

Economic and Energy Outlook of Japan through FY2017

Appropriate domestic energy policy measures are required to pursue diversification of energy

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Highlights

Macro economy | Japanese economy grows slowly, and manufacturing sector will recover

The Japanese economy will continue to grow in FY2017 at about 1% for the third consecutive year. This is because private consumption will remain strong, and production of the manufacturing sector will recover as exports and private investments expand.

Energy supply and demand | Energy consumption continues to decrease but at a slower pace; fossil fuels dependency will be lower than 90% for the first time in six years

Total primary energy supply in FY2017 will decrease for the fourth consecutive year due to the advancement of energy conservation despite a slow recovery of production of the manufacturing sector. Energy intensity (a measure of energy per unit of GDP) will improve by 1.3% from the previous year. Moreover, fossil fuel consumption and energy-related CO₂ emissions will be substantially reduced to levels below those observed before the Great East Japan Earthquake due to the restart of nuclear power plants and increase in renewable energy.

Energy sales | City gas and electricity will grow for the second consecutive year but fuel oil declines

In FY2017, for the first time since the Great Earthquake, electricity sales by utilities will increase by 0.5% for a second consecutive year. This is because of production recovery and demand increase from industry and commercial sectors. City gas sales in FY2017 will increase by 1.4% and reach the highest-level for a second consecutive year due to better economic conditions, including development efforts to increase demand in the industry sector. Overall sales of fuel oil in FY2017 will decrease for the fifth consecutive year; the decrease in FY2017 will be 2.4%. This is because sales for Type C fuel oil for power generation will decrease as more of nuclear power plants restart and because of an anticipated decrease in kerosene sales.

Nuclear power generation | Five plants restart but judicial ruling stops two plants; three plants are approved to operate for more than 40 years

No. 3 reactor at the Ikata Power Station was reactivated in August 2016. It was the fifth plant to restart under Japan's new safety regulations. However, two plants at the Takahama Power Station are still suspended from operations due to an injunction issued by a district court. In November 2016, No. 3 reactor at the Mihama Power Station was approved for a life extension to 60 years but

its actual restart will be after 2020, when its construction will be completed. It was the third plant to receive an extension of its operation period.

Relative to the case where 18 plants will be in operations, the case which assumes a total of seven nuclear power plants will have restarted by the end of FY2017, total spending on fossil fuel imports will increase by JPY500 billion, and the electricity cost* per MWh will rise by JPY400/MWh. In that case, the energy-related CO₂ emissions will increase by 28 Mt-CO₂ (2.5%), the self-sufficiency rate will be lowered by 2.6% point, and GDP will decrease by JPY400 billion (0.1%). These outcomes show that nuclear power generation plays an important role in the achievement of the 3Es in Japan.

* Electricity cost = Fuel cost + FIT purchasing cost + Grid stabilisation cost.

Actual electricity price includes capital and labour costs, etc. (METI "Long-term Energy Supply & Demand Outlook")

Renewable power generation | Decrease of spending on imports by JPY9 trillion for 20 years vs. increase of electricity cost by JPY38 trillion

In the case, 81 GW of approved renewables (solar PVs for non-households, onshore wind, and woody biomass under Feed-in Tariff [FIT] system) substitute LNG-fired power generation, the energy-related CO₂ emissions decrease by 800 Mt. LNG imports decrease by 294 Mt, and spending on LNG imports decreases JPY16 trillion. However, net decrease effect on spending on import is JPY9 trillion since spending on imports of panels for solar PVs and fuel of biomass is JPY7 trillion.

Electricity cost increases JPY38 trillion relative to LNG-fired power generation for the same condition as above. Progress of renewable energy is required with considering burden capacity (i.e. capacity for cost) and industry competitiveness.

Coal-fired power generation | Decrease of electricity cost by JPY630 billion/year and increase of the energy-related CO₂ emissions by 54 Mt/year by operation of total 23 GW of planned coal-fired power plants

As of December 2016, 48 units totalling 23 GW of coal-fired power plants are planned for construction. Assuming all of them reach operation, the share of coal-fired power increases to 48% from 31% of Japan's power generation. Consequently, electricity cost decreases by JPY630 billion (10%) while the net energy-related CO₂ emissions will increase by 54 Mt. The capacity factor of LNG-fired power plants would decrease to 30% from 49% due to substitution to coal. Evaluation and consideration under comprehensive judgement are important.

Executive summary of outlook through FY2017 [Reference Scenario]

Macro economy

The Japanese economy will grow in FY2016 at 1.2% due to strong fixed capital formation and steady private consumption. For FY2017, private consumption will remain strong with good labour and income situation; demand related to Tokyo Olympics will appear, and goods exports will increase. GDP grows by 1.0% for the period due to increase of import with strong domestic demand.

