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Retaining Nuclear Plants after 2030: Four Conditions

At the end of June 2012, the government's Energy and Environment Council announced three options relating to Japan's reliance on nuclear power plants through 2030 (see Reference Table, last page). The government plans to select one of these options as early as August. We have estimated the economic impact of costs relating to the Fukushima Daiichi accident which followed the March, 2011 Great East Japan Earthquake, including cleanup costs and insurance and other expenses necessary to provide against the risk of future accidents. Based on these estimates, we have in the present report highlighted those points which we believe are essential to consider if Japan relies on nuclear power plants to supply a certain portion of its electric power needs through 2030 and after. A major premise underlying our proposals is that the causes of the Fukushima Daiichi accident must be clarified and new physical and procedural safety standards established by 2030.

1. Future cost estimates for cleanup, compensation and decommissioning urgently needed: Disclose full cost of Fukushima accident

The energy mix options that the government has only taken into account the minimum costs necessary to cope with the Fukushima accident. These costs include radiation decontamination, compensation to victims and decommissioning of the reactors. The government should therefore urgently prepare estimates which take into consideration the maximum risks as well. Giving the public a correct understanding of the cost of continued reliance on nuclear plants, and allowing them to make their own choice will build a foundation for executing a stable, long-term energy policy. Figures 1and 2 present our estimates of the costs required either to maintain nuclear plants at levels prior to the accident or to abandon all reliance on nuclear energy by 2050. The estimates given in Figure 1 are based on data from the Cost Review Committee of the government's Energy and Environment Council and the feed-in tariff scheme for renewable energy launched in July. Figure 2 represents the projections given in our 38th Medium-Term Forecast for the Japanese Economy released in March. Based on detailed information, the full cost of the Fukushima accident should be estimated and publicly disclosed by the government and the electric power industry.

Figure 1 Comparison between Maintaining Nuclear Plants and "Exit Costs" from Nuclear Power in FY 2050 (Total Costs in 40 years)

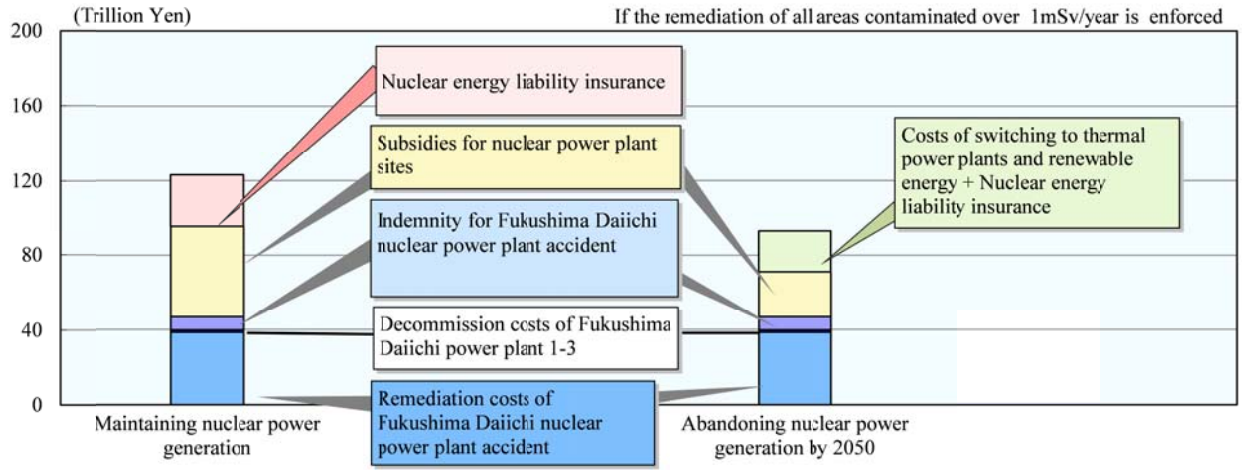
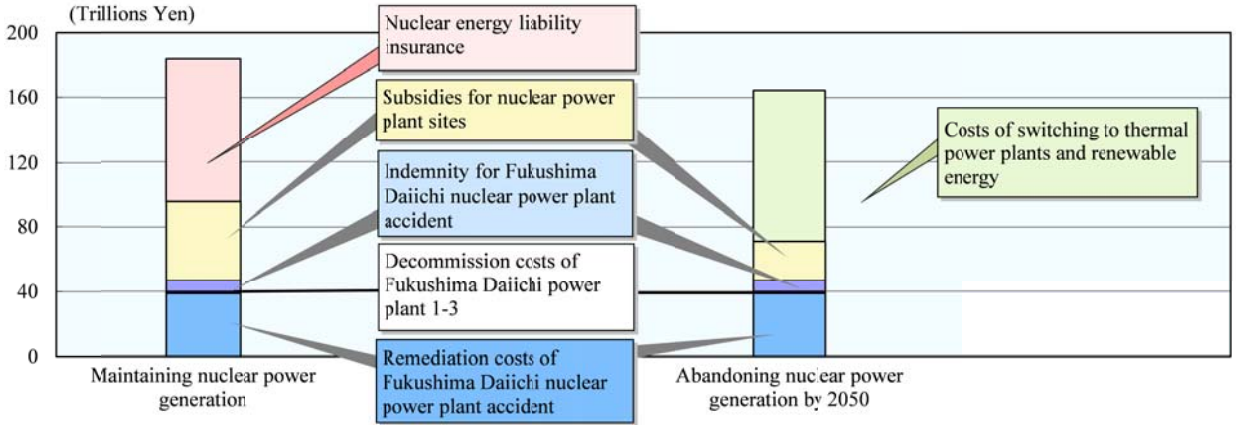


