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60% Reduction in CO_2 Emissions by 2050 Relative to 2005 is Achievable

30% reduction — matching U.S. Target — by 2030

Japan must lead international debate on the prevention of global warming

Japan Center for Economic Research[1]

At the 21st Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21) at the end of 2015, specific greenhouse gas (GHG) emissions reduction targets for 2030 will be determined. Japan is also expected to finalize plans for reductions by the summer. We estimated the extent of possible reductions and the scale of costs and benefits from fiscal 2012 to fiscal 2050 that would result from the use of renewable energy sources, nuclear power and carbon capture and storage (CCS). A reduction target matching that of the United States is achievable and to secure a leading role in the international debate on prevention of global warming, Japan must set itself a target of a 30% reduction in emissions by fiscal 2030. In the meantime, to achieve further reductions by 2050, examination of emissions regulations and carbon pricing cannot be avoided.

Summary

- Assuming that the pace of growth of emerging economies increases and fossil fuel prices rise in the medium-to-long term, energy conservation will increase and economies are likely to become less manufacturing-centric and more services-centric. All of these factors combined with future population decline will cause energy consumption to be reduced by more than 40% relative to fiscal 2005 by fiscal 2050.
- Renewable energy sources will constitute 60% of the total energy mix (including hydroelectric power) by fiscal 2050. The fact that with the introduction of feed-in tariffs, solar PV systems approvals, without environment assessments or adjustments with local residents, surpassed projections indicated the enormous potential for installations. Renewable energy sources are considered to be relatively expensive but, with the reduction in cost brought about by advances in technology, even solar power, which is the most costly, will be profitable by the 2030s.
- Maintaining nuclear power at a certain level (15% of total electricity generation) is likely to require premiums for severe accidents and an increase in grants for the location of electric power plants in light of extension of the evacuation area to a 30-kilometer radius.

[1] This paper was co-authored by Principal Economist Tatsuo Kobayashi, Senior Research Fellow Hikaru Kobayashi (professor at Keio University), Specially Appointed Fellow Tatsujiro Suzuki (professor at Nagasaki University) and President Kazumasa Iwata.

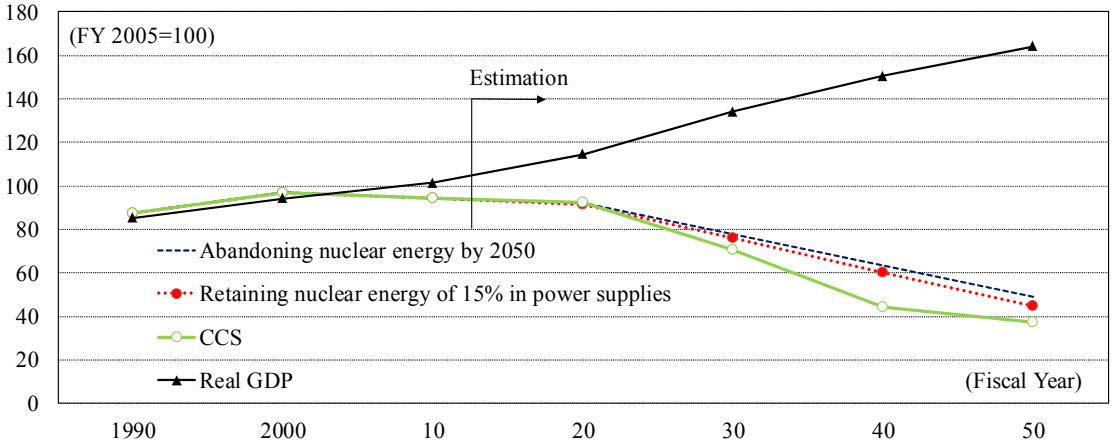
Based on this assumption, the reduction costs are the same whether Japan opts to phase out nuclear power by fiscal 2050 or maintains nuclear power's contribution to electricity at 15%.

- Assuming that CCS is practically applied from fiscal 2025 and emissions of carbon dioxide (CO_2) by the electric power sector are reduced to zero from fiscal 2040, reductions in CO_2 emissions of 29.5% by fiscal 2030 and 62.7% by fiscal 2050 relative to fiscal 2005 are achievable (reductions of 19.5% and 57.5% relative to fiscal 1990 respectively).
- Assuming that fossil fuel prices rise, CO_2 reductions will reduce fossil fuel imports and bring enormous economic benefits. By fiscal 2050, CO_2 reductions will bring benefits worth around 4 trillion yen a year on average. However, assuming that fossil fuel prices are unchanged in real terms, conversely reduction costs of just fewer than 4 trillion yen will be incurred.
- To be sure of achieving reductions, measures such as the establishment of upper limits on emissions, or a heavy environmental tax or an emission trading scheme for putting a price on CO_2 emissions will be necessary. It is also worth considering that a 60% reduction by 2050 through the introduction of an environmental tax amid sticky-upward fuel prices is expected to result in total tax revenues of around 15 trillion yen in fiscal 2050, which can be spent in other areas besides environmental preservation such as maintaining the social security system and funding tax cuts.
- In view of the results of our estimates, Japan can achieve a 60% CO_2 reduction relative to 2005 by fiscal 2050 and a 30% reduction by fiscal 2030. The U.S. Obama Administration announced a 26–28% reduction target by 2025 relative to 2005 and intended to lead discussions on the international framework for the prevention of global warming at COP21, but Japan can also set a reduction target which compares favorably with this and has the potential to lead the international debate. In the long term, Japan must start to examine introduction of emission regulations or carbon pricing.