Production activity

The production activity will tend toward recovery in FY2016, despite some slow down factors, such as Kumamoto Earthquake in the first half of FY2016. Production will improve in FY2017, due to an increase of

exports of heavy electrical machinery for Asia and progress on replacement of high value-added consumer electronics. Increase of private investments will also be a rising factor for GDP.

Energy supply and demand

Under moderate economic expansion and continued energy conservation, the decline of total primary energy supply in FY2016 is moderate because of the increase in cooling and heating demand relative to the previous year's cooler summer and warmer winter. For FY2017, the energy supply will slightly decrease for the fourth consecutive year because production and economic activities will recover, but temperature factors will make the demand decrease. The shift from oil and natural gas to nuclear and renewable energy will progress.

In FY2016, industry sector's final consumption is almost same as the previous year because production activities recovered even though continuous advancement of energy conservation progresses. The transport sector consumes less due to an increased share of fuel-efficient cars while consumption increases in the buildings sector due to temperature effect. For FY2017, the industry sector will increase for the first time in four years through further recovery of production activities while the consumption of the buildings sector will decrease to the level in FY2015 due to progress of energy conservation; the transport sector will also consume less.

Energy sales

In FY2016, electricity sales by utilities increase since those to lighting and power services increase because of a rebound from the previous year's cooler summer and warmer winter. For FY2017, sales for high and extra high voltage power services will grow reflecting moderate production recovery and total sales will increase for the second consecutive year. This will be the first time since the Great East Japan Earthquake.

City gas sales in FY2016 reach an all-time high due to demand development efforts and the rebound from the previous year's cooler summer and warmer winter. In FY2017, the overall sales will mark the highest-level for a second consecutive year because sales to industry will increase for the eighth consecutive year, reflecting the recovery of production activities and demand development efforts.

Total fuel oil sales show an overall decrease in FY2016, primarily in response to a decline in naphtha sales related to a decrease in ethylene production. In FY2017, overall sales of fuel oil will decrease for the fifth consecutive year. It is because sales for Type C fuel oil for power generation will substantially decrease, as more nuclear power plants restart, and because of the decrease in Type A and B/C fuel oils and kerosene sales for fuel switching to electricity or city gas.

Renewable power generation

The pace of expansion for renewable power generating capacity of the last few years, supported by a generous Feed-in Tariff (FIT) system, is slowly subsiding due to reduced tariff for solar PVs and the cancellation of approvals for contracts/permits of some facilities, which have not started operation. Despite such situation, the operating capacity of renewable power generation (excluding large-scale hydro) will reach 65.5 GW by the end of FY2017.

Coincidentally, the unavoidable burden expands also. The cumulative cost burden for 20 years could be JPY57 trillion if all of the approved 88.2 GW (of which 80.3 GW is solar PVs) by the end of August 2016 become operational. This is equivalent to an increase of JPY3,300/MWh above the rates in place just before FIT started – an increase of 14% for households and 20% for industrial consumers.

CO₂ emissions

Energy-related CO₂ emissions reached a historical high of 1,235 Mt-CO₂ in FY2013 but will decrease for the fourth consecutive year through FY2017. The energy conservation and the restart of nuclear power plants combined with the increase in renewable energy will considerably diminish oil and natural gas consumption, lowering the emission to 1,105 Mt-CO₂ in FY2017. The GOJ set its international target (Nationally Determined Contributions) for GHG emissions reduction at 26% (25% for energy-related CO₂) from FY2013 by FY2030. CO₂ emissions in FY2017 will be 10.5% less than in FY2013, a step closer to achieve the target.

