

## Economic and Energy Outlook of Japan for FY2022

*Increasing energy expenditure and CO<sub>2</sub> emissions  
while back to a normal economic situation*

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### Summary of economic and energy outlook [Reference Scenario]

#### Macro economy | GDP growth rate will be 3% range for the second years

Real GDP for FY2022 will be larger than FY2018 and hit a record high on the back of the recovery from the COVID-19 pandemic (+3.3% from the previous year). Supported by released pent-up demand, the index of industrial production will be higher than the level of FY2019, rising 5.5% in FY2022 led by automobile and heavy electrical machinery.

#### Energy supply and demand | With a return to a normal economic situation, total energy consumption will increase for the second years in a row and the CO<sub>2</sub> reduction pace will slow down

Total energy consumption per GDP will be improved with recoveries in machinery production and service industries but total energy consumption will increase (+0.4%). LNG imports will fall for the sixth consecutive year due to install of zero-emission power sources and coal-fired power plants. They will be almost same before the Great East Japan Earthquake (0.6% higher than FY2010).

CO<sub>2</sub> emissions will increase by 0.9% to 995 Mt in FY2022, due to more coal and oil energy use from the previous year and will be down 19.5% from FY2013, the base year for the Paris agreement. The reductions will not reach the halfway point of the Paris agreement target (cut by 45% by FY2030 from FY2013).

#### Energy sales | Lighting services will decrease primarily due to a decline in the less stay-home rate, but power services will grow with recovery in the machinery production and the service industry. City gas sales will be the second highest after FY2017. Total fuel oil sales will decrease mainly due to the decrease of ethylene production.

Electricity sales will be 1.1% higher than FY2021 and higher than FY2019 before the COVID-19 pandemic with the recovery of economic activities in addition to the temperature effect. Sales for power services will grow 1.9% with production recovery in industries, mainly with the machinery. Despite an increase in all-electrified houses, sales for lighting services will slightly decrease (-0.4%) primarily due to a decline in the less stay-home rate and diffusion of PV and energy efficient technologies such as LED.

Overall city gas sales will be nearly 42.0 billion m<sup>3</sup> (2.2% higher than FY2021). FY2022 will be the second highest after FY2017 when summer was cool and winter was cold. Note that a sharp increase in sales to electric utilities after FY2020 will contribute largely, while sales to general industry and commercial will increase, they will be lower than FY2019.

Fuel oil sales in FY2022 will decrease by 0.7% due to the non-energy use such as naphtha with more regular ethylene plant repairs while fuel oil sales in energy use will increase. While fuel efficiency will be improved, sales of gasoline, diesel oil, and jet fuel oil will increase two years in a row with higher transportation demand.

Despite an increase in industrial production, sales for industries such as heavy fuel oil A and heavy fuel oil C will fall due to fuel switching and energy saving accelerated by higher oil prices. Sales of kerosene will also fall due to energy saving and fuel switching with little effects from changes in temperature.

## Renewable power generation | The FIT power generation capacity will reach 95 GW by the end of FY2022

The installed renewable energy-based power generation capacity (including capacity subject to FIT contract expiration) will boost to 95 GW by the end of FY2022. Although COVID-19 delayed installation by restricting solar PV power plant builders' communications with residents near plant sites and by making it difficult to secure construction workers, capacity will expand to 57.8 GW. Wind capacity will be limited to 5.3 GW because of the long lead time to operation due to environmental assessment, etc. Renewable energy-based power generation in FY2022 will total 183.0 TWh (including 87.4 TWh for solar PV, 40.9 TWh for small and medium-sized hydro plants, 38.2 TWh for biomass, 12.8 TWh for wind), accounting for 17.8% of Japan's total power generation. With the inclusion of large-sized hydro, renewable power will generation account for 22.4%.

**Table 1 | Summary of Reference Scenario**

	Historical				Projection		Year-over-year			
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022	
Energy	Primary energy supply (Mtoe) <sup>1</sup>	515.9	455.4	444.6	414.9	427.6	429.6	-6.7%	3.1%	0.5%
	Oil <sup>2</sup> (GL)	232.3	192.8	186.1	169.7	174.8	175.0	-8.8%	3.0%	0.1%
	Natural gas <sup>2</sup> (Mt of LNG equiv.)	73.3	81.6	78.3	78.5	74.1	72.3	0.1%	-5.6%	-2.3%
	Coal <sup>2</sup> (Mt)	184.7	188.1	187.6	174.4	184.3	189.7	-7.0%	5.6%	2.9%
	Nuclear (TWh)	288.2	62.1	61.0	37.0	67.6	71.8	-39.4%	82.7%	6.2%
	Renewable electricity <sup>3</sup> (TWh)	110.4	177.0	187.9	197.8	213.3	223.5	5.3%	7.8%	4.8%
	FIT generation (TWh)	63.2	133.9	146.2	158.1	171.2	177.3	8.1%	8.3%	3.5%
	Self-sufficiency ratio	20.2%	11.6%	12.0%	11.2%	13.5%	13.8%	-0.8p	2.3p	0.3p
	Electricity sales <sup>4</sup> (TWh)	(926.6)	852.6	836.1	820.9	831.5	841.0	-1.8%	1.3%	1.1%
	City gas sales <sup>5</sup> (Billion m <sup>3</sup> )	39.28	41.58	40.42	39.51	41.07	41.99	-2.3%	3.9%	2.2%
	Fuel oil sales (GL)	196.0	167.7	161.6	151.5	154.5	153.4	-6.2%	1.9%	-0.7%
	Energy-related CO <sub>2</sub> emissions (Mt)	1,137	1,065	1,029	967	986	995	-6.0%	1.9%	0.9%
	(Changes from FY2013)	-8.0%	-13.8%	-16.7%	-21.7%	-20.2%	-19.5%	-5.0p	1.5p	0.7p
Prices	Crude oil, import, CIF (\$/bbl)	84	72	68	43	71	68	-36.3%	63.9%	-4.6%
	LNG, import, CIF (\$/MBtu)	11.3	10.5	9.5	7.5	10.6	11.1	-20.8%	40.3%	5.4%
	Steam coal, import, CIF (\$/t)	114	120	102	79	144	142	-22.4%	82.7%	-1.7%
	Coking coal, import, CIF (\$/t)	176	160	138	104	182	198	-24.5%	75.4%	8.2%
Economy	Real GDP (JPY2015 trillion)	512.1	554.3	550.6	525.7	540.4	558.3	-4.5%	2.8%	3.3%
	Industrial production (CY2015=100)	101.2	103.8	99.9	90.4	96.7	102.1	-9.5%	7.1%	5.5%
	Balance of trade (JPY trillion)	5.3	-1.6	-1.3	1.3	0.5	1.5	-201%	-63.0%	215.8%
	Fossil fuel imports (JPY trillion)	18.1	19.1	16.6	10.6	17.9	18.2	-36.2%	69.5%	1.6%
	Exchange rate (JPY/\$)	86.1	110.6	108.8	106.0	111.6	113.5	-2.6%	5.3%	1.7%
	Cooling degree days	559	489	439	442	407	414	0.6%	-8.0%	1.6%
Heating degree days	1,079	865	818	863	956	974	5.6%	10.7%	1.9%	

Notes:

1. Mtoe = 10<sup>10</sup> 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<sup>3</sup> = 10,000 kcal

## Topic |

### **1 Impacts on the economy and the energy situation of a decline in the production of automobiles**

From August to October 2021, the automobile production decreased by about 710 thousand from the production plan. Assuming the volume is not caught up through FY2022, production will be lower by 7.3% from the reference scenario and IIP will be lower by 2.6%. GDP will fall 0.3% less than IIP because service industries are less affected. City gas sale will fall the most (-0.8%) among energy sales with high share of industries. Primary energy supply will fall more than GDP (-0.7%) with the fall of manufactures such as iron and steel as a material of automobiles.

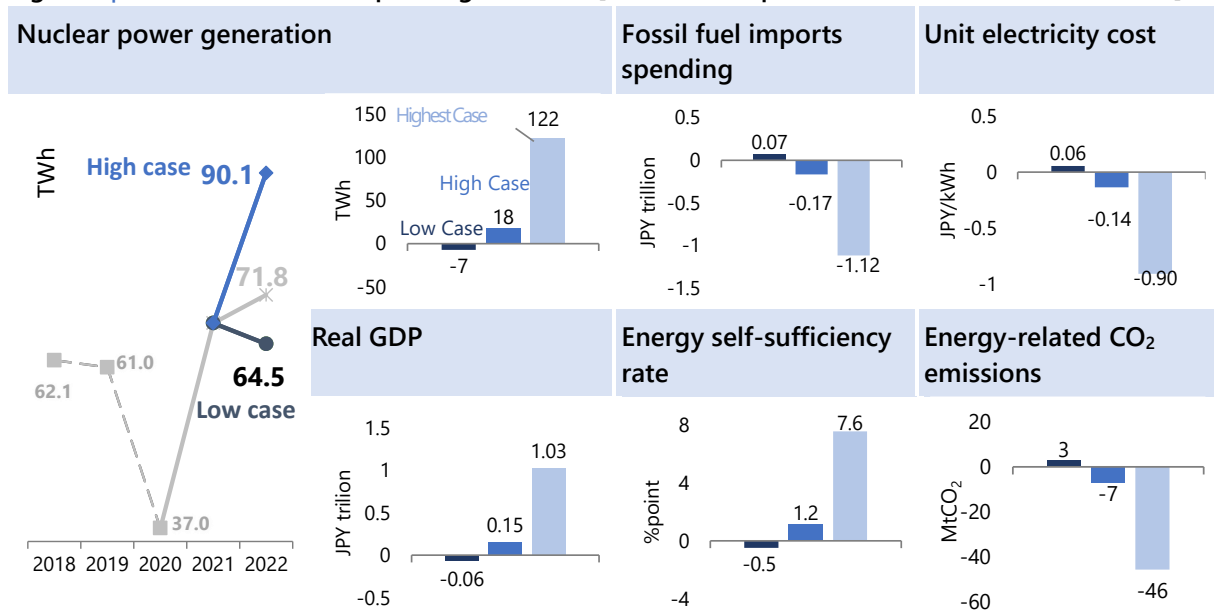
### **2 Impacts of the temperature changes on household energy expenditures**

With a very little temperature impacts and lower stay-home rates, energy purchase will decrease while expenditures will rise to the highest level in seven years by 3.6% due to the higher energy prices. If the summer (Jul-Sep) is hotter by 1°C and the winter (Dec-Feb), colder by 1°C, energy expenditures will reach to FY2013, the highest year. As a response to the temperature effect, the Energy Engel's coefficient will rise and this would affect more for lower-income household or household with reduced income due to the COVID pandemic. To reduce energy expenditures at the normal condition, additional expenditures brought by hotter summer and colder winter for lower-income household, mixing energy and environmental policies such as enhancing energy efficiencies and redistribution policies is expected.