Figure 1: Reductions in Each Case

Reduction rate of CO_2(%)	Abandoning nuclear energy by 2050	Retaining nuclear energy of 15% of total power supplies	Applying CCS
The rate in fy 2030 in comparison with fy 2005	-22.3	-24.3	-29.5
The rate in fy 2050 in comparison with fy 2005	-51.2	-55.4	-62.7
The rate in fy 2030 in comparison with fy 1990	-11.3	-13.5	-19.5
The rate in fy 2050 in comparison with fy 1990	-44.3	-49.1	-57.5

Figure 2: Even under Economic Growth, a 63% CO_2 Reduction Relative to FY 2005 is Achievable (58% Reduction Relative to FY 1990)



(Note) In the case of utilization of CCS with a 63% reduction, the emission reduction is the same whether nuclear power is phased out or maintained because the CO_2 from thermal power stations generated due to the difference between the two will all be absorbed through CCS. In the case of the phase-out of nuclear power, nuclear power stations are gradually decommissioned from fiscal 2030, reaching zero in fiscal 2050. In the case of maintenance of nuclear power, nuclear power's contribution to total electricity is maintained at 15% from fiscal 2030.

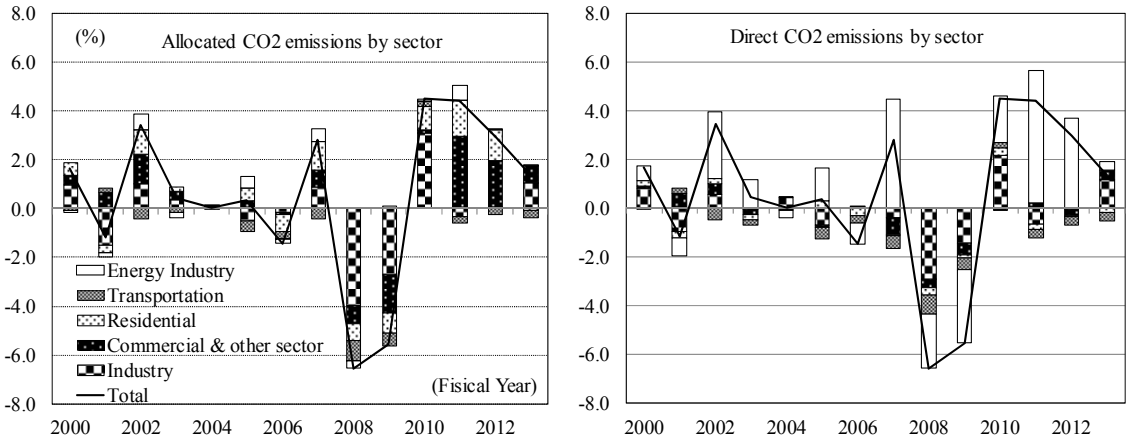
(Sources) Database of the Institute of Energy Economics, Japan, and the system of national accounts (SNA). Real GDP figures are growth scenario forecasts in *JCER Long-Term World Forecast-Three Scenarios*.

● Increased CO_2 emissions and increased energy conservation caused by suspension of operations of nuclear power plants

Japan's GHG emissions fell sharply from fiscal 2008 amid persistently high fossil fuel prices and economic recession following the collapse of Lehman Brothers. However, they then started trending upward due to modest economic recovery and the gradual suspension of operations of nuclear power plants in Japan following the Fukushima Daiichi nuclear disaster on March 11, 2011 (no operating nuclear power plants from autumn 2012 onward). In particular, emissions from the civilian sector, that is, businesses and households, increased. This is because thermal power generation was used to make up for the suspension of operations of nuclear power plants. In face of higher electricity charges, the business sector and the household sector dramatically stepped up their energy conservation efforts. The left side of Figure 3 shows that, since fiscal 2011, CO_2 emissions appear to have increased due to the civilian sector (businesses and households). However, before the energy conversion sector (mainly electricity generation) is allocated to each use sector (right side of Fig. 3), neither businesses nor households are factors for increase. This is because the CO_2 emissions increase resulting from the suspension of operation of nuclear power plants was allocated to the civilian sector. If anything, both households and businesses have dramatically stepped up their energy conservation efforts since the mid-2000s. (For further details, see *Energy Consumption*

Down 40% in Fiscal 2050 by Economic Structural Changes released in November 2014). The main reason for the emissions increase in fiscal 2013 after operating nuclear power plants were reduced to zero in fiscal 2012 was an increase in energy consumption in the industrial sector as a result of economic recovery.

Figure 3: Factors for Increase in CO_2 Emissions (Year to Year Change in Contribution)



(Source) National Institute for Environmental Studies

The suspension of operation of nuclear power plants ceases being a factor for increase in emissions from fiscal 2014, and the energy conservation efforts of each sector, the economic growth rate and extent of transformation in the economic structure are directly translated into an increase or decrease in CO_2 emissions. The reduction scenarios shown in Figure 1 are estimated based on three cases: the case where nuclear power provides 15% of total electricity generation until fiscal 2030 and is then gradually phased out; the case where nuclear power's contribution to total electricity generation is maintained at 15%; and the case where CCS starts to be practically applied from fiscal 2025 and CO_2 emissions by the electric power sector are reduced to zero by fiscal 2040.

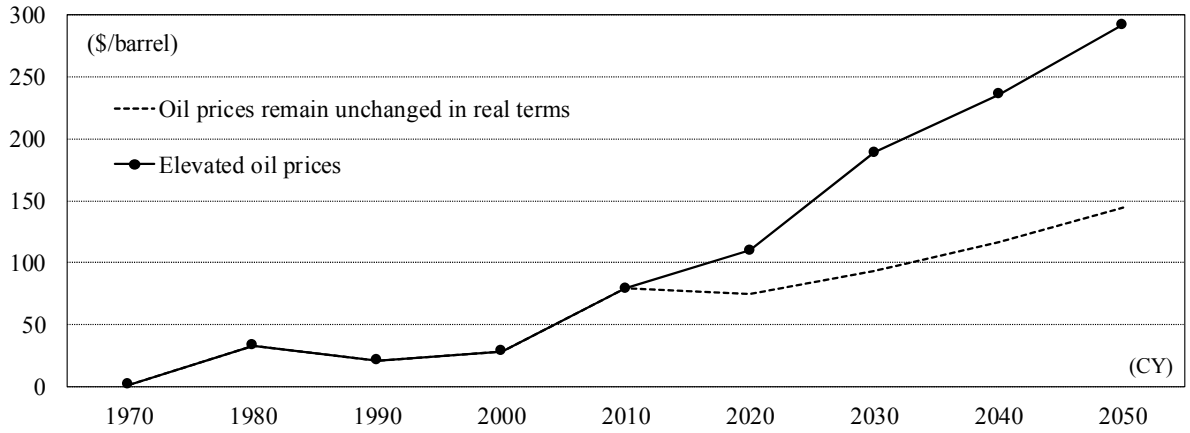
● Assumptions of Estimates

Growth rate — Average annual growth rate over period to fiscal 2050 of 1.4%, fossil fuel prices of US$290 per barrel

