2.1p	-3.1p	-0.5p
Oil, etc.	(8%)	(8%)	8%	7%	5%	5%	-1.0p	-1.8p	-0.7p
Nuclear	(29%)	(1%)	2%	3%	6%	7%	+1.4p	+3.1p	+0.4p
Renewables (excluding hydro), etc.	(1%)	(5%)	7%	8%	9%	10%	+1.1p	+1.0p	+0.8p

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 FY2018 will decrease mainly for the residential sector and power utilities. In FY2019, sales will slightly increase to a record high, driven by those for industrial use. The residential sector will be primarily responsible for the drop in FY2018 and the rise in FY2019.

City gas sales for general industrial use in FY2018 will increase on moderate expansion in production and economic activities and fuel switching for industrial furnaces and boilers. Due to the impact of a severely cold winder in the previous year and a fall in sales for electric utilities, however, overall city gas sales will turn down for the first time in three years, with a 2.3% decline. In FY2019, city gas sales will expand by 2.6% to a record 42.6 billion m^3 as a rise in sales for electric utilities is coupled with an increase in those for industrial use amid production expansion and greater water- and space-heating demand in a colder winter.

Residential sales in FY2018 will post a substantial decline of 7.1% due to a warmer winter after a severely cold winter in the previous year. In FY2019, residential sales will grow by 4.4% on greater water- and space-heating demand due to a colder winter and a cooler summer, although energy-saving equipment including highly efficient water heaters will diffuse further.

Business sales (commercial and other sales) will decrease (-1.9% for commercial sales and -0.6% for others) on the continued spread of energy-efficient equipment and a warmer winter, despite greater space-cooling demand in a warmer summer. In FY2019, greater winter space- and water-heating demand, continuous fuel switching to city gas and new demand exploration efforts for gas heat pumps and other products will decelerate a decline in commercial sales to 0.5% and provide a 0.9% increase in other sales, although energy-efficient equipment will diffuse further.

Industrial sales in FY2018 will turn down for the first time in five years with a 0.7% loss on a decline in sales for power generation, although those for general industrial use will expand on a production recovery, fuel switching for industrial furnaces and boilers, and new demand exploration efforts. In FY2019, they will turn up with a 2.8% gain on continuous demand exploration for general industrial use as well as a sharp rise in sales for electric utilities on the planned launch of the Moka power station's Unit 1 (with capacity at 620 MW) in the second half of the year.

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 13.4% in August 2018. Such share exceeded 15% for industrial sales and is continuing to rise for residential sales.

Until FY2016, industrial sales had been mainly responsible for changes in city gas sales. Due to the deceleration of industrial sales growth and steep winter temperature changes, however, residential sales were mainly responsible for changes in FY2017 and FY2018. In FY2019, sales for electric utilities will make the greatest contribution to the overall city gas sales growth. However, residential sales' contribution will be almost similar.

Figure 4 | Changes in city gas sales

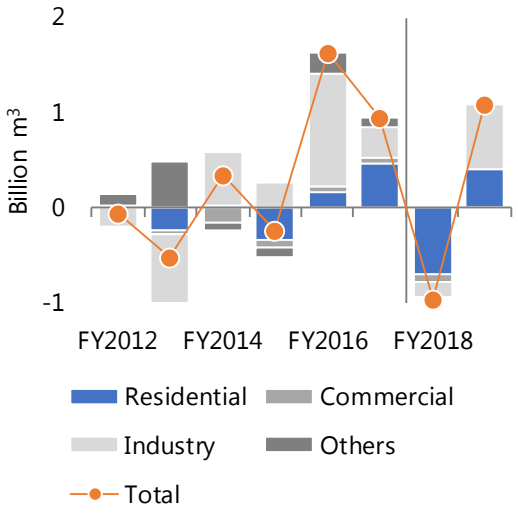


Table 6 | City gas sales (gas utilities)

	Historical				Projection		Year-over-year		
	FY2010	FY2015	FY2016	FY2017	FY2018	FY2019	FY2017	FY2018	FY2019
Total (Billion m^3)	39.28	39.91	41.53	42.48	41.52	42.61	2.3%	-2.3%	2.6%
Residential	9.79	9.24	9.41	9.88	9.18	9.59	5.0%	-7.1%	4.4%
Commercial	4.75	4.26	4.32	4.37	4.29	4.27	1.2%	-1.9%	-0.5%
Industrial	21.61	23.01	24.20	24.52	24.36	25.04	1.3%	-0.7%	2.8%
Manufacturing	(20.18)	(20.16)	19.30	19.97	20.19	20.43	3.5%	1.1%	1.2%
Electric utilities	(1.43)	(2.85)	4.90	4.55	4.17	4.60	-7.1%	-8.4%	10.4%
Others	3.13	3.41	3.61	3.71	3.69	3.72	2.8%	-0.6%	0.9%

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

Fuel oil / LPG sales and crude oil throughput

Fuel oil sales in FY2019 will decline for the seventh straight year. Excluding diesel oil in robust demand, fuel oil sales for various applications will follow a downtrend. Heavy fuel oil sales will decline to 40% of the level before the Great East Japan Earthquake. Crude oil throughput will decline by 30% from 20 years ago.