Table 1 | Summary of Reference Scenario

	Historical				Projections		Year-to-year changes		
	FY2010	FY2013	FY2014	FY2015	FY2016	FY2017	FY2015	FY2016	FY2017
Energy									
Primary energy supply (Mtoe) ¹	513.3	493.2	477.5	470.3	469.5	468.0	-1.5%	-0.2%	-0.3%
Oil ² (GL)	232.3	234.5	217.1	211.4	208.4	201.9	-2.6%	-1.4%	-3.1%
Natural gas ² (Mt of LNG equiv.)	73.6	91.1	91.5	87.0	84.8	79.0	-4.9%	-2.6%	-6.8%
LNG imports (Mt)	70.6	87.7	89.1	83.6	81.6	77.3	-6.2%	-2.3%	-5.3%
Coal ² (Mt)	184.7	194.6	190.0	190.1	190.5	190.9	0.1%	0.2%	0.2%
Nuclear (TWh)	288.2	9.3	0.0	9.4	17.2	62.9	..	82.2%	266%
Hydro (TWh)	44.0	40.0	44.3	46.7	47.3	47.3	5.3%	1.2%	0.1%
Renewables excl. large hydro (TWh)	63.9	67.9	76.0	87.6	99.7	111.9	15.2%	13.8%	12.3%
Final energy consumption (Mtoe)	340.4	327.7	319.2	315.7	315.5	313.7	-1.1%	-0.1%	-0.6%
Industry ³	159.1	156.9	153.7	152.3	152.2	152.6	-0.9%	0.0%	0.3%
Buildings	98.7	91.5	88.5	86.3	87.1	86.4	-2.4%	0.9%	-0.8%
Transport	82.7	79.3	77.0	77.1	76.1	74.6	0.1%	-1.2%	-2.0%
Petroleum products	176.2	164.3	158.4	158.5	156.8	153.9	0.0%	-1.1%	-1.9%
Natural gas and city gas	34.4	34.5	34.3	33.8	34.5	35.0	-1.3%	2.1%	1.4%
Coal and coal products	36.7	36.4	36.0	34.0	34.3	34.4	-5.4%	0.7%	0.4%
Electricity	89.8	84.7	82.7	81.5	82.0	82.4	-1.4%	0.6%	0.5%
Electricity sales (TWh)	926.6	871.5	851.4	837.5	842.7	846.6	-1.6%	0.6%	0.5%
City gas sales ⁴ (Billion m ³)	39.28	39.82	40.16	39.91	40.77	41.35	-0.6%	2.2%	1.4%
Fuel oil sales (GL)	196.0	193.6	182.7	180.5	176.6	172.4	-1.2%	-2.2%	-2.4%
Energy-related CO ₂ emissions (Mt)	1,139	1,235	1,190	1,148	1,137	1,105	-3.5%	-1.0%	-2.8%
(FY2013=100)	92.2	100.0	96.4	93.0	92.1	89.5
Prices									
Crude oil, import, CIF (\$/bbl)	84	110	89	49	48	58	-45.2%	-2.2%	21.9%
LNG, import, CIF (\$/t)	584	837	797	452	344	419	-43.3%	-24.0%	21.9%
(\$/MBtu)	11.3	16.1	15.3	8.7	6.6	8.0
Steam coal, import, CIF (\$/t)	114	108	93	76	81	88	-18.4%	7.1%	8.4%
Coking coal, import, CIF (\$/t)	175	135	109	88	134	139	-19.3%	52.9%	3.9%
Economy									
Nominal GDP (JPY trillion)	499.2	507.4	517.9	532.2	538.8	545.3	2.8%	1.2%	1.2%
Real GDP (JPY2011 trillion)	492.8	512.7	510.4	517.2	523.4	528.5	1.3%	1.2%	1.0%
Industrial production (2010=100)	99.4	99.0	98.4	97.4	97.7	99.1	-1.0%	0.3%	1.4%
Exchange rate (JPY/\$)	86.1	100.0	109.2	120.4	107.8	110.0	10.2%	-10.4%	2.0%

Notes:

1. Mtoe = 10¹³ 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: 13,141 kcal/kg; steam coal: 6,203 kcal/kg; coking coal: 6,877 kcal/kg since FY2013.

3. Industry includes non-energy use.

4. Conversion factor: 1 m³ = 10,000 kcal

Executive summary of topics

Topic 1 | Effect of the pace of nuclear power plants' restart

No. 3 reactor at the Ikata Power Station was reactivated in August 2016. Currently, there are 20 plants under safety checks for restarting through the new regulation standards. In addition, No. 3 reactor at the Mihama Power Station was approved for a life extension of 60 years in November 2016. Three plants have so far been approved to extend their period of operations.

The [Reference Scenario] assumes that a total of 14 nuclear power plants will have restarted by the end of FY2017. They will be in service during FY2017 with a total electricity generation reaching 62.9 TWh. Total spending on fossil fuel imports reaches JPY15.9 trillion and the electricity cost per MWh (i.e. electricity unit cost) is about JPY6,800/MWh. Furthermore, the energy-related CO₂ emissions reach 1,105 Mt-CO₂, and the self-sufficiency rate remains 12.8%.