We assumed the Growth Scenario (average annual growth rate of 1.4% over the period to fiscal 2050) according to JCER Long-Term World Forecast—Three Scenarios. We used the crude oil price to represent fuel oil prices and made two assumptions. The first is an assumption based on the relationship between growth rates and prices in the past. It is the case where the world is expected to continue on an energy-intensive growth path led by emerging economies until fiscal 2030; fossil fuel prices will once again enter an upward trend after bottoming out at US$65 per barrel in fiscal 2015, and prices remain high reaching US$290 per barrel by fiscal 2050. The second case is where fossil fuel prices are unchanged in real terms, continuing to rise from US$65 at a modest pace of just over 2% a year on average. We assumed that the crude oil price will be around US$150 by fiscal 2050. The yen will continue

to weaken, reaching 121 yen per dollar by fiscal 2017 (in line with JCER's *41st Medium-term Economic Forecast for the Japanese Economy*), but will then strengthen to 98 yen per dollar by fiscal 2050 on the back of Japan's economic growth.

Figure 4: Crude Oil Price Assumption

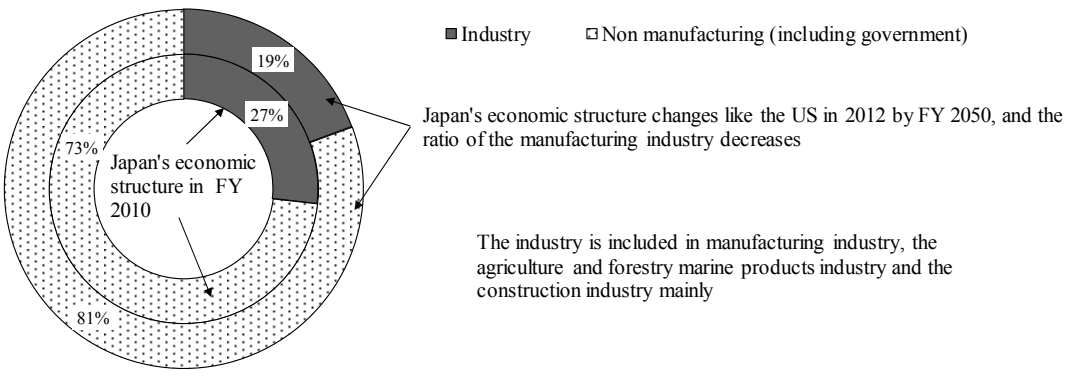


(Source) IEA "World Energy Outlook 2014"

Energy consumption — 40% reduction through an investment of 1% of GDP (30% reduction in electricity consumption)

We assumed that Japan will invest an amount equal to 1% of its GDP in energy conservation each year. As a result, the trend for improvement in energy conservation seen from the oil crisis to fiscal 2013 will continue in each sector. We also assumed that Japan's economic structure will shift to GDP component ratios similar to those of the United States at present by fiscal 2050. The manufacturing industry remaining in fiscal 2050 will improve its energy efficiency furthermore, with the rise of non-manufacturing industries, whose energy consumption (energy efficiency) per unit of GDP is about one-tenth of manufacturing industries, energy consumption will decrease (see *Energy Consumption Down 40% in Fiscal 2050 by Economic Structural Changes*).

Figure 5: Japan Must Match the U.S. 2012 Level by Fiscal 2050 through the Structural Transformation of its Economy



(Sources) United States Department of Commerce, the system of national accounts (SNA)

Renewable energy sources — Investment expenditure of around 140 trillion yen by fiscal 2050

The cost of renewable energy sources is estimated based on feed-in tariff amounts (cost of solar power is expected to fall from 42 yen per kWh to 38 yen, 36 yen, etc. as solar power becomes more widespread, and cost of wind power is also expected to fall from 22 yen to 15 yen by fiscal 2050). We also anticipated 15 trillion yen for system stabilization costs associated with more widespread use of renewable energy sources. The cost of augmenting existing hydroelectric power is estimated based on the proposal of the Japan Project-Industry Council (Chairman Akio Mimura [also Chairman of the Japan Chamber of Commerce and Industry]). Construction costs of 5 trillion yen will be incurred by 2030.

Nuclear power generation — Costs of 19 trillion yen, reflecting premiums for severe accidents and increased grants for the location of electric power plants

Believing that an insurance system that provides for severe events, according to electricity generation, is required to permanently maintain nuclear power, we added, according to electricity generation, extra premiums estimated from the cost of the Fukushima nuclear disaster. We assumed 40 trillion yen as the cost of decontamination of contaminated areas and the cost of final disposal as low-level radioactive waste, 10 trillion yen as decommissioning cost, 17 trillion yen as the cost of treatment of contaminated water, and 20 trillion yen as total compensation, and estimated the probability of occurrence of a nuclear accident in Japan as once every forty years. We also added extra grants for the location of electric power plants commensurate with the expansion of the evacuation area from a 10-kilometer radius to 30 kilometers. Costs of around 19 trillion yen will be incurred by fiscal 2050.

