

Inside Japan's Long-term Energy Policy



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Introduction

On July 16 the Ministry of Economy, Trade and Industry (METI) officially approved its “Long-Term Energy Supply and Demand Outlook” for fiscal 2030. The first revision of this document in five years represents an important milestone in reviewing Japanese energy policy in light of the Great East Japan Earthquake and the Fukushima nuclear disaster. In this article I will discuss the significance of the Outlook, issues of debate in the deliberations over it, important points in the paper’s content and anticipated challenges, while undertaking a big-picture survey of where the Outlook stands.

Significance of the Outlook

With the world’s third-largest GDP, Japan is among the world’s largest users of energy. The scarcity of fossil-fuel resources in its territories and its extremely low energy self-sufficiency make the stable supply of energy a high policy priority for Japan. The Japanese government and private sector have joined hands to advance necessary measures to ensure reliable energy supplies, seen as tantamount to energy security. Such measures are gaining importance in addressing climate change as well.

Requiring special attention in securing energy supply generally are the long lead times of energy-related investments, which influence future supply-demand structures. The work involved in building and starting operations of a large power plant, from design and planning through site acquisition, groundbreaking and construction, typically takes 10-15 years or more. Such long lead times make it necessary to build a specific vision now of a desirable supply-demand structure for the future, and undertake joint efforts by the public and private sectors to achieve it.

Because Japan does not employ a planned economy, the Long-term Energy Supply and Demand Outlook has no legally binding power. But it’s in the Japanese style to pursue nationwide efforts to achieve a desired goal presented by the government, and with the periodic reviews of the Outlook as a precondition, this practice has become central to official Japanese energy strategy. The new Outlook updates the government’s desired policy vision after five years.

Background of Latest Outlook & Related Decision Processes

The Cabinet approved the previous Outlook version to complement its Basic Energy Plan, Japan’s fundamental energy strategy, in June 2010. To improve energy self-efficiency and address climate change, that version included the goal of increasing the nuclear component to 50% of

total power generation. This goal has been withdrawn in response to the earthquake and nuclear plant disaster of 2011, and since then METI has been reviewing energy policy from the ground up.

In April 2014 the government released a long-awaited review of the Basic Energy Plan, including its basic policy priorities, labeled the “Three Es with Safety”. Taking lessons from the Fukushima disaster, the fundamental precondition of “safety” was added to the old “Three Es” — i.e. energy security, economic efficiency and environmental protection, and more balanced, simultaneous achievement of the 3E+S goals became the guiding priority. The new Basic Energy Plan designates nuclear energy as an “important baseload power source”.

At that time all operations of Japan’s nuclear plants were suspended, and the true value and challenges of renewable energy sources had not been proven despite rising expectations. So a new Outlook version was not presented, while the more qualitative and general Basic Energy Plan came out ahead of it. Because of the importance of sharing a specific future vision, at the end of 2014 METI set up the Subcommittee on Long-term Energy Supply-Demand Outlook under its Advisory Committee for Natural Resources and Energy, which began discussions in January 2015. I had the opportunity to participate in this subcommittee as a member.

Balancing the 3E+S Goals

The subcommittee deliberated intensively through its 11th meeting in July. To encourage constructive discussion while bringing together diverse opinions, in these meetings the subcommittee decided on one fundamental point: the Outlook would be based on the Basic Energy Plan as decided by the Cabinet in April 2014.

The Basic Energy Plan is a long policy document that includes various statements and opinions. On the balance of nuclear and renewable resources, one statement held that the use of the former would be reduced as much as possible, while use of the latter would rise above the goal set in the previous Outlook. Many members of the subcommittee, myself included, understand rather that in essence the Basic Energy Plan recommends working to achieve the 3E+S goals simultaneously in a balanced way.

So how will the 3E+S goals be balanced? With safety designated a top-priority precondition, in its latest deliberations the subcommittee decided to set three specific 3E goals:

- 1) Energy security: raise the nation’s energy self-sufficiency rate from 6% now to 25% in fiscal 2030.
- 2) Economic efficiency: reduce the cost of electricity, which rose significantly after the 2011 earthquake, to a level below today’s.
- 3) Environment: set goals for greenhouse-gas emissions that are in line with those of the United States and Europe.

The talks focused on building an energy supply-and-demand structure that allows the simultaneous achievement of the three goals.