Figure 2 the projections given in our 38th Medium-Term Forecast for the Japanese Economy released in March



Sources: Ministry of Environment, Japan Nuclear Fuel Limited, TEPCO, Nuclear and Industrial Safety Agency, Japan Atomic Energy Commission, and Cabinet Secretariat (Forecast by JCER)

2. Establish an insurance system providing state compensation for severe accidents: The public as a whole must be prepared to shoulder the burden

The Act on Compensation for Nuclear Damage presently in force provides that electric power companies bear de facto unlimited compensation liability, but the recent accident has made it clear that operators would be hard pressed to provide full compensation if the government fails to assume liability. If Japan relies on nuclear energy to supply a certain portion of its energy needs, it will be necessary to change to a system under which the state compensates for any damage which exceeds a certain amount. In other words, the Japanese public as a whole will bear the risk of coping with any accidents. A thorough overhaul of the nuclear energy budget, which includes considering options such as decommissioning of the "Monju" fast breeder reactor, will be unavoidable. The estimates presented in Section 1 constitute the premises for a new state compensation system, which is indispensable. As shown in Figures 1 and 2, if a compensation system that anticipates nuclear accidents is created, and the expense borne in the form of electricity rates, higher rates would be unavoidable even if nuclear power plants are retained. If the cost is passed on in this way, electricity rates would rise by 20% to 30%. There is no indication of when use of the prototype fast breeder reactor "Monju" might be practical. Even if it is decommissioned in the course of a thorough overhaul of the nuclear energy budget, and the savings allocated for compensation, the full cost could still not be met. Some in the nuclear industry have expressed a desire to continue using nuclear power plants in order to avoid higher electricity rates. However, advocating continued long-term use of nuclear plants under conditions prior to the Fukushima accident (without any safety measures nor a state compensation system) amounts to saying there is no need for contingency measures or voluntary insurance because operators would operate plants carefully.

3. Review greenhouse gas reduction target: Target will affect reliance on nuclear power

The government is moving toward eliminating dependency on nuclear power plants, which will make it difficult to achieve its internationally pledged short-term target of cutting emissions of greenhouse gases such as CO_2 and methane by 25% versus 1990 levels by 2020. The government needs to draft a reduction plan in line with the extent to which nuclear and renewable energy are expected to be used. After all, the value of nuclear plants will differ depending on the greenhouse gas reduction plan. In addition to estimates based on the bottom-up approach adopted in Figures 1 and 2, we have used economic models to estimate by

how much expenses for responding to the risk of an accident would have to rise, in order to make abandoning nuclear energy dependency by 2050 a better option than maintaining it.

If Japan abandons nuclear energy gradually, insurance premiums providing against future accidents will decline while expenses required to satisfy CO_2 constraints will increase. If nuclear plants remain in operation on the other hand, insurance premiums will be necessary in proportion to the total energy generated, but since nuclear generation does not emit CO_2, the cost of measures to combat climate warming would be lower.