Carbon Capture and Storage (CCS) — Practical application from fiscal 2025, decrease in cost from 5,000 yen per ton to 3,000 yen per ton

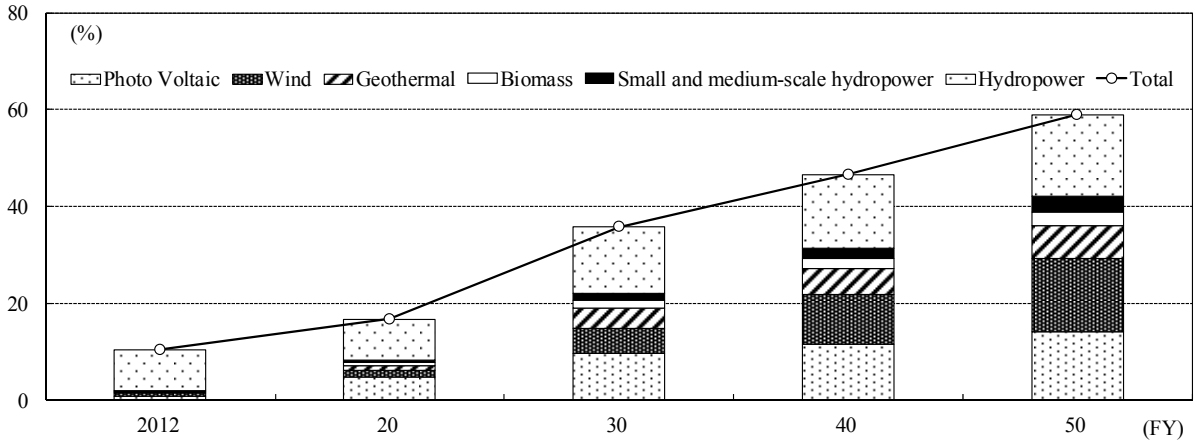
In view of the fact that Japan CCS Co., Ltd. will start a CCS demonstration project from April in Tomakomai, we assumed that the cost of capturing and storing one ton of CO_2 will be more than halved from its current level which is set at just over 7,000 yen. This is because one of the goals of the practical application of CCS is to halve the cost. We assumed that practical application will start at a cost of 5,000 yen in fiscal 2025 and that the cost will fall to 3,000 yen by fiscal 2050, and we assumed that, from fiscal 2040, CO_2 emissions from thermal power plants will all be processed using CCS.

● Renewable energy will constitute 60% of primary energy

Regarding the level of introduction of renewable energy sources, given that solar power capacity is already just under 70 GW based on approvals alone and technological innovation is also extremely fast, we estimated solar power capacity of more than 90 GW by fiscal 2050. We assumed wind power capacity of 50 GW, mainly with reference to the targets of the Japan

Wind Power Association, geothermal power capacity of 7.3 GW and biomass power capacity of 4 GW based on hearings of the relevant industries and the Study of Potential for the introduction of *Renewable Energy* issued by the Japanese Ministry of the Environment. We also assumed capacity of 4.2 GW for small and mid-size hydroelectric power plants based on the same study. With respect to the augmentation of existing hydroelectric power plants, we estimated an increase in capacity of 10 GW by fiscal 2030 based on estimates of the Japan Project-Industry Council. We calculated electricity generation by multiplying the capacity of each by capacity utilization rates (solar power 12%, wind power 24%). The results showed that renewable energy sources will constitute around 60% of total electricity generation by fiscal 2050 and 36% by fiscal 2030 (Figure 6).

Figure 6: Ratios of Renewable Energy Sources (Including Existing Hydroelectric Power) to Total Electricity Generation

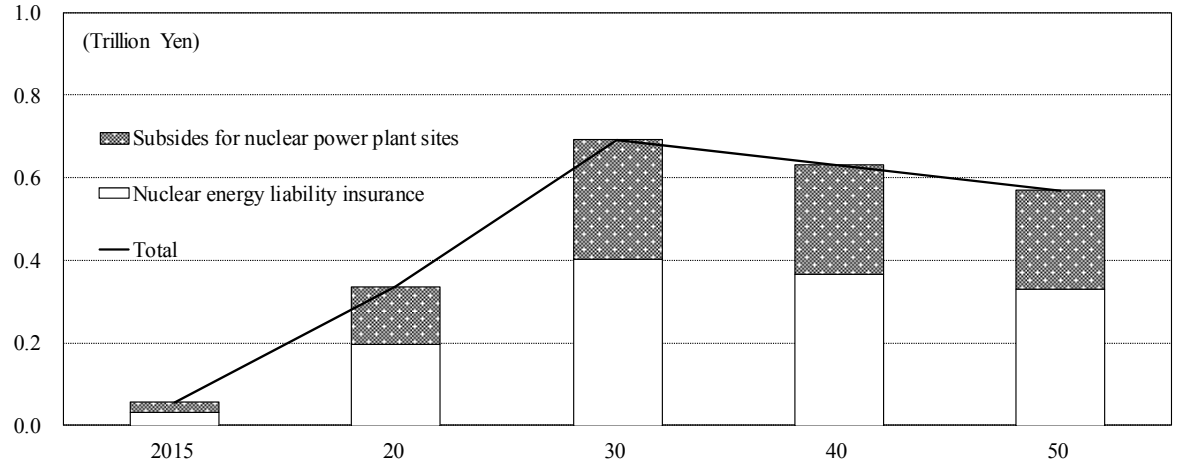


(Source) Survey of Electric Power Statistics

● Assuming maintenance of nuclear power, three-quarters of electricity generation will be non-fossil fuel sources

Assuming that nuclear power will continue to account for 15% of Japan's electricity generation from fiscal 2030, non-fossil fuel sources will constitute 75% of total electricity generation by fiscal 2050 and half of it by fiscal 2030. To enable this, permanent measures against severe accidents would no doubt be required. We have revised our estimates of maintenance costs since the Fukushima Nuclear Disaster. Based on past estimates and taking our current nuclear power electricity generation assumptions into consideration, we estimated premiums for severe accidents and grants for the location of electric power plants. Total costs including premiums and grants will peak at just under 700 billion yen a year and then start to decline, reflecting a gradual reduction in nuclear power generation associated with the decrease in electricity generation from fiscal 2030 (Figure 7).