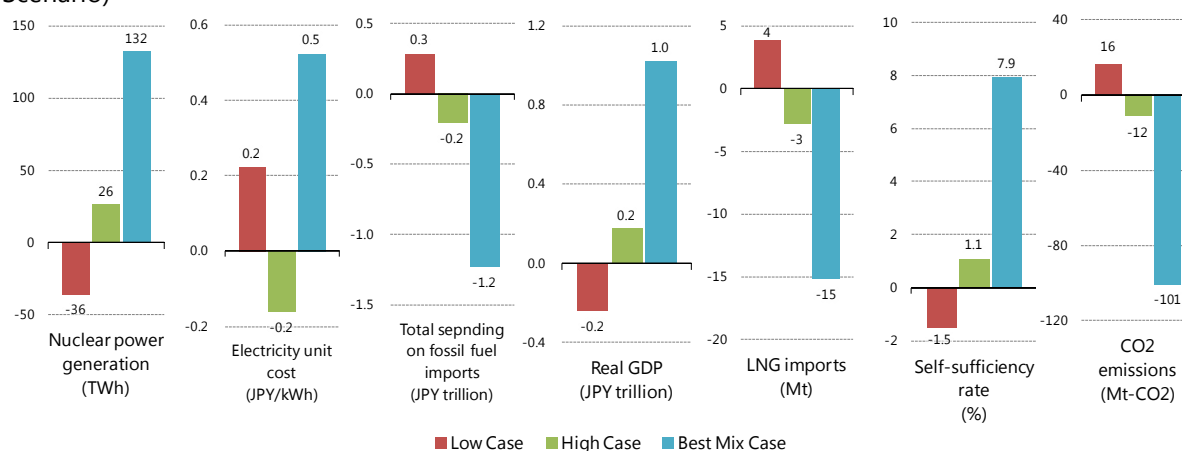
In the [Low Case], which assumes a total of seven plants to restart by the end of FY2017, total fossil fuel imports spending increases by JPY300 billion relative to the Reference Scenario. In this comparison, the electricity unit cost increases by about JPY200/MWh, the self-sufficiency rate decreases by 1.5% point, and the energy-related CO₂ emissions increase by 16 Mt-CO₂ (1.5%) whilst GDP decreases by JPY200 billion (0.03%).

In the [High Case], which assumes a total of 18 plants to restart by the end of FY2017, total fossil fuel imports spending decreases by JPY200 billion relative to the Reference Scenario. In this comparison, the electricity unit cost is lowered by about JPY200/MWh, the self-sufficiency rate improves by 1.1% point and the energy-related CO₂ emissions decrease by 12 Mt-CO₂ (1.1%) whilst GDP increases by JPY200 billion (0.03%).

The hypothetical [Best Mix Case] reflects the power generation mix of METI's "Long-term Energy Supply & Demand Outlook." Under this Case, compared to the Reference Scenario, total fossil fuel imports spending decreases by JPY1.2 trillion, the self-sufficiency rate is improved by 7.9% point and the energy-related CO₂ emissions are decreased by 101 Mt-CO₂ (9.1%). The electricity unit cost is increased by JPY500/MWh, and GDP increases by JPY1.0 trillion (0.2%).

Nuclear power generation plays an important role towards the achievement of the 3Es in Japan.

Figure 1 | Influence of the pace of nuclear power plants' restart (FY2017, compared to Reference Scenario)



Topic 2 | Income and expenditure through renewable power generation

Installation of renewable power generation is progressing in Japan. Under FIT system, 51 GW of renewable power generation plants is operating, and an additional 30 GW has been approved for a total of 81 GW, which is 1.7 times of current operating capacity. Assuming a total 81 GW of approved solar PVs for non-households, onshore wind, and woody biomass generates 2,100 TWh for 20 years under FIT system and the generated power substitutes LNG-fired power generation, the energy-related CO₂ emissions will decrease by 800 Mt-CO₂, and LNG imports will decrease by 294 Mt.

Spending on LNG imports decreases by a total of JPY16 trillion. However, as an increase of importing related goods to such renewable power generation for a cumulative total of JPY7 trillion is expected, the spending on imports represents about JPY3,100/MWh to JPY3,500/MWh as electricity cost. In short, the net reduction effect of spending on import is JPY9 trillion.

Electricity cost for generating 2,100 TWh is JPY16 trillion by LNG-fired power generation. On the other hand, in the case of renewable power generation, the electricity cost reaches JPY54 trillion, increased by JPY38 trillion due to the high tariff.

Topic 3 | Effect of realising a huge amount of coal-fired power plants in Japan

As of December 2016, 48 units for a total 23 GW of coal-fired power plants are planned. Such capacity is equivalent to half the current capacity of existing coal-fired power plants in Japan. It is also close to Chubu Electric Power Co.'s total fossil fuel-fired power generation capacity of 24 GW.

Assuming all the planned coal-fired power plants reach operation and substitute oil- and LNG-fired power plants, power generation from coal-fired plants increases by 153.8 TWh, and the share of coal-fired power increases to 48% of Japan's total power generation. On the other hand, power generation by LNG decreases by 117.9 TWh, and its share decreases to 25%; power generation by oil also decreases by 35.6 TWh. Consequently, electricity cost decreases by JPY630 billion (10%).

In this case, however, the energy-related CO₂ emissions increase by 54 Mt-CO₂, and the increase is equivalent to 3.8% of GHG emissions in FY2013. The result means adverse effects on the international target set by the GOJ for GHG emissions reduction of 26% from FY2013 by FY2030.