Uncompromising Energy Conservation

In the discussion of the supply-demand outlook, top priority was placed on uncompromising energy conservation. Macroeconomic factors like economic growth are necessary preconditions for finalizing the Outlook. Annual average growth of 1.7%, as set by government policy, became a precondition. Then a model was created in which no extra energy-saving measures were applied. This became a starting point for discussions on reducing energy consumption with enhanced measures to encourage conservation.

For this purpose a separate subcommittee was created, which listed specific areas where energy conservation is possible for the industrial, residential and transport sectors. All were quantified and summed to create maximum numeric goals. As a result, between the case of no extra energy conservation and the one with enhanced energy conservation, final energy consumption could fall by roughly 13%, or 50.30 million kiloliters oil-equivalent in fiscal 2030 (*Chart 1*). The study also showed the possible reduction of electricity consumption by 17%, or 196.1 billion kWh, in the enhanced energy saving case. From these consumption figures with enhanced energy saving, the subcommittee calculated a goal for total power generation at 1,065 billion kWh, and discussed which energy sources in what ratios should meet that requirement.

Enhancing energy conservation and improving the structure of energy supply and demand is the right choice for Japan. But it should be noted that the conservation goal set out in the latest Outlook version is very ambitious. It aims to improve the energy/GDP intensity by 35% by fiscal 2030, a rate of improvement equivalent to what Japan achieved between 1970 and 1990, which included two international oil crises. This is a challenging goal because Japan has already accomplished significant energy conservation, and the improvement of energy/GDP intensity has actually stagnated in the two decades since 1990.

It should also be noted that half of that 50.30 million kl-equivalent reduction in final energy consumption is expected in the residential sector. Going any deeper with energy conservation will not be easy, because uncompromising enhancement of energy conservation will require understanding and cooperation from the public as well as specific measures to ensure implementation.

Expanding Renewables

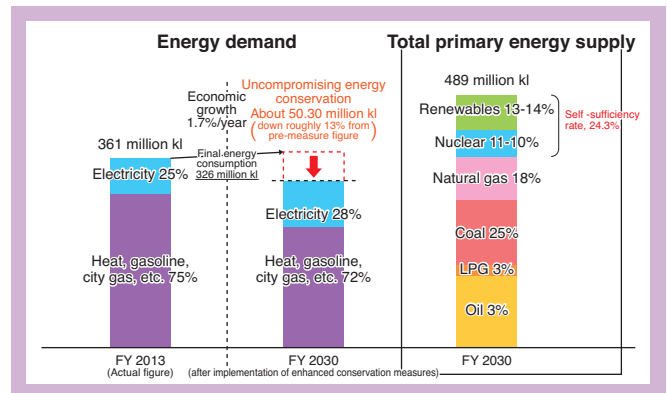
The use of renewable energy resources, which are domestically available and emit no carbon dioxide, should be promoted heavily for energy security and environmental protection, two of the Es representing the priorities of the Basic Energy Plan. Challenges to be addressed will be the high costs and the intermittent supply nature of solar and wind energy resources. Subcommittee discussions explored how to expand the use of renewables to the practical maximum while adhering to the policy priority of

reducing energy costs to final users. The subcommittee members looked at each of the various practical renewable resources and calculated an estimate of generation capacity from each, based on available information. In sum, in fiscal 2030, 236.6-251.5 billion kWh of energy was estimated to come from renewable sources.

In detail, hydroelectric will remain the largest renewable energy resource, with solar, wind and biomass components growing significantly between now and fiscal 2030. All combined, renewables will account for 22-24% of total power generation in fiscal 2030 (*Chart 2*). An important point was made about the cost of purchasing renewable energy under the FIT scheme, categorized as electricity cost, based on this share ratio (volume of power generated). To promote the generation of renewable energy, a feed-in tariff system was introduced in 2012. It has been effective in quantitatively increasing new renewable energy supply capacity, but the burden of continuously purchasing renewable energy at a high tariff rate over a long period surfaced as a serious economic challenge for Japan. The new Outlook version estimates that annual renewable purchasing costs will grow from 0.5 trillion yen now to 3.7-4 trillion yen in FY 2030, and most of that will be from the intermittent sources: solar (2.3 trillion yen) and wind (0.4 trillion yen). However, even as expenditures for renewables expand, the Outlook concludes, total electricity costs can come down by 3-5% from the