Figure 7: Trends in Premiums and Grants for the Location of Electric Power Plants according to Electricity Generation



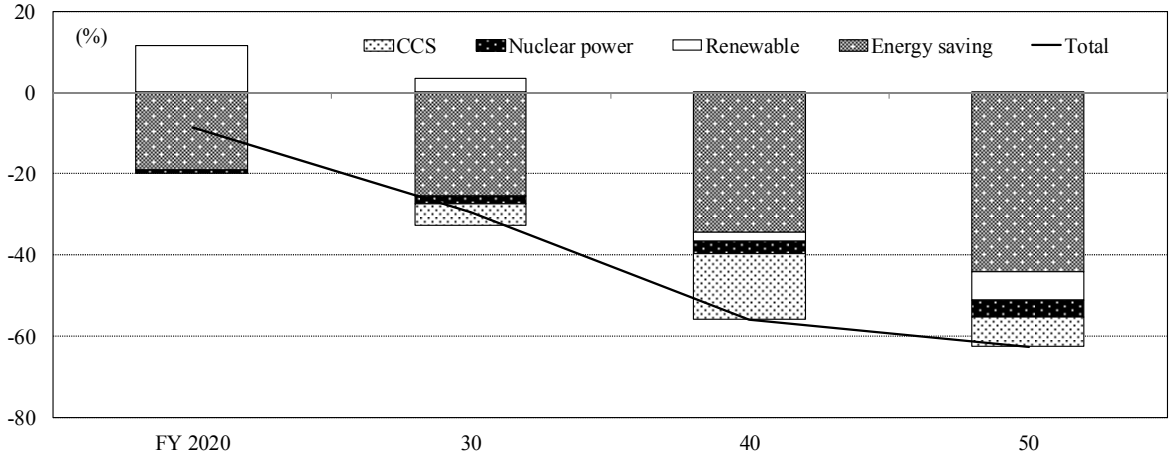
Premiums were estimated based on the cost of dealing with the Fukushima Disaster as explained already, but the total cost of dealing with the disaster (decontamination, decommissioning, compensation, etc.) is extremely uncertain at the moment and it should, therefore, be borne in mind that it is uncertain whether premiums will end up at this level or whether lower premiums will be okay.

● Reduced consumption as a result of energy conservation will make the biggest contribution to reductions

Based on the assumptions explained so far, in the case of utilization of CCS, emissions will be reduced 30% relative to fiscal 2005 by fiscal 2030 and reduced 63% by fiscal 2050. Figure 8 shows the contributions of energy conservation, renewable energy sources, nuclear power generation and CCS to reductions. The reason renewable energy sources appear to increase CO_2 in fiscal 2020 and fiscal 2030 is because we included the increase in CO_2 resulting from the use of thermal power to make up for the suspension of operations of nuclear power plants. We included this increase in renewable energy sources for the sake of convenience to verify when the increase associated with the use of thermal power in place of nuclear power can be covered by renewable energy sources. We forecast that electricity generation from nuclear power in fiscal 2010 can be covered with renewable energy sources in the 2030s. The key to large-scale reduction lies in the extent of reduction in energy consumption resulting from transformation to an energy conserving economic structure and population decline. With regard to nuclear power, if nuclear power plants are decommissioned after forty years of operation pursuant to government regulations, nuclear power will constitute 15% of electricity generation in fiscal 2030, but this, in terms of a contribution to reduction, is limited. Whether Japan phases out nuclear power or maintains it, the difference this will ultimately make to the reduction by fiscal 2050 will only be five percentage points. Reduction in the cost of CCS holds the key to achieving zero carbon emissions. It is said that to prevent global warming it is

necessary to halve emissions of CO_2 and other greenhouse gases by 2050 (reduce by 80% in the case of advanced economies) and achieve zero emissions by 2100, but reducing usage of fossil fuels to zero is difficult and hopes are pinned on CCS to chemically remove air pollutants such as SOx and NOx.

Figure 8: Breakdown of CO_2 Reduction by Energy Conservation, Nuclear Power and CCS



- Savings of 24 trillion yen by fiscal 2050, assuming fossil fuel prices remain high

So what will happen in terms of costs? Though already mentioned in Assumptions of Estimates, energy conservation, renewable energy sources and maintenance of nuclear power will be extremely costly, but will pay off handsomely provided fossil fuel prices continue their upward trend. Although China has probably entered a stable growth phase, emerging economies, such as India and countries in Southeast Asia, could continue growing at a fast pace. If these highly populated countries enter a high growth phase, the pattern of growth fueled by resources will once again be repeated, and this could well lead to rising resource prices. This is because the recent sharp drop in resource prices is attributable not only to supply factors such as the shale revolution in the United States and the postponement of reduced production in Saudi Arabia, but also to demand factors such as the slowdown in the world economy.

Figure 9: Net Expenditure for Energy Conservation, Renewable Energy Sources and Nuclear Power (top is single fiscal year, bottom is cumulative expenditure, assuming nuclear power's contribution is maintained at 15%)