Fuel oil sales in FY2018 will decrease by 4.0% from the previous year for the largest decline in four years due mainly to a drop in oil-fired power generation, vehicle fuel efficiency improvements, regular check-ups on petrochemical plants and less heating demand in a warmer winter. In FY2019, fuel oil sales will fall by 0.6% for the seventh straight annual decline as a drop in heavy fuel oil and gasoline sales outpaces growth in sales of naphtha subject to less production equipment check-ups and diesel oil in firm demand.

Gasoline sales will continue a downtrend on growth in hybrid, mini and other fuel-efficient vehicles. They will decrease by 1.2% in FY2018 from the previous year despite a severely hot summer. In FY2019, gasoline sales will decline by 1.9% for the fourth straight year of fall to just above 50 billion litres, down about 20% from the peak of 61.48 GL in 2004.

Naphtha sales will decrease by 4.6% in FY2018 due to an increase in regular ethylene plant repairs. In FY2019, they will rise back as regular ethylene plant repairs decrease. However, they will fall short of recovering the FY2017 level, with growth limited to 3.0%.

Kerosene sales in FY2018 will decrease by 11.6% as heating demand in a warmer-than-normal winter declines substantially from a colder-than-normal winter in the previous year. In FY2019 when air temperatures will be normal, kerosene sales will continue a downtrend with a 0.9% drop on energy switching from kerosene to city gas or electricity.

Diesel oil sales had followed a downtrend for a long time after a peak in FY1996 and have recently turned up on rising demand for freight transportation on growing sales via the internet and for bus transportation for increasing foreign tourists. They will rise by 0.3% in FY2018 and by 0.9% in FY2019, posting a three-year consecutive increase for the first time in about 20 years.

Heavy fuel oil A sales will drop by 1.8% in FY2018 on price hikes and fuel switching to city gas in industry and commercial sectors. In FY2019, they will decrease by 3.9% on further progress in fuel switching.

Heavy fuel oil B / C sales for industrial use will decrease due to progress in fuel switching and energy conservation. Those for power generation will substantially decline on the shutdown or retirement of oil-fired power plants. Total heavy fuel oil B / C sales will plunge by 23.7% in FY2018 and by 13.5% in FY2019, posting a double-digit decline for the seventh straight year and sinking to 40% of the FY2010 level before Japan's energy situation turned around due to the Great East Japan Earthquake.

LPG sales will decrease by 3.3% in FY2018 as residential demand plunges on temperature changes. In FY2019, they will decline by 1.4% due to energy switching to electricity or city gas in buildings and industry sectors.

Crude oil throughput will decrease by 4.6% in FY2018 and by 1.6% in FY2019 on a fall in fuel oil sales, posting a three-year consecutive decline. From a peak of 249.93 GL in FY1997, it will log a 30% plunge.

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

	Historical				Projection		Year-over-year		
	FY2010	FY2015	FY2016	FY2017	FY2018	FY2019	FY2017	FY2018	FY2019
Fuel oil sales (GL)	196.0	180.5	176.9	174.7	167.7	166.7	-1.2%	-4.0%	-0.6%
Gasoline	58.2	53.1	52.5	51.8	51.2	50.3	-1.3%	-1.2%	-1.9%
Naphtha	46.7	46.2	44.8	45.1	43.0	44.3	0.7%	-4.6%	3.0%
Jet fuel	5.2	5.5	5.3	5.0	5.3	5.3	-5.2%	5.5%	0.0%
Kerosene	20.4	15.9	16.3	16.6	14.7	14.6	2.4%	-11.6%	-0.9%
Diesel oil	32.9	33.6	33.3	33.8	33.9	34.2	1.5%	0.3%	0.9%
Heavy fuel oil A	15.4	11.9	12.0	11.5	11.3	10.9	-4.0%	-1.8%	-3.9%
Heavy fuel oils B and C	17.3	14.2	12.8	10.8	8.3	7.2	-15.1%	-23.7%	-13.5%
For electric utilities	7.7	8.2	7.9	6.0	4.1	3.4	-23.8%	-31.7%	-16.6%
For other users	9.7	6.1	4.8	4.8	4.2	3.7	-0.9%	-13.6%	-10.3%
LPG sales (Mt)	16.5	14.7	14.4	14.8	14.3	14.1	2.9%	-3.3%	-1.4%
Crude oil throughput (GL)	208.9	189.0	190.6	184.2	175.7	172.9	-3.3%	-4.6%	-1.6%

Renewable energy-based power generation (FIT power source)

Renewable energy-based power generation capacity will reach 73 GW. However, some approved non-residential solar PV projects were cancelled, contributing to suppressing an increase in the burden on consumers.