CHART 1

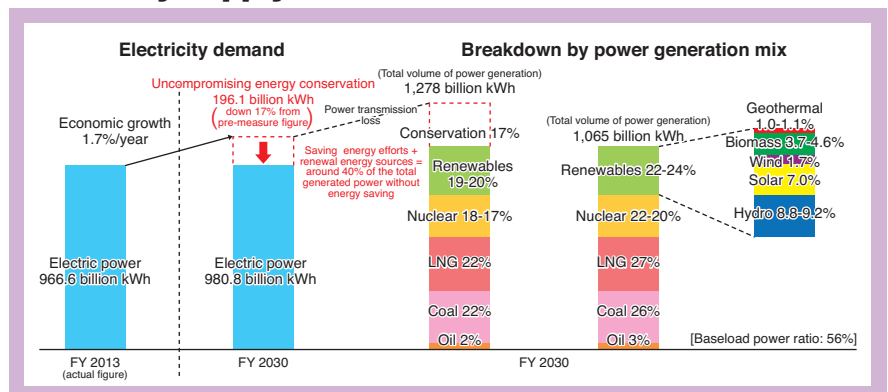
Outlook for emergency consumption & primary energy supply in FY 2030



Source: Reference material for the 10th meeting (June 1, 2015) of the Subcommittee on Long-term Energy Supply-Demand Outlook

CHART 2

Outlook for electricity demand & structure of electricity supply in FY 2030



Source: Reference material for the 10th meeting (June 1, 2015) of the Subcommittee on Long-term Energy Supply-Demand Outlook

current 9.7 trillion yen as the consumption of fossil fuels can fall significantly with wider use of renewable and nuclear energies, and conservation measures take effect ([Chart 3](#)).

Increases in generating capacity were considered for each renewable resource. The goal figures for geothermal, hydro and biomass are practical maximums, very challenging to achieve. For solar and wind, higher goals than those proposed by the Outlook may lead to an increase in purchasing costs, making the reduction of total electricity costs more difficult. The suggested figures here are meant to answer the question of increasing renewables as much as possible, making the most of their advantages without compromising economic efficiency.

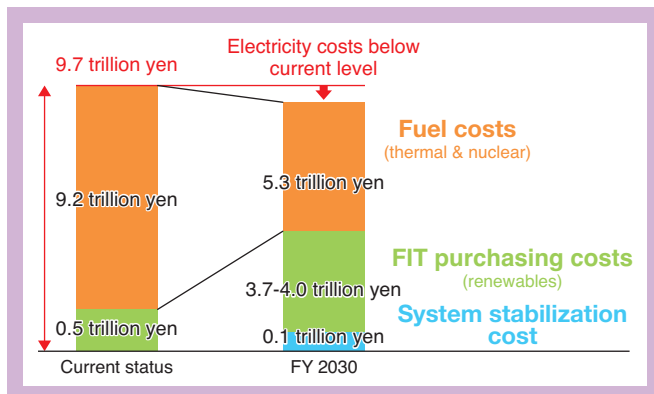
Status of Nuclear Energy

The Basic Energy Plan designates nuclear energy as “an important baseload power source”. But with persistent public anxiety about its safety and no resumption of operations at any suspended nuclear power plant, it was not easy to promote its future ideal use.

The core point in discussing nuclear energy was its contribution to the 3E balance. As a quasi-domestic energy resource, it can help improve energy self-sufficiency (the first E), and its relative freedom from carbon-dioxide emissions promotes environmental protection (the second E) as

CHART 3

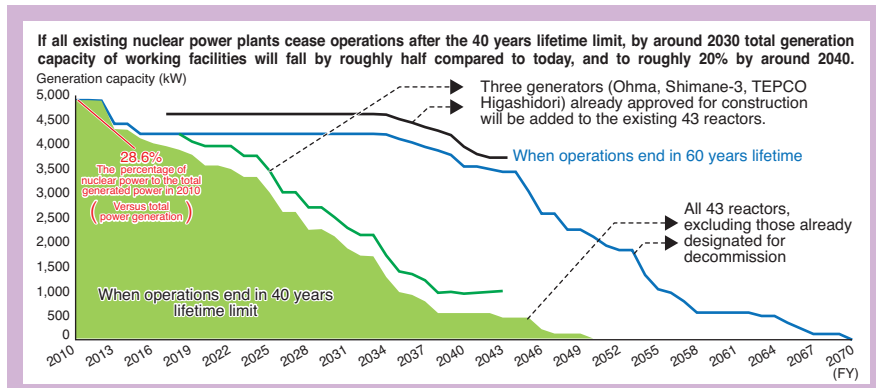
Outlook for electricity costs in FY 2030