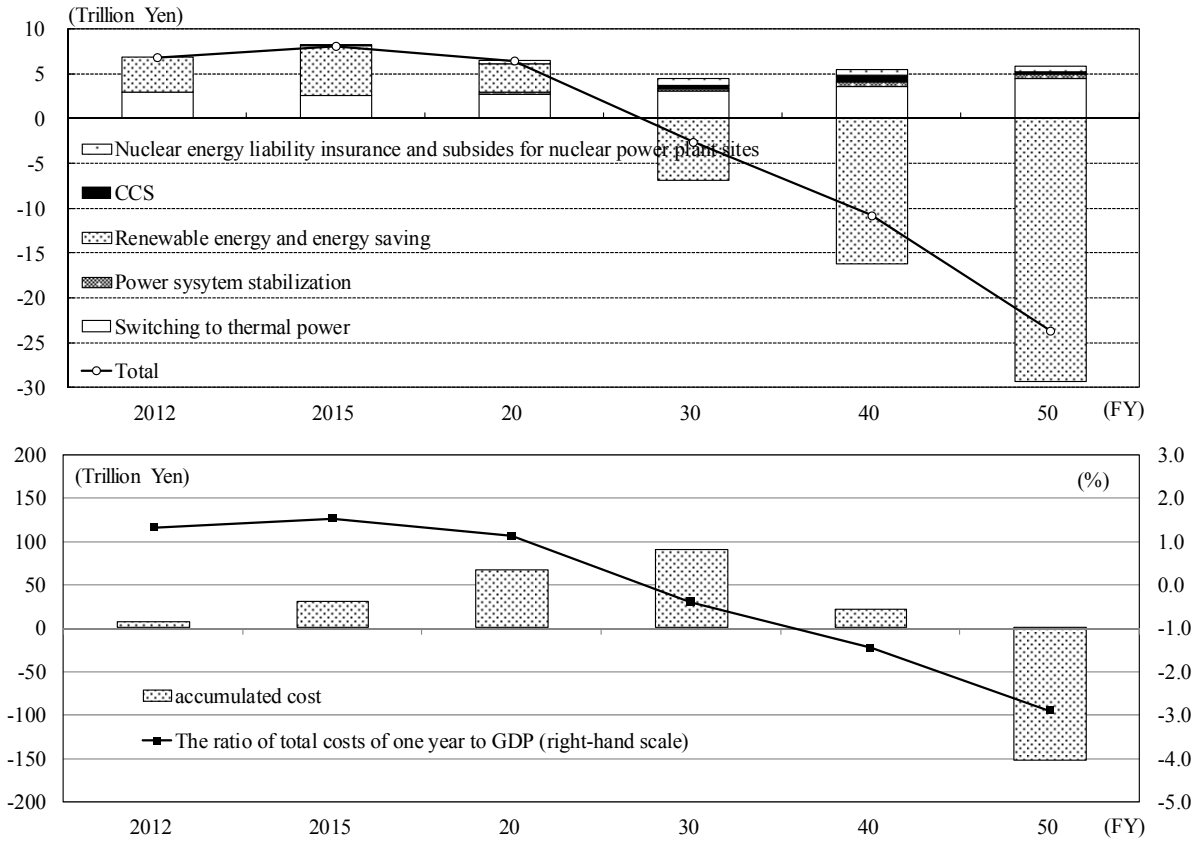
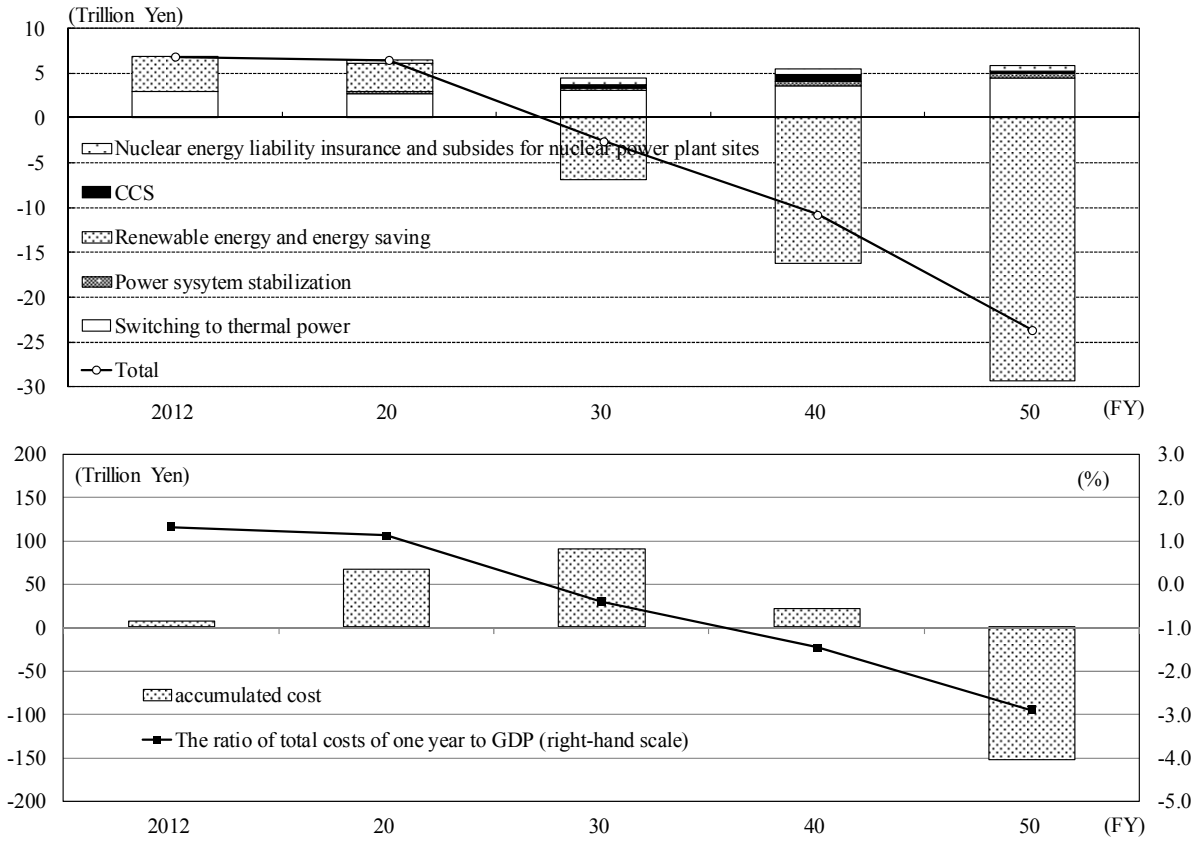


Figure 9 shows net expenditure calculated by deducting savings on fossil fuel imports from expenditure incurred for energy conservation, renewable energy sources, maintenance of nuclear power, etc. Until the 2020s, the cost of fossil fuels used to make up for suspension of the operations of nuclear plants, energy conservation, renewable energy sources, and maintenance of nuclear power will exceed savings on fossil fuel imports. However, once past this stage, savings as a result of renewable energy sources, energy saving and conservation of other forms of energy besides electricity will increase and, by fiscal 2050, net expenditure after deduction of savings on fossil fuels from investment expenditure will amount to 24 trillion yen (net profit of 24 trillion yen), pushing up the growth rate accordingly. The ratio of net profit to GDP in fiscal 2050 will be 3%. Under the Growth Scenario, we assume a growth rate of 0.8% in fiscal 2050, and our estimates also suggest that, to maintain this growth rate even if fossil fuel prices reach 290 dollars, the positive effect of factors such as energy conservation will be essential. The bottom figure of Figure 9 shows that just fewer than 100 trillion yen in cumulative net expenditure will be required by fiscal 2030, but this will bring benefits of 150 trillion yen in total by fiscal 2050. On average over the period fiscal 2012 to fiscal 2050, savings of 4 trillion yen a year will surpass investment.