### 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 compared to the reference scenario, 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 JPY160 billion, the self-sufficiency rate would be improved by 1.2 points, and CO<sub>2</sub> emissions would be reduced by 7 Mt. 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 [FY2022, compared with the Reference Scenario]**



### 4 The impacts of the oil price changes on Japan's economy and energy situation

If the average crude oil price is \$10/bbl higher (lower) than in the Reference Scenario, GDP and IIP would be pushed down(up). It is therefore important for Japan to reduce renewable energy costs and facilitate the restart of nuclear power plants to prepare for such risks.

**Table 2 | Macroeconomic indicators**

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
Real GDP (JPY2015 trillion)	512.1	554.3	550.6	525.7	540.4	558.3	-4.5%	2.8%	3.3%
Private demand	383.7	415.9	411.8	386.2	396.0	411.6	(-4.7%)	(1.9%)	(2.9%)
Private consumption	290.5	302.4	299.3	282.9	290.1	299.7	-5.5%	2.5%	3.3%
Private residential investment	18.2	19.9	20.4	18.8	18.8	19.0	-7.8%	0.1%	0.9%
Private non-residential investment	73.7	91.3	90.8	83.9	86.2	89.9	-7.5%	2.7%	4.3%
Public demand	124.2	136.2	139.1	143.3	144.2	145.9	(0.8%)	(0.2%)	(0.4%)
Government consumption	98.1	108.7	111.0	113.8	116.0	117.3	2.5%	2.0%	1.1%
Public investment	26.2	27.6	28.1	29.5	28.3	28.7	5.1%	-4.3%	1.4%
Net exports of goods and services	4.7	2.3	-0.2	-4.2	0.0	0.6	(-0.6%)	(0.8%)	(0.1%)
Exports of goods and services	83.8	105.0	102.7	91.9	103.0	107.9	-10.5%	12.1%	4.8%
Imports of goods and services	79.2	102.7	102.9	96.0	103.0	107.3	-6.6%	7.2%	4.2%
Nominal GDP (JPY trillion)	504.9	556.3	557.3	535.5	547.1	567.4	-3.9%	2.2%	3.7%
Balance of trade (JPY trillion)	5.3	-1.6	-1.3	1.3	0.5	1.5	-201.2%	-63.0%	215.8%
Exports	67.8	80.7	75.9	69.5	84.6	88.7	-8.4%	21.8%	4.8%
Imports	62.5	82.3	77.2	68.2	84.2	87.2	-11.6%	23.4%	3.6%
Fossil fuels	18.1	19.1	16.6	10.6	17.9	18.2	-36.2%	69.5%	1.6%
Oil	12.3	11.3	10.1	5.8	10.0	10.0	-42.9%	74.2%	-0.4%
LNG	3.5	4.9	4.1	3.1	4.6	4.7	-23.1%	45.7%	1.4%
Current account (JPY trillion)	18.3	19.4	18.7	16.3	17.4	19.1	-12.7%	6.9%	9.5%
Domestic corporate goods price index (2015=100)	97.6	101.5	101.6	100.2	106.2	107.2	-1.4%	6.0%	0.9%
Consumer price index (2020=100)	94.7	99.6	100.2	99.9	99.7	100.5	-0.3%	-0.1%	0.8%
Unemployment rate (%)	5.0	2.4	2.3	2.9	2.8	2.6	[+0.6p]	[-0.1p]	[-0.2p]

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.

**Table 3 | Production activities**

	Historical				Projection		Year-over-year			
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022	
Production	Crude steel (Mt)	110.8	102.9	98.4	82.8	93.3	96.9	-15.9%	12.7%	3.8%
	Ethylene (Mt)	7.00	6.19	6.28	6.04	6.21	5.93	-3.8%	2.7%	-4.5%
	Cement (Mt)	56.1	60.2	58.1	56.1	56.8	57.9	-3.6%	1.3%	2.0%
	Paper and paperboard (Mt)	27.3	26.0	25.0	22.7	23.7	23.7	-9.5%	4.6%	-0.1%
	Automobiles (Million units)	8.99	9.75	9.49	7.97	8.65	9.68	-16.0%	8.5%	11.9%
Production indices	Mining and manufacturing (2015=100)	101.2	103.8	99.9	90.4	96.7	102.1	-9.5%	7.1%	5.5%
	Food and tobacco	100.7	99.6	100.6	96.9	97.8	99.7	-3.7%	0.9%	2.0%
	Chemicals	99.6	107.5	103.8	94.7	98.9	103.0	-8.8%	4.4%	4.1%
	Non-ferrous metals	100.0	104.3	99.2	90.0	98.6	104.4	-9.3%	9.5%	5.9%
	Machinery	99.4	105.6	100.3	89.7	98.0	105.1	-10.5%	9.2%	7.3%
Tertiary industry activity index (2015=100)	97.6	103.0	102.3	95.3	98.2	102.4	-6.9%	3.1%	4.3%	

Notes: Chemicals include chemical fibers.

Machinery includes general machinery, electrical machinery, information and telecommunications equipment, electronic parts and devices, precision machinery and metal products.

**Table 4 | Primary energy supply**

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
Primary energy supply (Mtoe)	515.9	455.4	444.6	414.9	427.6	429.6	-6.7%	3.1%	0.5%
Coal	119.1	121.5	120.4	110.6	116.0	118.8	-8.1%	4.9%	2.4%
Oil	212.0	176.2	170.1	155.1	159.8	160.0	-8.8%	3.0%	0.1%
Natural gas	95.7	106.6	102.4	102.5	96.8	94.5	0.1%	-5.6%	-2.3%
LNG imports (Mt)	70.6	80.6	76.5	76.4	73.8	71.1	-0.2%	-3.4%	-3.6%
Hydro	17.7	16.7	16.5	16.2	16.7	16.4	-1.6%	3.3%	-1.8%
Nuclear	60.7	13.3	13.0	7.9	14.3	15.1	-39.2%	80.0%	5.6%
New energy, etc.	10.7	21.1	22.2	22.6	24.0	24.7	1.6%	6.5%	3.0%
Self-sufficiency rate	20.2%	11.6%	12.0%	11.2%	13.5%	13.8%	-0.8p	2.3p	0.3p
Energy intensity (FY2013=100)	105.2	85.8	84.3	82.4	82.6	80.3	-2.2%	0.2%	-2.8%
Energy-related CO <sub>2</sub> emissions (MtCO <sub>2</sub> )	1,137	1,065	1,029	967	986	995	-6.0%	1.9%	0.9%
Change from FY2013	-8.0%	-13.8%	-16.7%	-21.7%	-20.2%	-19.5%	-5.0p	1.5p	0.7p

Notes: New energy includes solar photovoltaics, wind, biomass, solar heat, and geothermal, etc.

Self-sufficiency rate is based on IEA standard.

**Table 5 | Electricity sales and power generation / purchase mix (electric utility use)**

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
Electricity sales (TWh)	(926.6)	852.6	836.1	820.9	831.2	840.3	-1.8%	1.3%	1.1%
Lighting service	304.2	270.3	266.7	278.0	271.9	270.6	4.2%	-2.2%	-0.5%
Power service	(622.4)	582.2	569.4	543.0	559.4	569.7	-4.6%	3.0%	1.9%
Extra-high and High voltage	(576.5)	544.6	533.2	506.6	522.7	532.3	-5.0%	3.2%	1.9%
Low voltage	(45.9)	37.6	36.3	36.3	36.7	37.4	0.2%	1.1%	1.9%
Electricity generated and purchased (TWh)	(1,028)	957.0	932.0	920.3	932.0	941.3	-1.3%	1.3%	1.0%
Hydro	(8.5%)	9.1%	9.3%	9.5%	9.6%	9.4%	0.2p	0.2p	-0.3p
Fossil fuels	(61.7%)	74.6%	73.1%	74.0%	69.4%	68.2%	0.9p	-4.6p	-1.2p
Coal	(25.0%)	28.5%	28.4%	27.8%	27.7%	28.7%	-0.6p	-0.2p	1.0p
LNG	(29.3%)	39.3%	38.1%	38.6%	34.7%	32.7%	0.5p	-3.9p	-2.0p
Oil, etc.	(7.5%)	6.9%	6.6%	7.5%	7.1%	6.8%	0.9p	-0.5p	-0.3p
Nuclear	(28.6%)	6.5%	6.5%	4.0%	7.2%	7.6%	-2.5p	3.2p	0.4p
Renewables (excluding hydro), etc.	(1.1%)	9.8%	11.0%	12.5%	13.7%	14.8%	1.5p	1.2p	1.1p
	(1%)	0%	0%	0%	0%	0%	0.0p	0.0p	0.0p
Electricity prices (JPY/kWh)	(16.7)	21.7	21.6	20.4	22.5	23.9	-5.4%	10.4%	6.2%
Lighting service	21.4	27.2	27.3	26.0	28.3	29.7	-4.9%	8.9%	5.1%
Power service	(14.4)	19.1	18.9	17.5	19.7	21.1	-7.0%	12.3%	7.3%

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.