Source: Reference material for the 10th meeting (June 1, 2015) of the Subcommittee on Long-term Energy Supply-Demand Outlook

CHART 4

Nuclear power generators' capacity (or situation if their operations stop in 40 years)



Source: Reference material for the 10th meeting (June 1, 2015) of the Subcommittee on Long-term Energy Supply-Demand Outlook

long as its safe use is guaranteed. As for the other E, economic efficiency, the other government Working Group undertook fact-finding on generation costs alone, and at 10.1 yen/kWh, including the costs of related policy implementation and accident management/compensation, nuclear energy proved more economically competitive than other options.

So the subcommittee positioned the share of nuclear energy at 20-22% of total power generation, as at that level nuclear will contribute significantly to meeting all the 3E goals for being self-sufficient, cost-efficient and helpful in reducing total greenhouse-gas emissions.

The top priority in applying nuclear energy, of course, is securing its safety. It is therefore imperative that nuclear operations strictly comply with the new safety standards, regarded as the world's most stringent set by the Nuclear Regulation Authority (NRA), a new independent regulator set up as a committed response to the Fukushima disaster. Additional voluntary enhancement of safety by electric utilities operating nuclear plants will also be imperative. As for the back-end issues including those of handling spent nuclear waste, it will be very important for the government to take the initiative and lead in carrying forward necessary measures as well as the responsibility in enhancing the safety campaign to rebuild public trust.

As for the desired share of nuclear energy (20-22%), some subcommittee members expressed skepticism about the feasibility of supplying 20% of total power generation with nuclear, because if a 40-year operational lifetime cap is placed on all existing facilities, the capacity of existing plants will have fallen by FY 2030 ([Chart 4](#)). However, in principle an operating electric utility will be able to apply for a 20-year lifetime extension, based on its internal assessments and additional investment to comply with safety standards. The NRA will then screen those applications and decide whether or not the application can be approved. In this context, the opposition to rigid application of the 40-year lifetime cap was firm in the subcommittee discussions. That filled out a new picture of existing nuclear plants fulfilling the goal of about 20% nuclear in total power generation.

This vision for nuclear energy will not also be easy to realize. At the time of this writing Japan has not yet resumed nuclear-plant operations, and many uncertain factors remain in any decision to resume in the future. (On Aug. 11, 2015, however, Sendai nuclear power plant's No. 1 reactor restarted its operation, becoming the first case of a nuclear restart since 2013.) The electricity market will be increasingly deregulated, so nuclear energy's future status in a liberalized market will be difficult to project. Above all, many people remain concerned about the safety of nuclear energy. The Outlook indicates the important role that nuclear energy could play in the energy supply-demand structure that Japan desires, but many challenges remain in making it happen.

Realizing the Vision

In addition to renewable and nuclear energies, the new Outlook sets desired future shares for other resources in total power generation: 27% for liquefied natural gas (LNG) fired thermal, 26% for coal-fired thermal, and 3% for oil-fired

thermal. The component ratio for the total primary energy supply for fiscal 2030 was also clearly delineated: oil 30% (40% in 2013), coal 25% (25%), natural gas 19% (24%), nuclear 10-11% (0.4%), and 13-14% for renewables (8%) (Table 1 & Chart 5). By pushing energy conservation and the use of renewables and nuclear, Japan will likely raise its energy self-sufficiency (the sum of nuclear and renewables) to about 24% by 2030. At the same time fossil energy, mainly from oil and natural gas, is on track for significant decreases in both quantity and share compared with fiscal 2013 levels.

With more conservation and wider use of non-fossil energies, Japan's carbon-dioxide emissions will decrease substantially. Specifically, annual energy-derived CO2 emissions will drop by 25% between fiscal 2013 and fiscal 2030, from 1.24 to 0.93 billion tonnes. Japan's greenhouse-gas emissions will fall by 26% over the same period due to measures to absorb and reduce emissions of greenhouse gases other than carbon dioxide. Japan's official goal for emissions reduction is 26%. With fiscal 2013 as the benchmark year, the reduction will be in line with those of the US and Europe (Table 2).