We have assumed (1) no construction of new nuclear plants, (2) decommissioning of reactors after forty years in service, and (3) zero dependency on nuclear plants as an energy source by 2050. We have also assumed that nuclear dependency will be 15% in 2030 and that the greenhouse gas emission target will be to cut emissions 20% versus 1990 levels by 2030.

Table 1 How much are nuclear energy liability insurance premiums more costs of abandoning nuclear power

Condition			Estimation
case	CO_2 Cut Target(Comparison between 1990 and 2030)	Share of Renewable Energy about Electricity in 2030	Nuclear energy liability insurance premiums equal to Costs of switching to thermal power plants and renewable energy
a	-20%	10%	120 trillion yen
b	-20%	30%	60 trillion yen
c	-6%	—	12 trillion yen

Source: Advisory Committee for Natural Resources and Energy (Estimation by JCER)

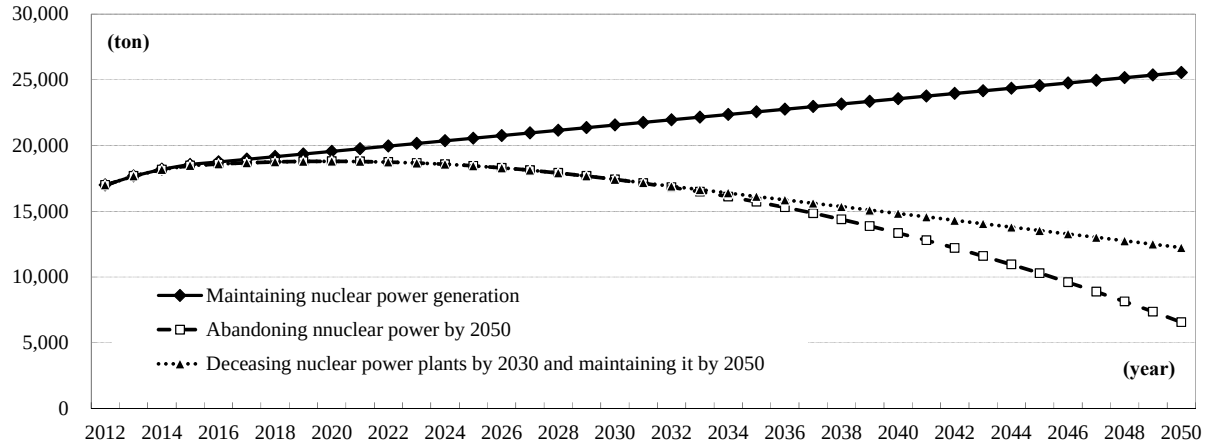
If the goal is to cut CO_2 emissions by 20% and the cost required to cope with nuclear plant accidents over the next forty years exceeds ¥120 trillion, then the economically advantageous choice would be to abandon nuclear energy by 2050 (Table 1 (a)). If we use estimates worked out by the Cost Review Committee for the expense of providing against nuclear accidents, then the cost of nuclear generation in this case would be equivalent to an increase of about ¥12 per kWh. But with nuclear energy generation costs rising fast, we could assume, given constraints on CO_2 emissions, that efforts to adopt renewable forms of energy would naturally be promoted. Thus if enough renewable generation were brought online to satisfy 30% of Japan's energy needs by 2030, the cost of maintaining nuclear energy could fall to ¥60 trillion (Table 1 (b). The cost which defines the borderline of economic viability would fall because the renewable energy contribution would satisfy CO_2 constraints, diminishing the advantages of nuclear energy.

4. Decide on permanent storage site for high-level radioactive waste by 2030: Abandon nuclear energy otherwise

Whether spent nuclear fuel is reprocessed or buried directly underground without being reprocessed, it is critical that a permanent storage site be found. If securing storage sites is put off any further while the use of nuclear energy is continued, it would amount to the present generation forcing future generations to pick up the tab for its own energy consumption. Choosing a permanent disposal site will also be indispensable in order to clean up the Fukushima accident and facilitate the decommissioning of reactors. If this choice cannot be made by 2030, there will be no option but to decommission reactors as they reach forty years in service and shut down all nuclear plants by 2050.