**Table 6 | City gas sales (gas utilities)**

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
City gas sales (Billion m <sup>3</sup> )	39.28	41.58	40.42	39.51	41.06	41.96	-2.3%	3.9%	2.2%
Residential	9.79	9.24	9.38	10.02	9.90	9.84	6.8%	-1.2%	-0.6%
Commercial	4.75	4.26	4.16	3.65	3.78	4.02	-12.2%	3.6%	6.3%
Industrial	21.61	25.03	23.83	22.76	24.28	25.00	-4.5%	6.7%	3.0%
Manufacturing	(20.28)	20.51	19.68	17.43	18.75	19.47	-11.5%	7.6%	3.8%
Electric utilities	(1.34)	4.52	4.15	5.33	5.53	5.53	28.4%	3.8%	0.0%
Others	3.13	3.05	3.05	3.08	3.09	3.11	1.1%	0.3%	0.4%
City gas prices(¥/m <sup>2</sup> )	83.79	87.62	88.64	80.10	92.22	101.9	-9.6%	15.1%	10.5%
Residential	160.1	165.3	165.7	153.9	169.2	180.1	-7.1%	9.9%	6.5%
Commercial	81.95	87.84	88.84	79.76	91.86	102.4	-10.2%	15.2%	11.4%
Industrial	50.67	58.52	59.08	48.70	61.52	71.56	-17.6%	26.3%	16.3%
Others	76.67	90.68	82.50	72.60	87.51	97.59	-12.0%	20.5%	11.5%

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

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
Fuel oil sales (GL)	196.0	167.7	161.6	151.5	154.5	153.4	-6.2%	1.9%	-0.7%
Gasoline	58.2	50.6	49.1	45.2	45.8	45.9	-7.9%	1.2%	0.3%
Naphtha	46.7	43.9	42.5	40.3	41.2	39.2	-5.2%	2.1%	-4.9%
Jet fuel	5.2	5.0	5.2	2.7	3.8	4.9	-46.9%	38.0%	30.1%
Kerosene	20.3	14.5	13.6	14.5	14.2	14.0	6.4%	-2.0%	-1.5%
Diesel oil	32.9	33.8	33.7	31.9	32.9	33.5	-5.3%	3.3%	1.7%
Heavy fuel oil A	15.4	11.1	10.2	10.2	10.1	9.9	0.7%	-0.8%	-2.6%
Heavy fuel oils B and C	17.3	8.8	7.4	6.7	6.5	6.1	-9.8%	-2.5%	-6.4%
For electric utilities	7.7	4.0	2.6	2.8	2.3	2.1	4.1%	-16.2%	-10.4%
For other users	9.7	4.9	4.7	3.9	4.2	4.0	-17.5%	7.1%	-4.1%
LPG sales (Mt)	16.5	14.2	14.1	12.9	13.5	13.8	-8.4%	4.4%	1.8%
Crude oil throughput (GL)	208.9	176.7	174.0	139.3	145.1	154.5	-19.9%	4.2%	6.5%

**Table 8 | Effects of differing nuclear power generation [FY2022]**

		Low Case	Reference Scenario	High Case	Highest Case	Changes from Reference		
						Low	High	Highest
Nuclear assumptions	Restarted nuclear reactors	10	12	14	27	-2	+2	+15
	Power generation (TWh)	64.5	71.8	90.1	193.4	-7.3	+18.2	+121.5
	Share in generation and purchases	6.5%	7.2%	9.0%	19.4%	-0.7p	+1.8p	+12p
Economy	Electricity unit cost <sup>1</sup> (JPY/kWh)	9.40	9.34	9.21	8.44	+0.06	-0.14	-0.90
	Fuel cost	5.75	5.69	5.55	4.79	+0.06	-0.14	-0.90
	FIT purchasing cost	3.65	3.65	3.65	3.65	-	-	-
	Total fossil fuel imports (JPY trillion)	18.56	18.49	18.33	17.38	+0.07	-0.17	-1.12
	Oil	10.00	9.99	9.97	9.90	+0.01	-0.02	-0.09
	LNG	5.00	4.94	4.79	3.91	+0.06	-0.15	-1.03
	Trade balances (JPY trillion)	1.31	1.36	1.50	2.27	-0.06	+0.14	+0.91
	Real GDP (JPY2011 trillion)	558.18	558.24	558.39	559.27	-0.06	+0.15	+1.03
Energy and environment	Primary energy supply							
	Oil (GL)	175.2	175.1	174.7	173.3	+0.2	-0.4	-1.8
	Natural gas (Mt of LNG eq.)	73.0	72.2	70.1	57.5	+0.9	-2.1	-14.7
	Self-sufficiency rate	13.3%	13.8%	15.0%	21.4%	-0.5p	+1.2p	+7.6p
	Energy-related CO <sub>2</sub> (Mt)	997	995	988	949	+3	-7	-46
Changes from FY2013	-19.3%	-19.5%	-20.0%	-23.2%	+0.2p	-0.6p	-3.7p	

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

The full text will be available later.



## Introduction

In the third quarter of 2021, Japan's GDP contracted by 0.9%, the first decline in two quarters, as a state of emergency declaration was coupled with sluggish automobile production amid semiconductor shortages and the spreading COVID-19 infection in Southeast Asia as a major automobile parts supply source for Japan. Domestic demand contributed 0.9 percentage points to the contraction and external demand 0 points. The Japanese economy is expected to grow in the future as services and durable goods consumption expands, thanks to the lifting of the state of emergency declaration and the elimination of constraints on automobile production.

The average crude oil import price for Japan fell to \$25 per barrel in June 2020 due to a global oil demand decline. As COVID-19 constraints on economic activities have gradually decreased since then, oil

demand increased. Currently, the price is staying above \$70/bbl, exerting downside pressure on the Japanese economy in a recovery process.

So far, applications for 27 nuclear power plants have been filed for conformity with the new regulatory standards in Japan. Of them, 17 have cleared the examinations, including 10 that have restarted. However, two of the 10 restarted plants had to suspend operations in FY2021 because of 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

With the two-shot vaccines rate rising to close to 80% in Japan, new COVID-19 infections began to decrease in October 2021 and the number of critical COVID-19 patients also declined substantially. Amid concerns over Omicron and other COVID-19 variants for the rest of FY2021, biosecurity measures such as social distancing continue to be in effect. With the third COVID-19 vaccination, the Japanese economy is expected to return to normal.

### Global economy

Global economic growth is assumed at 5.9% for 2021 and at 4.9% for 2022. As vaccination made progress in 2021, mainly in the United States, Europe and Russia, human mobility will recover under a strategy for coexistence with COVID-19. Pent-up demand will contribute to a substantial global economic growth that will continue well in 2022. Domestic demand will turn into economic growth in Asian and low-income countries that have been lagging in their economic recovery.

### Fossil fuel import CIF prices

Crude oil import prices for Japan are assumed to average \$71/bbl in FY2021 (\$70/bbl in the first half and \$72/bbl in the second) and \$68/bbl in FY2022, based on the international crude oil price outlook below. The average LNG import price for Japan is assumed to rise from \$11.1/Mbtu in FY2021 to \$11.9/Mbtu in FY2022, reflecting earlier crude oil price fluctuations. Steam and coking coal import prices are projected to decrease gradually from the second half of FY2021 to FY2022 as international supply shortages are phasing out due to the easing of supply constraints in China. Steam coal import prices are assumed to average \$144/t in FY2021 and \$142/bbl in FY2022. Coking coal import prices are projected to average \$182/t in FY2021 and \$198/t in FY2022. (IEEJ Ichihara "Outlook for International Oil

Market in 2022," Hashimoto "Outlook for Gas Market in 2022," Ito "Outlook for International Coal Market in 2022.")

### Exchange rate

We assume the dollar's average exchange rate with the yen to stand at JPY111.6/USD in FY2021 and at JPY113.5/USD in FY2022.

### Nuclear power generation

Given progress in regulatory standards conformity examinations for nuclear power plants, more plants are assumed to restart. One nuclear power plant restarted in FY2021, bringing the cumulative number of restarted plants to 10 at the end of the fiscal year. As the suspension of two restarted plants has been prolonged due to a delay in the completion of counterterrorism facilities, however, the 10 plants in FY2021 will operate for an average of 10 months and generate 67.6 TWh. From FY2020 when more plants were suspended, however, the FY2021 power generation will score a sharp increase of 82.7%. In FY2022, two additional plants will restart, boosting the cumulative number of restarted plants to 12 at the end of the fiscal year. The suspension of one restarted plant will be prolonged. The 12 restarted plants will operate for an average of 9 months and generate 71.8 TWh, up 6.2% from the previous year.

### Air temperature

According to the Japan Meteorological Agency's three-month forecast, we assume normal temperatures in winter FY2021. Later temperatures will be assumed normal. The average temperature in summer FY2021 was down 0.3°C from a year earlier while the winter average temperature will be down 0.9°C. The temperature will be up 0.2°C from a year earlier in summer FY2022 and remain unchanged in winter.

## Macro economy

**As the recovery from the COVID-19 crisis makes progress, GDP will score a real growth rate of 3.3% in FY2022 compared to 2.8% in FY2021. Fossil fuel import value will rise to the highest level in four years as prices remain high.**

Japan's GDP in FY2021 will post a real growth rate of 2.8% against a sharper contraction in the previous year. Private consumption will increase by 2.5% on a recovery in human mobility, despite lingering biosecurity measures. Private non-residential investment will rise by 2.6% due to a pickup in companies' appetite for investment. Private demand will thus contribute 1.8 percentage points to the GDP growth. Public demand will contribute 0.2 points through economic stimulus measures to tackle COVID-19, as well as a rise in healthcare spending. External demand will make a contribution of 0.8 points to the GDP growth thanks to a rebound in exports to the United States, Europe and China.

In FY2022, Japan's GDP will score a record real increase of 3.3%, topping the FY2018 growth, as the impacts of COVID-19 ease. Consumer confidence will continue to improve as employment and wages rebound on a pickup in face-to-face services amid human mobility growth under the easing COVID-19 impacts. The improvement will be coupled with the disappearance of constraints on automobile supply to push up private consumption by 3.3%. Private non-

residential investment will expand by 4.3% thanks to growing investment in business efficiency improvements and digitalization, as well as in construction and decarbonization measures. Private demand's contribution to the GDP growth will be limited to 2.9 points, less than in FY2019. Public demand will hit a record high due to a public investment increase through the National Resilience Plan and a government consumption rise through an increase in healthcare and nursing care spending, contributing 0.4 points to the GDP growth. External demand will contribute 0.1 points to the GDP growth as exports including automobiles expand on a recovery in the Asian economy, as well as the United States, Europe and China, despite import growth led by domestic demand expansion.

Japan's fossil fuel imports will shoot up by 71.6% in FY2021 as a volume increase is coupled with price hikes. In FY2022, they will increase by 1.9% due to an LNG price rise. The trade balance will post a surplus for the third straight year thanks to sharp growth in exports including automobiles.