Figure 10 shows the case where Japan opts to phase out nuclear power and uses CCS to deal

with the additional CO_2 emissions generated as a result of not using nuclear power. The cost in both cases is so similar that there is no distinguishing between the two at first glance. Whether Japan opts to phase out nuclear power or opts to maintain it, until the 2020s, investment in reduction will exceed savings on fossil fuels, but provided CCS is used, a return on investment will be possible from around fiscal 2030.

Figure 10 Net Expenditure by Fiscal 2050 in the Case where Japan Opts to Phase Out Nuclear Power



● Falling Fossil Fuel Prices — Average Reduction Expenditure of 3.7 Trillion Yen a Year will be Incurred

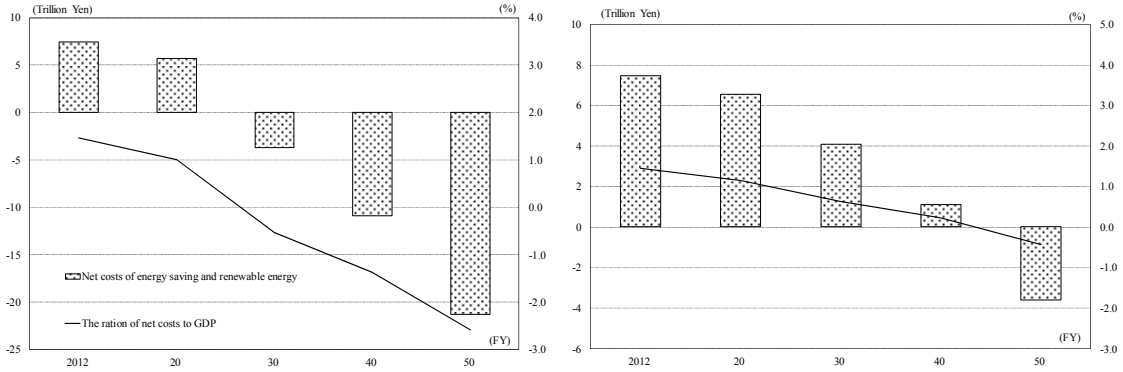
In the event of an environment in which fossil fuel prices rise, making it easier to promote energy conservation and renewable energy sources, CO_2 will be reduced to a considerable degree even without additional large-scale policy measures, but what will happen in the case where prices do not rise?

In the event that the crude oil price shown in Figure 4 only rises in line with global inflation (price is unchanged in real terms), reduction expenditure will exceed savings on fossil fuels. Figure 11 (comparison in case where nuclear power is phased out) shows net expenditure in the case where fossil fuel prices remain high (left) and are unchanged in real terms (right). In the right figure, savings on fossil fuel imports do not exceed reduction expenditure until the beginning of the 2040s. In terms of cumulative net expenditure, net expenditure of almost 150

trillion yen will be incurred even in fiscal 2050. As an annual average over the period fiscal 2012 to fiscal 2050, net expenditure reaches 3.7 trillion yen. Although the graphs are not shown here, as in the case where fossil fuel prices remain high, the reduction expenditure will be almost the same whether nuclear power's contribution is maintained at 15% or whether nuclear power is phased out by fiscal 2050.

Figure 11: Reduction Expenditure Varies Considerably Depending on Crude Oil Price (case of nuclear power phase-out; just under 150 dollars by fiscal 2050)

If fossil fuel prices rise　　If fossil fuel prices are unchanged in real terms



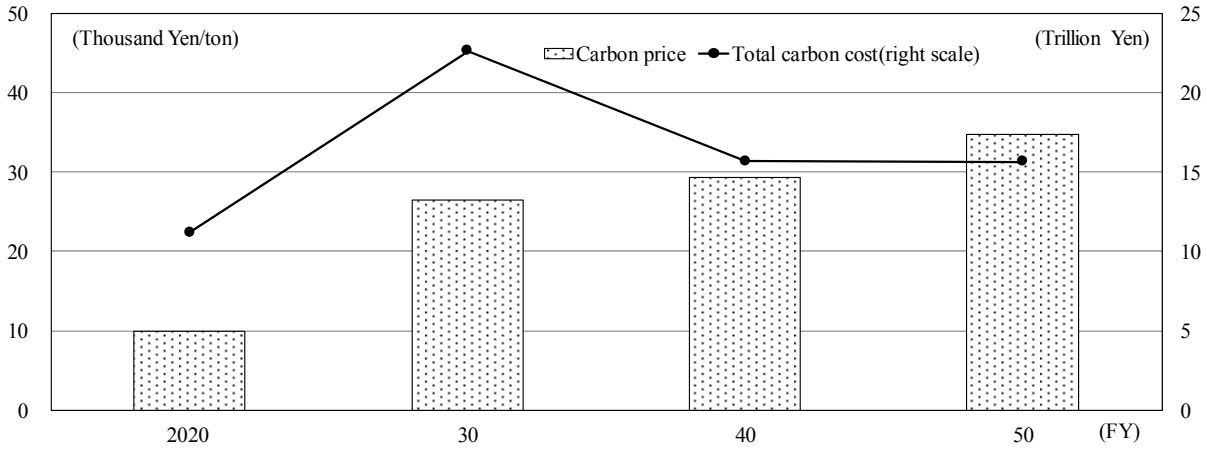
(Note) Both the figure on the left and the figure on the right assume nuclear power phase-out by fiscal 2050. In the left figure, the crude oil price rises to US$290 per barrel by 2050. In this case, by fiscal 2030, the saving on imports of fossil fuels will be greater than CO_2 reduction investment. The right figure is the case where the crude oil price stays at just under US$150 per barrel. Savings will not exceed investment until the beginning of the 2040s, and reduction expenditure will be incurred even in the long term.