Based on reprocessing capacity and the volume of spent nuclear fuel being produced, Figure 3 projects the outlook for the volume of spent nuclear fuel under three scenarios, namely maintaining nuclear power plants, eliminating them by 2050, or reducing them by half by 2030 and maintaining that level thereafter. (We assume that spent nuclear fuel will be reprocessed.) If it is possible for reprocessing facilities to operate at full capacity for a period of forty years to reprocess 800 tons of fuel, then reducing nuclear energy generation by half would result in a gradual reduction in the volume of spent fuel. However, if the operating rate falls from full capacity to just under 70% capacity (or from 800 tons to 540 tons), it would not decline in the least.

Figure 3 The future outlook for the volume of spent nuclear fuel



Source: Japan Atomic Energy Commission (Estimation by JCER)

In view of the foregoing, failure to narrow down prospective final disposal sites by 2030 would make it necessary to abandon the option of permanently preserving nuclear plants and to forsake nuclear energy by 2050. Nuclear energy advocates in the government and electric power industry have been stating for twenty years that choosing a permanent disposal site would take twenty years, but the situation has made absolutely no progress despite the lapse of that twenty years. One suspects that no sense of urgency developed regarding the disagreeable task of choosing a permanent disposal site because nuclear plants could remain in operation so long as the spent fuel storage pools were not full and could still be used for temporary storage. According to the existing decision-making framework, the central government considers offers from local governments to host permanent disposal sites. But another idea might be to switch to a system under which, as in Switzerland, a number of potential scientifically safe sites within Japan are chosen, after which the government would appeal to the public regarding the need for the facilities.

For example, the Basic Energy Plan now under consideration could contain a clear statement to the effect that if no permanent disposal site is determined by 2030, then the choice of abandoning nuclear energy would be made. This would force the nuclear power industry to confront the problem of finding permanent disposal sites. Prime Minister Yoshihiko Noda has expressed firm resolve with respect to raising the consumption tax, saying that the issue must not be postponed. It is essential that he take the same stance regarding selection of permanent storage sites.

The four conditions presented in our proposals assume the establishment of safety inspection standards for nuclear plants by 2030, with the causes of the Fukushima Daiichi plant clarified. If the causes are not clarified and the safety standards not established, there would be no other option than to abandon nuclear energy. These proposals are intended to complement the establishment of safety standards and constitute a very high hurdle for the

nuclear power industry. However, disclosure of transparent information and open debate will be indispensable in clearing these four hurdles, and above all, will be the first step to the restoration of confidence in nuclear power as a reliable source of energy.

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Reference Table

Three Scenarios for 2030

•The shares mean those in the electric energy generated. Figures in parentheses indicate changes from 2010 before the Great East Japan Earthquake.

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	2010	2030				
		0% scenario		15% scenario	20-25% scenario	(Reference) Current Strategic Energy Plan of Japan
		Before additional measures	After additional measures			
Share of nuclear energy	26% Note 1	0% (-25%)	0% (-25%)	15% (-10%)	20 to 25% (-5 to -1%)	45%
Share of renewable energy	10%	30% (+20%)	35% (+25%)	30% (+20%)	30 to 25% (+20 to +15%)	20%
Share of fossil fuels	63%	70% (+5%)	65% (Current level)	55% (-10%)	50% (-15%)	35%
Share of non-fossil energy resources	37%	30% (-5%)	35% (Current level)	45% (+10%)	50% (+15%)	65%
Electric energy generated	1.1 trillion kWh	Approx. 1 trillion kWh (-10%)	Approx. 1 trillion kWh (-10%)	Approx. 1 trillion kWh (-10%)	Approx. 1 trillion kWh (-10%)	Approx. 1.2 trillion kWh
Final energy consumption	390 million kl	310 million kl (-72 million kl)	300 million kl (-85 million kl)	310 million kl (-72 million kl)	310 million kl (-72 million kl)	340 million kl
Greenhouse gas emissions Note 2 (compared to 1990)	-0.3%	-16%	-23% (-21%)	-23% (-22%)	-25% (-25%)	(Around -30%)

Note 1: The share of nuclear energy under the current Strategic Energy Plan of Japan (53%) is the share of large-scale power sources (excluding cogeneration and private power generation)
Note 2: Figures in parentheses indicate only energy-related CO2 emissions.

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