Table 1 | Macroeconomic indicators

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
Real GDP (JPY2015 trillion)	512.1	554.3	550.6	525.7	540.4	558.2	-4.5%	2.8%	3.3%
Private demand	383.7	415.9	411.8	386.2	396.0	411.5	(-4.7%)	(1.8%)	(2.9%)
Private consumption	290.5	302.4	299.3	282.9	290.1	299.7	-5.5%	2.5%	3.3%
Private residential investment	18.2	19.9	20.4	18.8	18.8	19.0	-7.8%	0.1%	0.8%
Private non-residential investment	73.7	91.3	90.8	83.9	86.1	89.9	-7.5%	2.6%	4.3%
Public demand	124.2	136.2	139.1	143.3	144.2	145.9	(0.8%)	(0.2%)	(0.4%)
Government consumption	98.1	108.7	111.0	113.8	116.0	117.3	2.5%	2.0%	1.1%
Public investment	26.2	27.6	28.1	29.5	28.2	28.6	5.1%	-4.3%	1.4%
Net exports of goods and services	4.7	2.3	-0.2	-4.2	0.0	0.6	(-0.6%)	(0.8%)	(0.1%)
Exports of goods and services	83.8	105.0	102.7	91.9	103.0	107.9	-10.5%	12.1%	4.8%
Imports of goods and services	79.2	102.7	102.9	96.0	103.0	107.3	-6.6%	7.2%	4.2%
Nominal GDP (JPY trillion)	504.9	556.3	557.3	535.5	546.9	567.4	-3.9%	2.1%	3.7%
Balance of trade (JPY trillion)	5.3	-1.6	-1.3	1.3	0.3	1.4	-201.2%	-77.3%	362.8%
Exports	67.8	80.7	75.9	69.5	84.7	88.8	-8.4%	21.9%	4.9%
Imports	62.5	82.3	77.2	68.2	84.4	87.4	-11.6%	23.7%	3.6%
Fossil fuels	18.1	19.1	16.6	10.6	18.2	18.5	-36.2%	71.6%	1.9%
Oil	12.3	11.3	10.1	5.8	10.0	10.0	-42.9%	74.2%	-0.4%
LNG	3.5	4.9	4.1	3.1	4.8	4.9	-23.1%	52.8%	2.7%
Current account (JPY trillion)	18.3	19.4	18.7	16.3	17.3	19.0	-12.7%	5.9%	9.8%
Domestic corporate goods price index (2015=100)	97.6	101.5	101.6	100.2	106.3	107.3	-1.4%	6.0%	0.9%
Consumer price index (2020=100)	94.7	99.6	100.2	99.9	99.8	100.6	-0.3%	-0.1%	0.8%
Unemployment rate (%)	5.0	2.4	2.3	2.9	2.8	2.6	[+0.6p]	[-0.1p]	[-0.2p]

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 in FY2022 will exceed the FY2019 level as growth benefits from a production recovery for automobiles that has been delayed so far. Meanwhile, production in the four major energy-intensive industrial materials sectors will slip below levels before the COVID-19 crisis.**

In FY 2021, the industrial production index will rise by 7.0% from the previous year. Despite a delayed rebound in the automobile production, industrial machinery production increases on a global recovery from the COVID-19 crisis and domestic private non-residential investment. In FY2022, the index will increase by 5.5% and exceed the FY2019 level, supported by a delayed recovery in automobile production and demand mainly for heavy electrical machinery that had been pent up under the COVID-19 crisis.

Crude steel production in FY2021 will post a substantial increase of 12.7%. Domestic crude steel demand, though falling for shipbuilding, will rise back for machinery and building materials, and exports to Asia and the United States will recover. In FY2022, crude steel production will score a 3.8% rise. A recovery in domestic demand mainly in the automobile industry will be coupled with an increase in exports to ASEAN backed by an economic rebound. As steel demand for automobiles increases, converter steel output will rise, boosting its share of total crude steel production for the second straight year.

Ethylene production in FY 2021 will increase by 2.7% but fall short of restoring the FY2019 level. Domestic demand will rise thanks to an industrial production recovery. Exports to Asia including China will expand due to a decline in regular ethylene plant maintenance. In FY2022, ethylene production will decrease by 4.5%, slipping below 6 million tons for the first time since 1993. Due to an increase in regular plant repairs, both domestic shipments and exports will decrease.

Cement production in FY2021 will increase by 1.3%. Exports to ASEAN will expand substantially, while domestic demand declines due to a cement consumption fall through construction process changes and delayed construction under bad weather.

In FY2022, exports will increase as demand in Southeast Asia and Oceania recovers. Domestic demand will also grow as construction of disaster prevention and reduction facilities under a metropolitan redevelopment program and the National Resilience Plan is normalized. Cement production in FY2022 will thus rise by 2.0% but represent the third lowest level between FY1970 and FY2019 before the FY2020-2021 COVID-19 impacts.

Paper and paperboard production in FY2021 will increase by 4.5% from the previous year thanks to a rise in advertisement paper consumption amid a recovery in industrial activities and tourism demand and in events, as well as the continued electronic commerce uptrend. Due to a fire accident at a paper plant in Korea, exports will also expand temporarily. In FY2022, paper and paperboard production will fall by 0.1% as demand for newsprint and communication paper continues a downtrend due to structural digitalization. Paperboard production will increase on a recovery in tourism demand and growing electronic commerce. As a production increase is limited due to a decrease in used paper supply for paperboard, exports will decline.

Automobile production in FY2021 will increase by 8.5% from the previous year thanks to an economic recovery in Japan and the rest of the world but it will fall short of reaching 9 million units due to difficulties in procurement of semiconductors and other parts. For the second straight year, production will slip below the FY2009 level of 8.865 million units just after the global financial crisis. In FY2022 when supply chains will be normalized, automobile production will post a substantial increase of 11.9%, including vehicles that were sold in FY2021 for delivery in FY2022. Both domestic demand and exports will top FY2019 levels.

Table 2 | Production activities

	Historical				Projection		Year-over-year			
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022	
Production	Crude steel (Mt)	110.8	102.9	98.4	82.8	93.3	96.8	-15.9%	12.7%	3.8%
	Ethylene (Mt)	7.00	6.19	6.28	6.04	6.20	5.93	-3.8%	2.7%	-4.5%
	Cement (Mt)	56.1	60.2	58.1	56.1	56.8	57.9	-3.6%	1.3%	2.0%
	Paper and paperboard (Mt)	27.3	26.0	25.0	22.7	23.7	23.7	-9.5%	4.5%	-0.1%
	Automobiles (Million units)	8.99	9.75	9.49	7.97	8.64	9.67	-16.0%	8.5%	11.9%
Production indices	Mining and manufacturing (2015=100)	101.2	103.8	99.9	90.4	96.7	102.1	-9.5%	7.0%	5.5%
	Food and tobacco	100.7	99.6	100.6	96.9	97.8	99.7	-3.7%	0.9%	2.0%
	Chemicals	99.6	107.5	103.8	94.7	98.9	103.0	-8.8%	4.4%	4.1%
	Non-ferrous metals	100.0	104.3	99.2	90.0	98.6	104.3	-9.3%	9.5%	5.9%
	Machinery	99.4	105.6	100.3	89.7	98.0	105.1	-10.5%	9.2%	7.3%
Tertiary industry activity index (2015=100)		97.6	103.0	102.3	95.3	98.2	102.4	-6.9%	3.1%	4.3%

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

**In FY2022, energy consumption per GDP will fall, but energy demand will increase for the second straight year due to economic normalization. While surpassing the halfway point between FY2013 and FY2030, Japan will fall short of achieving half the FY2030 goal for energy self-sufficiency and CO<sub>2</sub> emission cuts.**

In FY2021, primary energy supply in Japan will post a substantial rise of 3.0% from the previous year due to industrial materials production and transportation growth on a recovery from the COVID-19 crisis, as well as a colder winter. In FY2022, energy consumption per GDP, or energy intensity, will decrease thanks to growth mainly in the machinery and services industries, but domestic primary energy supply will increase by 0.4% due to an economic recovery.

In FY2021, new energy supply including solar, wind and biomass energies will grow by 6.5% amid an economic recovery from the COVID-19 crisis. In FY2022, new energy supply will increase by 3.0%, and account for 6% of domestic primary energy supply. Non-residential solar photovoltaics power generation is the main contributor to the growth.

Nuclear power generation in FY2021 will score a sharp increase of 80.0% from the previous year as one nuclear plant is restarted and six other plants are resuming operations after their long shutdowns for such reasons as delays in completing their counterterrorism facilities. As two more plants will be restarted during the second half of FY2022, one will suspend operation until it completes its counterterrorism facility. The increase in nuclear power generation in FY2022 will thus be limited to 5.6%.

Oil supply in FY2021 will post a 3.0% increase from the previous year thanks to a recovery in production and transportation. In FY2022, gasoline and diesel oil supply will increase due to a transportation recovery, despite fuel efficiency improvement and fuel switching. But overall oil supply growth will be

limited to 0.1% because of a naphtha supply drop amid reduced ethylene production.

Coal supply will increase by 4.9% in FY2021 reflecting a rise in the capacity factor for coal-fired power plants and a sharp rise in crude steel production. Coal supply in FY2022 will rise by another 2.4%, mainly for power generation, despite a slowdown in industrial materials production recovery, as five new coal-fired power plants go on stream in late FY2021.

Natural gas supply will decrease by 5.7% in FY2021 as supply for power generation decreases much faster than a rise in supply for city gas. In FY2022, natural gas supply will fall again by 2.4% as supply for power generation decreases in line with the launches of new coal-fired and solar PV power plants. LNG imports will decline for a sixth consecutive year to 0.6% above imports in FY2010, the year before the Great East Japan Earthquake.

Japan's energy self-sufficiency rate in FY2021 will increase by 2.3 percentage points due to a rise in nuclear power generation. In FY2022, the rate will rise by 0.3 points to 13.8%. Though passing the halfway point between FY2013 and FY2030, Japan will fall short of achieving half of the FY2030 goal of around 30%.

Japan's energy-related CO<sub>2</sub> emissions in FY2021 will increase by 1.9% to 986 Mt from the year before, the first time to rise since FY2013. In FY2022, emissions will further increase by 0.9% to 995 Mt, the equivalent of 19.5% below the levels of FY2013. One year beyond the halfway point between FY2013 and FY2030, Japan will fall short of achieving half the goal of a 45% cut for FY2030.