Renewable energy-based power generation capacity approved under the FIT scheme reached 105 GW in March 2017 as applications for such approval increased sharply just before a FIT price cut in April 2017. As a deadline was set for making approved capacity operational under the revised FIT Act, however, some approved capacity including non-residential solar PV facilities (such as mega-solar plants) was cancelled, leading the approved capacity to fall to 86 GW in March 2018.

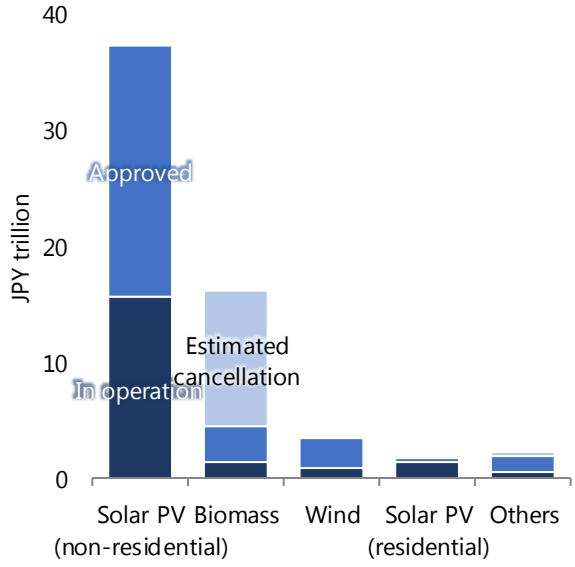
If all the approved capacity totalling 86 GW at the end of March 2018, including already operational and transferred facilities[1], is operational, the cumulative burden on consumers will reach an estimated JPY61 trillion[2]. (The approved capacity includes 70.2 GW for solar PV, 6.5 GW for wind and 8.4 GW for biomass.) The estimated burden amounts to an electricity rate hike of JPY3,500/MWh, or 15% for residential users and 21% for industrial users. However, the estimated burden represents a substantial fall from JPY77 trillion for the peak approved capacity of 105 GW, indicating that the revised FIT Act can be assessed as making some achievement. The estimated burden may be lowered to JPY49 trillion, if about 6 GW in approved biomass capacity expected to be cancelled due to barriers to long-term stable fuel supply is excluded. As the government considers revising the FIT Act again to enhance the cancellation of approved capacity that is yet to become operational, the burden on consumers will be suppressed further.

While no substantial growth can be expected in approved renewables power generation capacity, approved capacity now under construction is expected to become operational. While local problems still exist with the connection of renewables power generators to the electric grid, initiatives to mitigate these problems have been implemented gradually from the current fiscal year. Large barriers to the operation of renewables power generators may thus be avoided. Installed renewables power generation capacity will reach 73.2 GW at the end of FY2019. Particularly, installed non-residential solar PV capacity will expand to 42.8 GW at the end of FY2019, accounting for more than half the total. As about five years are required for launching wind power generation after approval, installed wind generation capacity will be limited to 4.4 GW at the end of FY2019. Renewable energy-based power generation in FY2019 will total 134.5 TWh (including 56.6 TWh for solar PV, 39.1 TWh for small and medium-sized hydro, 27.8 TWh for biomass and 7.7 TWh for wind), accounting for 13% of Japan's total power generation.

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

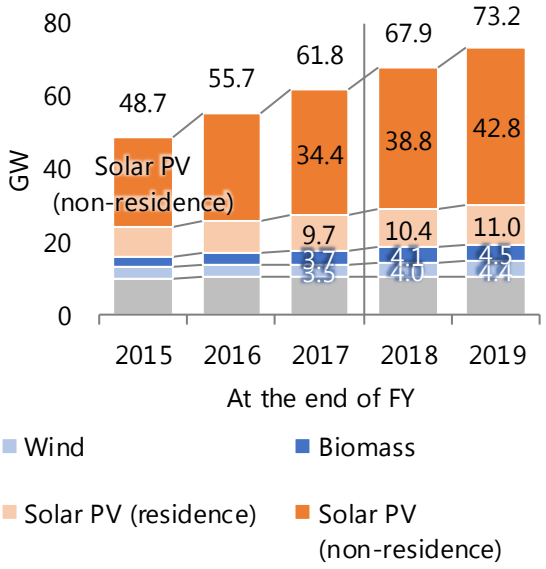
[2] The remaining FIT periods for transferred facilities are taken into consideration. The avoidable cost has been estimated by the IEEJ, based on various documents. The capacity factor is assumed at 20% for wind, 12% for solar PV, 70% for geothermal, 45% for hydro and 70% for biomass.