It is important to discuss how the benchmark year should be determined in the first place. As Europe and the US have selected theirs in terms of their respective supply-demand structures, Japan selected FY 2013 as the benchmark year, and will work to persuade other nations that this is reasonable in terms of its supply-demand structural situation. In comparing goals for emission cuts, the costs involved (especially that for marginal abatement costs) are as important as the reduction targets. Judging from the results of past actions, Japan's marginal abatement costs are higher than those of its Western peers, and in that sense the new goal is competitive. The goal for Japan should even be considered very ambitious and challenging.

The latest Outlook describes ways to almost fully satisfy the 3E goals set up for it. Balancing these components will be a very delicate task. For example, increasing renewables to reduce carbon-dioxide emissions and raise energy self-sufficiency could raise electricity costs. Reducing electricity costs by adding coal-fired thermal capacity will likely increase emissions and reduce energy self-efficiency. The energy supply-demand balance the Outlook sets out this time is as far as Japan can practically go to achieve the 3E goals in a balanced way.

So it will be important to accomplish the supply-demand structure that the Outlook sets out as desirable, and the challenge will be in the execution. From where Japan is today, achieving the energy-savings goals, expanding renewable capacity and using nuclear energy safely will not be easy. Strong policy, joint public-private efforts and public understanding will all be essential. The international energy landscape includes many uncertain factors, such as the influence of future deregulation on the power and gas markets, the instability of oil prices, volatility in the Middle East, and the shale revolution. In that context Japan will continue to work hard to realize the most desirable energy supply-demand structure for its future.

Conclusion

It is significant that the Long-term Energy Supply and Demand Outlook, which METI has officially endorsed, clearly points up the importance of realizing the ideal structure and enhancing means to that end. It is important to undertake specific measures and actions to move forward despite energy situations replete with uncertainty both at home

TABLE 1

Total primary energy supply (million kl)

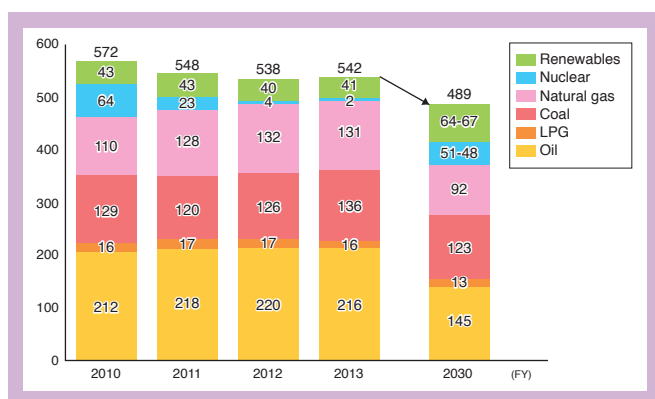
	FY 2013		FY 2030	
Oil	216	40%	145	30%
LPG	16	3%	13	3%
Coal	136	25%	123	25%
Natural gas	131	24%	92	19%
Nuclear	2	0.4%	51-48	11-10%
Renewables	41	8%	64-67	13-14%
Total	542	100%	489	100%

Note: All 2030 figures are approximate.

Source: Reference material for the 10th meeting (June 1, 2015) of the Subcommittee on Long-term Energy Supply-Demand Outlook

CHART 5

Trends in total primary energy supply (million kl)



Source: Reference material for the 10th meeting (June 1, 2015) of the Subcommittee on Long-term Energy Supply-Demand Outlook

TABLE 2

Comparison of reduction targets of greenhouse-gas emissions among Japan, US & EU

	Compared to 1990	Compared to 2005	Compared to 2013
Japan (Draft outline by advisory committee)	▲18.0% (FY2030)	▲25.4% (FY2030)	▲26.0% (FY2030)
US	▲14-16% (FY2025)	▲26-28% (FY2025)	▲18-21% (FY2025)
EU	▲40% (FY2030)	▲35% (FY2030)	▲24% (FY2030)

Note: US and EU submitted their emission reduction goals based on the benchmark year of 2005 and 1990 respectively.

Source: Reference material for the 10th meeting (June 1, 2015) of the Subcommittee on Long-term Energy Supply-Demand Outlook

and abroad. To effectively handle the changing landscape, it will be necessary to review the Long-term Energy Supply and Demand Outlook regularly along with revision of the Basic Energy Plan, which happens roughly every third year.

There will be many important points to consider in these regular reviews, such as issues in the international energy market, progress in Japan's resumption of nuclear plant operations, progress in renewable generation and use, and related challenges. The basic policy — of simultaneously achieving the 3E goals with safety as a prerequisite — should remain firm.

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