Table 1 | Primary energy supply

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
Primary energy supply (Mtoe)	515.9	455.4	444.6	414.9	427.6	429.4	-6.7%	3.0%	0.4%
Coal	119.1	121.5	120.4	110.6	116.0	118.8	-8.1%	4.9%	2.4%
Oil	212.0	176.2	170.1	155.1	159.8	160.0	-8.8%	3.0%	0.1%
Natural gas	95.7	106.6	102.4	102.5	96.7	94.3	0.1%	-5.7%	-2.4%
LNG imports (Mt)	70.6	80.6	76.5	76.4	73.7	71.0	-0.2%	-3.5%	-3.7%
Hydro	17.7	16.7	16.5	16.2	16.7	16.4	-1.6%	3.3%	-1.8%
Nuclear	60.7	13.3	13.0	7.9	14.3	15.1	-39.2%	80.0%	5.6%
New energy, etc.	10.7	21.1	22.2	22.6	24.0	24.7	1.6%	6.5%	3.0%
Self-sufficiency rate	20.2%	11.6%	12.0%	11.2%	13.5%	13.8%	-0.8p	2.3p	0.3p
Energy intensity (FY2013=100)	105.2	85.8	84.3	82.4	82.6	80.3	-2.2%	0.2%	-2.8%
Energy-related CO <sub>2</sub> emissions (MtCO <sub>2</sub> )	1,137	1,065	1,029	967	986	995	-6.0%	1.9%	0.9%
Change from FY2013	-8.0%	-13.8%	-16.7%	-21.7%	-20.2%	-19.5%	-5.0p	1.5p	0.7p

Notes: New energy includes solar photovoltaics, wind, biomass, solar heat, and geothermal, etc.

Self-sufficiency rate is based on IEA standard.



## Electricity sales, power generation mix, electricity prices (electric utilities)

**In FY2022, electricity sales will increase for the second year thanks to a rise in industrial sales amid a recovery mainly in the machinery and services industries. Residential sales will drop on a fall in the stay-at-home rate. Non-fossil and coal-fired power generation will continue growing, while gas-fired generation declines substantially.**

In FY2021, electricity sales will increase by 1.3%. Sales to power service users will increase by 3.0% due to production growth in the steel and machinery industries, increased commercial operations and the effects of temperature changes. Meanwhile, those to lighting service users will decrease by 2.2% in line with a drop in the winter stay-at-home rate.

In FY2022, electricity sales will increase by 1.1% from FY2021 and surpass the relatively low level for FY2019 (including an abnormally warm winter) before the COVID-19 crisis. Sales to power service users will rise by 1.9% on a machinery production recovery. Sales to lighting service users will fall by 0.5% due to the easing of restrictions on outing with a lower stay-at-home rate and the diffusion of light-emitting diode bulbs and other energy efficient devices as well as more residential solar PV power generation. On the other hand, more all-electric homes increase the electrification of water heating and cooking equipment to push up sales to lighting service users.

Electricity prices for power and lighting service users in FY2022 will increase for the second straight year combining with continued increases in renewable energy surcharges and higher fossil fuel import prices since the second half of FY2020. The electricity price will rise by 10.4% for power service users and by 6.2% for lighting service users. The price for lighting service users in FY2022 will surpass the record high reached in FY1985 due to consumption tax, and petroleum and coal tax hikes in addition to the absence of renewable energy surcharge reduction.

Nuclear energy's share of total power generation in FY2021 will post a sharp rise of 3.2 percentage points due to one plant's restart and six restarted plants' resuming operation after their long suspension for such reasons as a delay in the completion of counterterrorism facilities in FY2020. The nuclear share in FY2022 will rise by 0.4 points as two more plants are restarted. The share for non-hydro renewables will increase by 1.2 points in FY2021 and by 1.1 points in FY2022 as non-residential solar PV capacity expands. Non-fossil energy sources' share of total power generation in FY2022 will rise for a second straight year to 31.8%. However, the share will still be 6.4 points lower than the 38.2% in FY2010 and must rise further.

Two new coal-fired power plants (Taketoyo Unit 1 and Kobe Unit 3 with total capacity at 2.26 GW) will be operational in late FY2021 and will be followed by three more (Higashi Unit 3, Misumi Unit 2 and Kobe Unit 4 with total capacity of 1.95 GW) in FY2022. Coal's share of total power generation will thus increase by 1.0 point. The share for power plants fired will drop by 0.3 points by fuel oil C and crude oil drop in FY2022. Due to growth in non-fossil and coal-fired power generation, the LNG share will decline by 2.0 points to 32.8% in FY2022. The LNG share will still be 3.5 points higher than 29.3% for FY2010 the year before the Great East Japan Earthquake which affected nuclear power generation and led to a sharp rise in gas-fired power generation.

Table 4 | Electricity sales, power generation mix, electricity prices (electric utilities)

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
Electricity sales (TWh)	(926.6)	852.6	836.1	820.9	831.2	840.3	-1.8%	1.3%	1.1%
Lighting service	304.2	270.3	266.7	278.0	271.9	270.6	4.2%	-2.2%	-0.5%
Power service	(622.4)	582.2	569.4	543.0	559.4	569.7	-4.6%	3.0%	1.9%
Extra-high and High voltage	(576.5)	544.6	533.2	506.6	522.7	532.3	-5.0%	3.2%	1.9%
Low voltage	(45.9)	37.6	36.3	36.3	36.7	37.4	0.2%	1.1%	1.9%
Electricity generated and purchased (TWh)	(1,028)	957.0	932.0	920.3	932.0	941.3	-1.3%	1.3%	1.0%
Hydro	(8.5%)	9.1%	9.3%	9.5%	9.6%	9.4%	0.2p	0.2p	-0.3p
Fossil fuels	(61.7%)	74.6%	73.1%	74.0%	69.4%	68.2%	0.9p	-4.6p	-1.2p
Coal	(25.0%)	28.5%	28.4%	27.8%	27.7%	28.7%	-0.6p	-0.2p	1.0p
LNG	(29.3%)	39.3%	38.1%	38.6%	34.7%	32.7%	0.5p	-3.9p	-2.0p
Oil, etc.	(7.5%)	6.9%	6.6%	7.5%	7.1%	6.8%	0.9p	-0.5p	-0.3p
Nuclear	(28.6%)	6.5%	6.5%	4.0%	7.2%	7.6%	-2.5p	3.2p	0.4p
Renewables (excluding hydro), etc.	(1.1%)	9.8%	11.0%	12.5%	13.7%	14.8%	1.5p	1.2p	1.1p
Electricity prices (JPY/kWh)	(16.7)	21.7	21.6	20.4	22.5	23.9	-5.4%	10.4%	6.2%
Lighting service	21.4	27.2	27.3	26.0	28.3	29.7	-4.9%	8.9%	5.1%
Power service	(14.4)	19.1	18.9	17.5	19.7	21.1	-7.0%	12.3%	7.3%

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 and unit prices (gas utilities)

**City gas sales in FY2022 will rise for the second straight year to the highest level since FY2017 reflecting a recovery in industrial production and commercial operations. However, sales to industrial and commercial users will slip below FY2019 levels, the year before the COVID-19 crisis.**

City gas sales<sup>1</sup> in FY2021 will increase by 3.9% from the previous year due to a rise in those to industrial and commercial users, despite a fall in those to residential users. In FY2022, city gas sales will expand by 2.2% to about 42 billion m<sup>3</sup>, the highest since FY2017 that featured an abnormally cold winter and an abnormally cool summer. However, the rise will reflect a substantial increase in sales to electric utilities, with sales to industrial and commercial users slipping below FY2019 levels.

Of residential sales, those for cooking have continued to structurally decrease due to the spread of induction heating cookers. Those for water and space heating have also structurally declined on the diffusion of more energy efficient water heaters and all-electric homes. In FY2021, residential sales will decline by 1.2% as sales for both cooking and heating decrease due to a fall in the winter stay-at-home rate, despite a colder winter. In FY2022, residential sales will continue to decrease by 0.6% as sales for both cooking and heating will reflect a warmer summer and a drop in the stay-at-home rate through the easing of restrictions on outing.

Industrial sales for manufacturing in FY2021 will increase by 7.6% on a production recovery. In FY2022, they will rise by 3.8% due to a pickup in automobile and heavy electrical machinery production, though falling short of topping the FY2019 level. Sales for electric utilities will remain unchanged in FY2022 as no new power plant using city gas is planned to start operation from FY2021. Overall industrial sales will rise by 6.7% in FY2021 and by 3.0% in FY2022.

Regarding business sales (commercial and other sales) in FY2021, air-conditioning demand decreased in a cooler summer, but water and space heating demand will increase due to a colder winter, despite continued energy efficiency improvement that works to cut gas sales. Commercial sales will increase 3.6% on a recovery in accommodation, food, living-related and personal, and amusement services sectors. The other sales will rise by 0.3% with a rise in those for schools, despite a drop in those for hospitals. In FY2022, air-conditioning demand will increase in a warmer summer, but water-heating demand will fall in the absence of any winter weather change. Commercial sales will increase by 6.3% due mainly to the rise in air-conditioning demand as business operations recover in accommodation, food, living-related and personal, and amusement services sectors. The commercial sales will top 4 billion m<sup>3</sup> for the first time in three years, though slipping below the level for FY2019 that included an abnormally warm winter. The other sales will rise by 0.4% on the normalization of schooling, despite the spread of remote medical care and online classes.

City gas prices will rise for the second straight year due to LNG price hikes from the second half of FY2020, posting a 15.1% increase in FY2021 and a further 10.5% in FY2022. Prices for all sectors will hit highest levels since the liberalization of gas retail sales in FY2017.