Figure 5 | Cumulative burden of FIT scheme over purchasing period (capacity approved or in operation at the end of March 2018)



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

Figure 6 | Installed FIT power generation capacity (based on operation)



Impact of the pace of nuclear power plant restart

Nuclear greatly contributing to the 3Es

This chapter assesses the impact on the so-called 3Es (energy security, environmental friendliness and economic efficiency) of differing paces for restarting nuclear power plants.

In addition to the Reference Scenario in which the number of restarted nuclear power plants will increase from nine at present to 11 by the end of FY2019, we have developed the "High Case" in which five more will have been restarted by FY2019-end and the "Low Case" in which five fewer will have been restarted then[3], for sensitivity analysis. For the theoretical "Best Mixed Case," we have referred to the target power generation mix for 2030 in the Long-term Energy Supply and Demand Outlook by the Ministry of Economy, Trade and Industry, setting the power generation mix share at 21% for nuclear, 23% for renewable energy and 56% for fossil fuels for FY2019.

Nuclear's contributions to the 3Es

Regarding economic efficiency, the fossil fuel import value in the High Case is JPY0.3 trillion less than in the Reference Scenario and the value in the Best Mixed Case is JPY1 trillion yen less. The unit electricity cost in the High Case is JPY200/MWh less but the cost in the Best Mixed Case is JPY700/MWh more. This is because the FIT cost for the Best Mixed Case is more while the unit electricity cost is less. Real GDP in the High Case is JPY0.3 trillion more than in the Reference Scenario due to the lower fossil fuel import value. Real GDP in the Best Mixed Case is JPY1.1 trillion more than in the Reference Scenario, and the energy self-sufficiency rate indicating energy security is 2.1 percentage points higher in the High Case and 10.5 points higher in the Best Mixed Case.

CO_2 emissions indicating environmental friendliness are 13 Mt less in the High Case and 52 Mt less in the Best Mixed Case. From FY2013 or the base year for Japan's emission reduction target[4] for the Paris Agreement, emissions in the High Case fall by 14.6% and those in the Best Mixed Case decline by 17.7%.

[3] Each of the five nuclear plants is assumed to have capacity at 1 GW and operate at 80% of its capacity.

[4] Japan's target calls for cutting GHG emissions in FY2030 by 26% and energy-related CO_2 emissions by 25% from FY2013 by mobilising the low-carbonisation of power generation discussed here as well as energy efficiency improvements and the low-carbonisation of final energy consumption.

Table 8 | Effects of differing nuclear power generation [FY2019]

		Low Case	Reference Scenario	High Case	Best Mixed Case	Changes from Reference		
						Low	High	Best Mixed
Nuclear assumptions	Restarted nuclear reactors	6	11	16	..	-5	+5	..
	Power generation (TWh)	30.4	65.4	100.4	234.5	-35.0	+35.0	+169.0
	Share in generation and purchases	3%	6%	9%	21%	-3p	+3p	+15p
Economy	Electricity unit cost[1] (JPY/kWh)	6.7	6.5	6.3	7.2	+0.2	-0.2	+0.7
	Fuel cost	4.8	4.6	4.3	3.9	+0.2	-0.2	-0.7
	FIT purchasing cost	2.0	2.0	2.0	3.3	0.0	0.0	+1.4
	Total fossil fuel imports (JPY trillion)	18.9	18.6	18.3	17.6	+0.3	-0.3	-1.0
	Oil	11.0	11.0	10.9	10.8	+0.1	-0.0	-0.2
	LNG	5.2	4.9	4.7	4.1	+0.2	-0.2	-0.8
	Trade balances (JPY trillion)	0.5	0.8	1.0	1.7	-0.3	+0.3	+0.9
	Real GDP (JPY2011 trillion)	540.1	540.4	540.8	541.5	-0.3	+0.3	+1.1
Energy and environment	Primary energy supply							
	Oil (GL)	194.6	193.5	192.6	190.3	+1.1	-0.9	-3.3
	Natural gas (Mt of LNG eq.)	85.8	82.0	78.1	68.7	+3.8	-3.9	-13.3
	Self-sufficiency rate	10.2%	12.3%	14.4%	22.9%	-2.1p	+2.1p	+10.5p
	Energy-related CO_2 (Mt)	1,082	1,069	1,056	1,017	+13	-13	-52
	Changes from FY2013	-12.4%	-13.5%	-14.6%	-17.7%	..	..	..

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

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