● Case of depressed fossil fuel prices— Pricing for CO_2 Emissions is Essential

In the event that fossil fuel prices are depressed, progress with energy conservation and the introduction of renewable energy sources as a result of price mechanisms will be less than in the case where fossil fuel prices rise. In this event, systems such as an environment tax or emissions trading to put a price on CO_2 emissions will be required to make up for the price difference.

What level of CO_2 prices will be required to make up for the price difference? Our estimates show that it is necessary to increase pricing every year until fiscal 2050 so that the price reaches 35,000 yen per ton by fiscal 2050. User cost will peak at just under 23 trillion yen around fiscal 2030 and then, with the pace of reductions exceeding the rate of increase in CO_2 prices, total user cost will start to decline, reaching around 15 trillion yen in the 2040s (See Figure 12).

Figure 12: CO_2 Prices and User Cost Accompanying Emissions



Considering that consumption tax of 1% generates 2.5 trillion yen in tax revenue, this figure is equal to consumption tax of 6–9%. Our long-term economic forecast proposes the policy of raising the consumption tax rate to 25% by fiscal 2030 in the interests of fiscal reconstruction and maintenance of the social security system, in addition to corporate tax cuts, etc. to achieve the Growth Scenario. It may, for example, be worth considering replacing part of this with an environment tax.

● Scope for further reduction — Through lifestyle changes, introduction of cogeneration, etc.

The results of our estimates so far assume changes in the economic structure, but changes in individuals' lifestyles are not taken into consideration. However, from a long-term perspective, energy consumption is likely to change dramatically with the widespread use of information and communication technology (ICT). For example, it is easy to imagine that styles of "commuting" and "shopping" and methods of communicating information will change dramatically even from now.

The shift to a non-manufacturing-centric economic structure in the manner of the United States, which is seen as the key to energy conservation, is essential, alongside improvement in productivity through full utilization of ICT. Job losses as a result are also anticipated and changes in lifestyle due to economic restructuring are inevitable. However, our current forecast does not anticipate reduction as a result of changes in lifestyle. ICT is key technology supporting efficiency improvements (in addition to energy conservation) in various industries and businesses, households and the transport sector, and acceleration of advances in and use of ICT will enhance Japan's growth potential. We published an interim report about ICT in February 2015, and when we put together a concrete argument in the future, the contribution of ICT to energy conservation and a low-carbon society will also be included in the scope of policy proposals.

We have also not taken cogeneration systems used to supply electricity and heat into consideration. The Innovative Strategy *for Energy and the Environment* formulated during the Democratic Party of Japan administration aimed to achieve 150 billion kWh of power output

by cogeneration systems by fiscal 2030, and, if achieved, this could also lead to an annual CO_2 reduction of 50 million tons, which equates to around 4% of total emissions.

Japan has set itself a long-term target to reduce its CO_2 emissions by 80% by 2050 and a reduction of just over 60% is expected to be achievable through domestic measures and the remainder will probably need to be achieved through cooperation with emerging countries and developing countries to reduce CO_2.

Also, regarding nuclear power, the cost of dealing with severe accidents has been factored into our forecast, but the cost of final disposal of high level radioactive waste has not been taken into consideration. Whether Japan maintains nuclear power or phases it out, the cost will be almost the same. However, additional examination is required to determine whether nuclear power can be maintained without any prospects for final disposal sites and what time scales and costs are involved.

- Long-term perspective and philosophy are required — Low-carbon society will not be realized through the coordination of interests alone

At the beginning of 2015, the Japanese Government set up a Committee to determine the energy mix in fiscal 2030 and began setting reduction targets for the prevention of global warming. However, it appears to be determining forecasts of supply and demand and the scope for reduction based on feedback from the industrial sector, etc., and the stance of exploring a bold change in economic structure is lacking. Also, with regard to nuclear power generation, efforts are being put into nothing but the resumption of operations using safety regulations as a shield and more fundamental questions such as to what extent will nuclear power be maintained and under what conditions are not being specifically addressed.

Such examination cannot be conducted without a perspective or philosophy for envisioning Japanese society in 2030 or 2050. Examination is impossible without a vision for realizing a low-carbon society in which the economy grows in harmony with the environment by 2050.

During the oil crisis, Japan made rapid progress with energy conservation and diversification of its energy resources. Japan also has a history of dramatically transforming its industrial structure from a “smokestack industry” to a high-tech industry-centric structure and enhancing its global competitiveness. In face of sharply rising electricity charges after the Fukushima Nuclear Accident, there were cries from some industrial sectors that competitiveness cannot be maintained if electricity charges rise any higher and yet corporate earnings of listed companies in fiscal 2014 (the fiscal year ending March 2015) are expected to reach record high levels. This suggests that first-tier companies have steadily promoted energy conservation and have, on the contrary, started to turn high energy prices into business seeds. As at the time of the oil crisis, they used the crisis as a lever to increase their intrinsic strength. A certain large car manufacturer said, when asked, that it could accept strict regulations provided they were unified global fuel efficiency standards and environment standards. This is because it knows this will serve as an opportunity to enhance its own

competitiveness.

The European Union (EU) has set a target of a 40% reduction from 1990 by 2030, the United States also has a target of a 26–28% reduction by 2025 relative to 2005, and even China has pledged to ensure emissions peak in 2030. Behind these targets lies the intention to link negotiations over the prevention of global warming to the development of their own economies. Doing nothing more than making ad-hoc adjustments amongst interested parties within Japan will not pave the way to a bold low-carbon society achieved alongside economic growth and it will not enable Japan to assume a leading role in international discussions. It might even lead to Japan being made to swallow a framework determined by Europe, the United States and China, which could be a drag on Japan's economy.

Figure 13 Greenhouse Gas Emission Targets of the United States, China, Europe and Japan

U.S.	26–28% reduction by 2025 relative to 2005
EU	40% reduction by 2030 relative to 1990 (35% relative to 2005)
China	To ensure emissions peak around 2030
Japan	Provisional target of 3.8% reduction by fiscal 2020 relative to fiscal 2005; 2030 target is currently being formulated.

For inquiries regarding this paper, please contact Tatsuo Kobayashi of the JCER Economic Research Department at t.kobayashi {at mark} jcer.or.jp. (* Please change { at mark } to @)

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