<sup>1</sup> Sales by gas utilities excluding former community gas utilities

Table 5| City gas sales and prices (gas utilities)

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
City gas sales (Billion m <sup>3</sup> )	39.28	41.58	40.42	39.51	41.06	41.96	-2.3%	3.9%	2.2%
Residential	9.79	9.24	9.38	10.02	9.90	9.84	6.8%	-1.2%	-0.6%
Commercial	4.75	4.26	4.16	3.65	3.78	4.02	-12.2%	3.6%	6.3%
Industrial	21.61	25.03	23.83	22.76	24.28	25.00	-4.5%	6.7%	3.0%
Manufacturing	(20.28)	20.51	19.68	17.43	18.75	19.47	-11.5%	7.6%	3.8%
Electric utilities	(1.34)	4.52	4.15	5.33	5.53	5.53	28.4%	3.8%	0.0%
Others	3.13	3.05	3.05	3.08	3.09	3.11	1.1%	0.3%	0.4%
City gas prices(JPY/m <sup>2</sup> )	83.79	87.62	88.64	80.10	92.22	101.9	-9.6%	15.1%	10.5%
Residential	160.1	165.3	165.7	153.9	169.2	180.1	-7.1%	9.9%	6.5%
Commercial	81.95	87.84	88.84	79.76	91.86	102.4	-10.2%	15.2%	11.4%
Industrial	50.67	58.52	59.08	48.70	61.52	71.56	-17.6%	26.3%	16.3%
Others	76.67	90.68	82.50	72.60	87.51	97.59	-12.0%	20.5%	11.5%

## Fuel oil/LPG sales and crude oil throughput

**Despite an increase in fuel oil sales for transportation, fuel oil sales in FY2022 will decrease due to an even larger ethylene production cut. As transportation fuel exports increase, crude oil throughput will exceed fuel oil sales for the first time in three years.**

Fuel oil sales in FY2021 will increase by 2.0% from the previous year, centering on those for transportation. Despite a rise in sales for transportation fuels, fuel oil sales in FY2022 will decrease by 0.7%, due to less ethylene production. Fuel oil sales for industrial use will decline despite industrial production growth as crude oil price hikes encourage fuel switching and energy conservation.

Gasoline sales in FY2021 will rise by 1.2% due to a substantial recovery in the use of passenger car. While transportation volume continues to expand substantially in FY2022, gasoline sales growth will be limited to 0.3% because of improvements in fuel efficiency and an increase in hybrid vehicles. Gasoline sales dropped 6.6% since FY2019 and continue a long-term downtrend.

Naphtha sales in FY2021 will increase by 2.1% due to less frequent regular maintenance of ethylene plants. In FY2022, they will decrease by 4.9%, slipping below 40 million kl for the first time since FY1993. The drop reflects more anticipated frequent maintenance at ethylene plants.

Jet fuel sales will increase by as much as 38.0% in FY2021 and by 30.1% in FY2022 as air passenger traffic continues its recovery.

Despite a colder winter, kerosene sales in FY2021 will decrease by 2.0% due to a fall in the stay-at-home rate. In FY2022, they will drop by another 1.5% due to fuel switching, although space heating demand will level off.

Diesel oil sales in FY2021 will increase by 3.3% from the previous year despite fuel efficiency improvements as passenger and cargo transportation demand recovers along with industrial production and construction. In FY2022, diesel oil sales will rise by 1.7% on a continued recovery in transportation demand.

Heavy fuel oil A sales in FY2021 will drop by 0.8%. The increase in sales for space and water heating was outweighed by the drop in sales resulting from the crude oil price hikes that encouraged energy conservation and fuel switching, mainly in non-manufacturing industries. In FY2022, they will decline 2.6% due to a fall in water heating demand, energy conservation and fuel switching, slipping below 10 million kl for the first time in 53 years.

Heavy fuel oil B/C sales for industrial use will increase by 7.2% in FY2021 on a production recovery, despite fuel switching and energy conservation. In FY2022, they will decrease by 4.1% as fuel switching and energy conservation outpaces industrial production growth. Those for power generation will decline as oil-fired power plants' capacity factor declines, with gas-fired power generation with lower fuel costs being used to cope with peak winter electricity demand. Overall heavy fuel oil B/C sales will drop by 2.1% in FY2021 and by 6.3% in FY2022.

In FY2021, LPG sales will increase by 4.4%. While those for the residential sector decline on a fall in the stay-at-home rate, business recovery for food service providers, industrial production growth and commercial passenger traffic expansion will work to push up LPG sales. In FY2022, LPG sales will rise by 1.8% on a recovery in food service operations, industrial production and passenger traffic, although ethylene plant operations will decline.

Crude oil throughput in FY2021 will post a 4.2% increase, faster than the fuel oil sales growth, as transportation fuel exports expand. In FY2022, crude oil throughput will score a substantial increase of 6.5% despite a fuel oil sales drop, as fuel exports continue to rise. In the year, crude oil throughput will surpass fuel oil sales volume for the first time in three years.

Table 6 | Fuel oil/LPG sales and crude oil throughput

	Historical				Projection		Year-over-year		
	FY2010	FY2018	FY2019	FY2020	FY2021	FY2022	FY2020	FY2021	FY2022
Fuel oil sales (GL)	196.0	167.7	161.6	151.5	154.5	153.4	-6.2%	2.0%	-0.7%
Gasoline	58.2	50.6	49.1	45.2	45.8	45.9	-7.9%	1.2%	0.3%
Naphtha	46.7	43.9	42.5	40.3	41.2	39.2	-5.2%	2.1%	-4.9%
Jet fuel	5.2	5.0	5.2	2.7	3.8	4.9	-46.9%	38.0%	30.1%
Kerosene	20.3	14.5	13.6	14.5	14.2	14.0	6.4%	-2.0%	-1.5%
Diesel oil	32.9	33.8	33.7	31.9	32.9	33.5	-5.3%	3.3%	1.7%
Heavy fuel oil A	15.4	11.1	10.2	10.2	10.1	9.9	0.7%	-0.8%	-2.6%
Heavy fuel oils B and C	17.3	8.8	7.4	6.7	6.5	6.1	-9.8%	-2.1%	-6.3%
For electric utilities	7.7	4.0	2.6	2.8	2.3	2.1	4.1%	-15.2%	-10.2%
For other users	9.7	4.9	4.7	3.9	4.2	4.0	-17.5%	7.2%	-4.1%
LPG sales (Mt)	16.5	14.2	14.1	12.9	13.5	13.8	-8.4%	4.4%	1.8%
Crude oil throughput (GL)	208.9	176.7	174.0	139.3	145.1	154.6	-19.9%	4.2%	6.5%

## Renewable power generation (FIT power source)

### Installed renewable power generation capacity will expand to 95 GW

Renewable power generation capacity approved under the FIT scheme reached 105 GW in March 2017. As approval for some capacity before installation was canceled, however, the capacity subject to existing approval fell to 86.4 GW in March 2018. As 5 GW for solar PV and 7 GW for wind were added later, increasing the capacity to 98.9 GW (including 75.7 GW for solar PV, 13.4 GW for wind and 8.1 GW for biomass). The capacity is as approved by the end of June 2021.

If all the approved capacity of 98.9 GW, including already operational and transferred facilities<sup>2</sup>, is operational, the cumulative burden on consumers will reach an estimated JPY73 trillion<sup>3</sup>. The estimated burden amounts to an electricity rate hike of JPY2,900/MWh, or 12% for residential users and 18% for industrial users.

Installed renewable power generation capacity (including capacity for which the FIT scheme has expired) will reach 95 GW at the end of FY2022. Non-residential solar PV capacity will expand to only to 57.8 GW by the end of FY2022, because 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. Wind power generation capacity will rise to 6.5 GW as the establishment of deadlines

for launching operation or cancelling approval for non-operational approved capacity increases pressure on planned approved capacity to become operational. Renewable power generation in FY2022 will total 183.0 TWh (including 87.4 TWh for solar PV, 40.9 TWh for small and medium-sized hydroelectric plants, 38.2 TWh for biomass and 12.8 TWh for wind), accounting for 17.8% of Japan's total power generation. If generation at large-sized hydroelectric plants is included, renewable power generation will command 22.4% of the total.

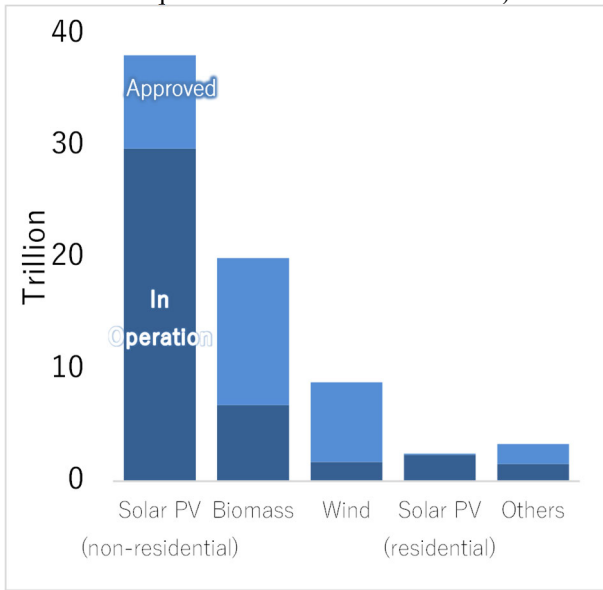
The sixth Strategic Energy Plan has set renewable energy's target share of the power generation mix at 36-38% for 2030. To achieve the target, Japan will be required to enhance all possible relevant policies. It is imperative to ensure harmony between power generation facilities and the environment and form agreements with residents near planned sites for such facilities. In FY2022, the feed-in premium (FIP) will be introduced to integrate large-scale solar PV and wind power generation capacity into the electricity market. It will be important to develop renewable energy into a major stable power source while securing renewable power generation's environmental harmony and market competitiveness.

<sup>2</sup> Transferred facilities are those that were installed before the introduction of the FIT scheme and later subjected to the scheme.

<sup>3</sup> The remaining FIT periods for transferred facilities are

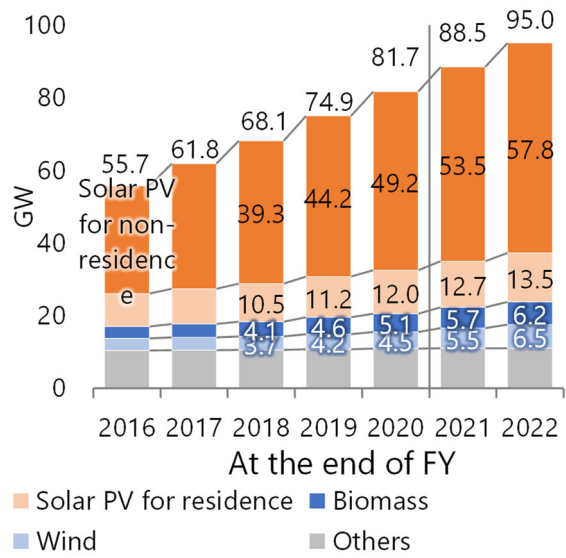
taken into consideration. The avoidable cost has been estimated by the IEEJ, based on various documents. The capacity factor is assumed at 24.8% for wind, 13.7% for solar PV, 70% for geothermal energy, 45% for hydro and 70% for biomass.

Figure 1 | Cumulative burden of FIT scheme over purchasing period (for capacity approved or in operation at the end of June 2021)



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

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



Note: Including capacity subjected to FIT contract expiration.

## Topic [1] Impacts on the economy and the energy situation of a decline in production of automobiles

**If automobile production fails to rebound, the failure would spill over to other industries, exerting downside pressure on energy sales and supply.**

While production in a wide range of industries has recovered from the COVID-19 disaster, automobile production falls have slowed down the economy since August 2021.

Automobile production in Japan had picked up on robust demand since hitting bottom in the April-June quarter of 2020. Since August 2021, however, global semiconductor shortages combined with a stagnation in parts procurement from Southeast Asia under the COVID-19 spread, forced automakers to adjust production and shut down plants. Due to the production constraints, Japan's new automobile sales (including mini-vehicles) in October posted a 31% year-on-year fall to the lowest level for the month since 1968 when the statistics started.

Each automaker has been trying to increase production from the second half of FY2021. In the Reference Scenario, automobile production is assumed to rise back to 96.7 million units in FY2022, with parts supply and employment being secured. However, the semiconductor supply is not sufficiently stable to secure an automobile production recovery, indicating downside risks for future automobile production. Some plants that had planned to start full-blown production in December 2021 were in fact shut down. Even into FY2022, automakers could have difficulties in securing employment for production recovery. If some plants manage to increase their parts procurement to expand production, other plants may have difficulties in increasing production.

**If automobile production fails to recover in FY2022, GDP would be pushed down by 0.3%, with the unemployment rate rising.**

Between August and October 2021, automobile production in Japan was about 710,000 units less than planned<sup>4</sup>. If the production decline fails to be covered in FY2022, automobile production in the year will decrease by 7.3% from the Reference Scenario level.

Production changes in the automobile industry (as a final assembly sector) exert impacts on a wide range of other industries. Given the automobile industry's high value added, industrial production will decrease by 2.6% from the Reference Scenario level. The impact on the steel industry will be great, leading to a 2.4% drop in crude steel production. As impacts on services industries are limited, the GDP fall through the automobile production recovery failure will be limited to 0.3%, smaller than the 2.6% fall in industrial production. If non-regular employees in industries are

adjusted to the automobile production drop in each industry, about 18,000 jobs will be lost to push the unemployment rate up by 0.03 percentage points. Attention should be paid to such impact on employment.

**Large impacts on industrial materials industries may lead to a 0.7% fall in Japan's primary energy supply**

Such industrial production drop will affect energy demand. Among energy sales, city gas sales account for a large share of industrial users, city gas sales will suffer the largest drop of 0.8%. Electricity sales will drop by 0.5% with declines of industrial electricity sales. Fuel oil sales will decline by 0.4%, centering on fuel oil C and naphtha consumed in manufacturing.

As manufacturing industries account for a large share of Japan's primary energy supply, the decline in primary energy supply will exceed the GDP drop to 0.7%. Given that the automobile industry features lower energy intensity than other manufacturing industries, however, the primary energy supply fall will be lower than the industrial production drop. Natural gas supply will decrease by 1.1% through the city gas and electricity demand drop. Coal supply will drop by 1.0% through the crude steel production decline. The oil supply fall will be limited to 0.5% as oil for transportation accounts for a dominant share of oil supply. As non-fossil electricity sources remain unaffected, the CO<sub>2</sub> emission drop through the automobile production decrease will slightly exceed the primary energy supply fall of 0.9%.

Table 2 | Impacts of automobile production decrease [FY2022]

	Reference	Decreased production of automobiles	Changes from Reference	
Economy	Real GDP (JPY2015 trillion)	558.2	556.5	-0.3%
	Industrial production (CY2015=100)	102.1	99.4	-2.6%
	Crude steel production (Mt)	96.8	94.5	-2.4%
	Automobile production (million)	9.67	8.96	-7.3%
	Unemployment rate(%)	2.58	2.60	[+0.03p]
Energy	Primary energy supply (Mtoe)	429.4	426.5	-0.7%
	Oil (GL)	175.1	174.3	-0.5%
	Natural gas (Mt of LNG equiv.)	72.2	71.4	-1.1%
	Coal (Mt)	189.7	187.8	-1.0%
	Electricity sales (TWh)	840.3	836.0	-0.5%
Environment	City gas sales (Billion m <sup>3</sup> )	41.96	41.64	-0.8%
	Fuel oil sales (GL)	153.4	152.7	-0.4%
	Energy-related CO <sub>2</sub> emissions (Mt)	913	905	-0.9%

<sup>4</sup> (Nomura Research Institute, "Spreading automobile production cuts: Cuts totalling 710,000 units estimated to amount to JPY1.44 trillion in economic loss")



## Topic [2] Impacts of temperature changes on household energy spending

Household energy spending will increase for two consecutive years, potentially reaching the record high posted in FY2013 depending on changes in temperature. Support for energy efficiency improvement is required for low-income households.

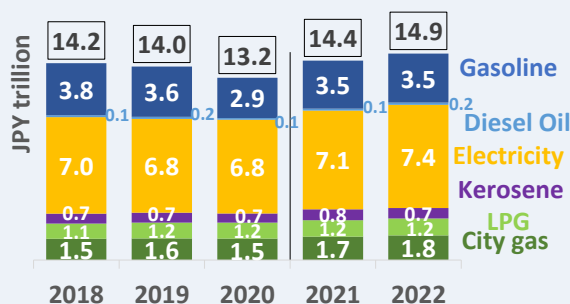
### Increasing household energy spending

Household energy consumption volume in Japan in the 2010s, though fluctuating depending on temperature changes, continued a downtrend. The energy intensity reduction factors include energy and fuel efficiency improvements, and the spread of an energy saving mind-set outdied energy consumption boosting factors such as increases in the number of households and private vehicle transportation volume. In FY2020, household energy consumption volume declined, despite the rise in the stay-at-home rate. Restrictions on outings under the COVID-19 pandemic increased telework and decreased private vehicle mobility. FY2020 also featured sharp energy price falls that made household energy spending in the year sink to JPY13.2 trillion<sup>5</sup>, the lowest in four years.

In the first half of FY2021, from April 2021, gasoline prices rose substantially year on year on crude oil price hikes. Due to lower air conditioning demand in a cooler summer, however, year-on-year household energy spending growth was limited to 1.6%. In the second half until March 2022, household energy spending will post a substantial year-on-year rise of 17.7% due to a colder winter and sharp increases in all energy prices, despite a fall in the stay-at-home rate that followed the lifting of the state of emergency. In FY2021, household energy spending will increase by 9.4% from the previous year to JPY14.4 trillion, the highest in seven years.

In FY2022, household energy consumption volume will decrease for the second straight year due to a decline in the stay-at-home rate and progress in energy saving, while gasoline consumption will increase on a rise in outings. Energy price hikes in FY2022, however, will for the second straight year push up household energy spending by 3.6%.

Figure 3 | Household energy spending



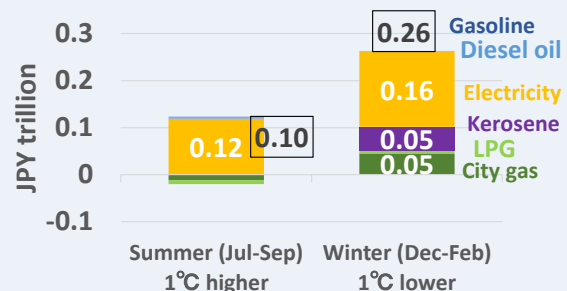
<sup>5</sup> Excluding community gas and heat supply

### Depending on changes in temperature, spending may reach the record high posted in FY2013

Household energy consumption is susceptible to air temperature changes over the short term, particularly regarding air conditioning and water heating demand. In the Reference Scenario, temperatures are assumed to be normal in FY2022. This means a hotter summer than in the previous year and no change in winter temperatures. However, temperatures are highly uncertain. Here, we assess the change in energy consumption of an average temperature increase of 1°C in the summer (July-September) and of a decrease of 1°C in the winter (December-February).

If the average temperature in the summer rises by 1°C from the Reference Scenario, water heating demand will decline in line with a water temperature increase, leading to a fall in city gas and liquefied petroleum gas consumption. However, air conditioning demand will increase to boost electricity consumption, resulting in an increase of JPY100 billion or 0.7% in household energy spending from the Reference Scenario. If the average temperature in the winter falls by 1°C from the Reference Scenario, space heating demand along with water heating demand will increase. As a result, electricity, city gas and kerosene consumption will expand, leading to a household energy spending increase of JPY260 billion or 1.8%. If the average temperature is 1°C higher in summer and 1°C lower in winter than the normal level in FY2022, household energy spending will be equivalent to the record high of JPY15.3 trillion posted in FY2013. That year featured the highest ever fossil fuel import prices as well as a severe summer heat and winter cold waves.

Figure 1 | Household energy spending changes caused by changes in temperature relative to the Reference Scenario



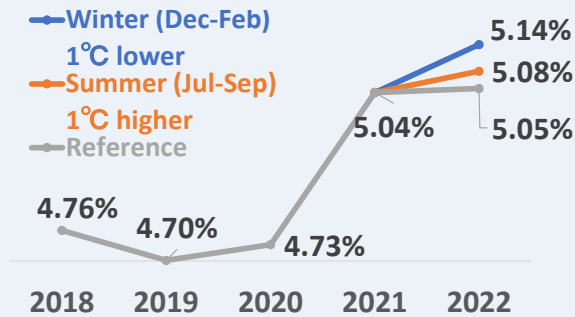
In the Reference Scenario, the energy Engel's coefficient<sup>6</sup>, which indicates an effective household energy cost burden, will rise substantially in FY2021

<sup>6</sup> Energy spending/household final consumption expenditure



but will limit growth to 0.01 points due to greater spending on cars and other durable goods and on food, tourism and amusement services. However, the coefficient will rise by 0.03 points through a 1°C rise in the summer average temperature and by 0.09 points through a 1°C fall in the winter average temperature. Depending on summer and winter temperature changes, energy spending's share of household final consumption expenditure will thus increase.

Figure 5 | Energy Engel's coefficient changes through temperature changes



### Energy and environment policies should be integrated with redistribution policy

Energy, mainly for air conditioning and water heating, is essential for our daily life. Income-based spending disparities for energy are far smaller than for other goods. Given that high-income households account for a larger share of residential solar photovoltaics capacity, low-income households feature a higher ratio of energy purchases to energy consumption than high-income households. Furthermore, high-income households have accumulated excessive savings under the COVID-19 crisis and may not have to reduce spending on non-energy goods and services even in the face of an increase in energy spending. This means that low-income households or families receiving less income under the COVID-19 crisis are hit harder by an energy spending increase. Support is required for these households to increase energy efficiency in order to reduce ordinary energy spending and additional energy costs for severe heat and cold waves. Such support includes subsidies for purchases of energy efficient housing, for housing reform to increase energy efficiency, for improving water heating and air conditioning efficiency and for introducing residential solar PV systems to cut electricity purchases. Energy and environment policies should thus be integrated with redistribution policy.

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

### Nuclear contributing to achieving to 3Es

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

In the Reference Scenario, two nuclear power plants will be restarted by the end of FY2022 in addition to the 10 plants that have already been restarted, with the shutdown of one of the restarted plants being prolonged due to delays in the completion of its counterterrorism facilities. Two other plants that have been approved by the regulatory authority as well as the relevant local governments for restarting will remain unable to begin operation within FY2022 due

to delays in the completion of their counterterrorism facilities. We assume in the High Case that three plants will go into operation with their counterterrorism facilities completed within FY2022. The Low Case assumes that the two plants planned to restart in FY2022 in the Reference Scenario will fail to restart within the year. And lastly, the Highest Case refers to the Long-term Energy Supply and Demand Outlook set by the Ministry of Economy, Trade and Industry and assumes all 27 plants so far subjected to examinations for conformity to new regulatory standards will operate at the capacity factor of 80%<sup>7</sup>.

Table 8 | Impacts of changes in nuclear power generation [FY2022]

		Low Case	Reference Scenario	High Case	Highest Case	Changes from Reference		
						Low	High	Highest
Nuclear assumptions	Restarted nuclear reactors	10	12	14	27	-2	+2	+15
	Power generation (TWh)	64.5	71.8	90.1	193.4	-7.3	+18.2	+121.5
	Share in generation and purchases	6.5%	7.2%	9.0%	19.4%	-0.7p	+1.8p	+12p
Economy	Electricity unit cost <sup>1</sup> (JPY/kWh)	9.40	9.34	9.21	8.44	+0.06	-0.14	-0.90
	Fuel cost	5.75	5.69	5.55	4.79	+0.06	-0.14	-0.90
	FIT purchasing cost	3.65	3.65	3.65	3.65	-	-	-
	Total fossil fuel imports (JPY trillion)	18.56	18.49	18.33	17.38	+0.07	-0.17	-1.12
	Oil	10.00	9.99	9.97	9.90	+0.01	-0.02	-0.09
	LNG	5.00	4.94	4.79	3.91	+0.06	-0.15	-1.03
	Trade balances (JPY trillion)	1.31	1.36	1.50	2.27	-0.06	+0.14	+0.91
Real GDP (JPY2011 trillion)	558.18	558.24	558.39	559.27	-0.06	+0.15	+1.03	
Energy and environment	Primary energy supply							
	Oil (GL)	175.2	175.1	174.7	173.3	+0.2	-0.4	-1.8
	Natural gas (Mt of LNG eq.)	73.0	72.2	70.1	57.5	+0.9	-2.1	-14.7
	Self-sufficiency rate	13.3%	13.8%	15.0%	21.4%	-0.5p	+1.2p	+7.6p
	Energy-related CO <sub>2</sub> (Mt)	997	995	988	949	+3	-7	-46
Changes from FY2013	-19.3%	-19.5%	-20.0%	-23.2%	+0.2p	-0.6p	-3.7p	

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

Regarding economic efficiency, fossil fuel imports in the High Case will be reduced by JPY170 billion from the Reference Scenario and those in the Highest Case by JPY1,120 billion. If crude oil and LNG prices increase from the assumed levels, due to changes in the international situation, the import fall resulting from fossil fuel-fired power generation cuts would be greater. Disposable income will increase through the fall in payments for fossil fuel imports, leading real GDP to rise by JPY150 billion in the High Case and by JPY1,030 billion in the Highest Case.

The unit cost of power generation will decrease by JPY0.14/kWh in the High Case and by JPY0.90/kWh in the Highest Case.

Given the growing geopolitical risks in the Middle East, energy security is now attracting interests. Japan's energy self-sufficiency rate as a representative energy security indicator will improve by 1.2 percentage points in the High Case and by 7.6 points in the Highest Case.

CO<sub>2</sub> emissions as an environment indicator will decline by 7 Mt in the High Case and by 46 Mt in the Highest

<sup>7</sup> Japan's target power generation mix for FY2030 includes nuclear energy's share at 20-22%, which is here assumed to be achieved in line with energy efficiency improvements and

an electricity demand fall.

Case. From FY2013 as the base year for Japan's CO<sub>2</sub> emission reduction target under the Paris Agreement, emissions will decrease by 20.0% in the High Case and by 23.2% in the Highest Case<sup>8</sup>.

Given that deadlines for completing counterterrorism facilities will expire for an increasing number of nuclear power plants after FY2022, 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.

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<sup>8</sup> The Japanese target calls for cutting GHG emissions in FY2030 by 46% from FY2013 and energy-related CO<sub>2</sub> emissions by 45%. Nuclear power generation, energy efficiency improvement, renewable energy expansion and

other measures are assumed to contribute to achieving the target.

## Topic [4] Impacts of changes in oil prices on Japan's economy and on the energy situation

**The Japanese economy's uncertainties will increase due to changes in crude oil prices. Japan should prepare for risks.**

If Japan's average crude oil import price increases or decreases by \$10/bbl from the Reference Scenario, due to changes in the global oil supply-demand balance, GDP and production will decline or rise. Such price changes will exert the greatest impact on fuel oil sales.

The reduction of renewable energy costs, the facilitation of nuclear power plant restarts and other measures to prepare for such risks are important for Japan.

Table 9 | Impacts of a \$10/bbl<sup>9</sup> crude oil price increase

		Historical	Reference scenario		Higher Oil Price Case			
					Changes from Reference			
			FY2020	FY2021	FY2022	FY2021	FY2022	FY2021
Prices	Crude oil, import, CIF (\$/bbl)	43	71	68	73	78	3.5%	14.8%
	LNG, import, CIF (\$/MBtu)	7.5	11.1	11.9	11.1	12.9	0.0%	8.7%
Economy	Real GDP (JPY2015 trillion)	525.7	540.4	558.2	540.3	557.7	0.0%	-0.1%
	Industrial production (CY2015=100)	90.4	96.7	102.1	96.7	102.0	0.0%	-0.1%
	Domestic corporate goods price index (2015=100)	100.2	106.3	107.3	106.4	108.1	0.1%	0.7%
	Consumer price index (2020=100)	99.9	99.8	100.6	99.8	100.8	0.0%	0.2%
	Balance of trade (JPY trillion)	1.3	0.3	1.4	0.0	0.1	-(0.3)	-(1.2)
	Fossil fuels(JPY trillion)	10.6	18.2	18.5	18.5	20.4	(0.4)	(1.9)
Energy	Primary energy supply (Mtoe) <sup>1</sup>	414.9	427.6	429.4	427.5	428.7	0.0%	-0.2%
	Electricity sales (TWh)	820.9	831.2	840.3	831.2	839.3	0.0%	-0.1%
	City gas sales <sup>3</sup> (Billion m <sup>3</sup> )	39.51	41.06	41.96	41.06	41.93	0.0%	-0.1%
	Fuel oil sales (GL)	151.5	154.5	153.4	154.4	152.9	-0.1%	-0.3%

<sup>9</sup> For details about a \$10/bbl increase and a \$10/bbl decrease from the Reference Scenario, see IEEJ Ichihara "Outlook for International Oil Market in 2022."

Table 10 | Impacts of a \$10/bbl crude oil price decrease

		Historical	Reference scenario			Lower Oil Price Case		Changes from Reference
			FY2020	FY2021	FY2022	FY2021	FY2022	
		Prices						
	Crude oil, import, CIF (\$/bbl)	43	71	68	68	58	-3.5%	-14.8%
	LNG, import, CIF (\$/MBtu)	7.5	11.1	11.9	11.1	10.8	0.0%	-8.7%
Economy								
	Real GDP (JPY2015 trillion)	525.7	540.4	558.2	540.4	558.8	0.0%	0.1%
	Industrial production (CY2015=100)	90.4	96.7	102.1	96.7	102.2	0.0%	0.1%
	Domestic corporate goods price index (2015=100)	100.2	106.3	107.3	106.2	106.5	-0.1%	-0.8%
	Consumer price index (2020=100)	99.9	99.8	100.6	99.7	100.4	0.0%	-0.2%
	Balance of trade (JPY trillion)	1.3	0.3	1.4	0.6	2.6	(0.3)	(1.2)
	Fossil fuels (JPY trillion)	10.6	18.2	18.5	17.8	16.6	-(0.4)	-(1.9)
Energy								
	Primary energy supply (Mtoe) <sup>1</sup>	414.9	427.6	429.4	427.7	430.2	0.0%	0.2%
	Electricity sales (TWh)	820.9	831.2	840.3	831.2	841.3	0.0%	0.1%
	City gas sales <sup>3</sup> (Billion m <sup>3</sup> )	39.51	41.06	41.96	41.06	42.00	0.0%	0.1%
	Fuel oil sales (GL)	151.5	154.5	153.4	154.7	154.0	0.1%	0.4%

Notes:

1. Mtoe = 1013 kcal

2. 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

3. Conversion factor: 1 m<sup>3</sup> = 10,000 kcal

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