

Strategic Energy Plan Overview and Analysis on 2030 Power Supply/Demand

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1. Overview of 6th Strategic Energy Plan

The Agency for Natural Resources and Energy in July 2021 compiled and published the Sixth Strategic Energy Plan¹ after a yearlong consideration at the Strategic Policy Committee of the Advisory Committee for Natural Resources and Energy. The government made a Cabinet decision on the plan, prior to the 26th Conference of Parties to the United Nations Framework Convention on Climate Change starting in the last October.

The Strategic Energy Plan features the goals of carbon neutrality by 2050 and a 46% reduction in greenhouse gas emissions from 2013 to FY2030. It indicates challenges and initiatives to realize stable and affordable energy supply while achieving the ambitious goals. This paper sums up the plan and considers challenges regarding the 2030 energy mix in particular.

2. 2030 energy mix overview and challenges

The GHG emission reduction goal is more ambitious than the 26% reduction from 2013 in the previous Strategic Energy Plan, but the fundamental direction of the energy policy to achieve the goal remains unchanged. Energy efficiency improvement and transition to non-fossil energy sources are combined and deepened to reduce fossil fuel consumption and GHG emissions.

(1) Thorough energy efficiency improvement

An energy consumption cut through energy efficiency improvement is set at about 62 million kiloliters of crude oil equivalent, up some 20% from the previous plan. This amounts to as much as 18% of total energy demand. An appendix to the plan specifies target energy consumption cuts and measures by sector. Table 1 indicates targets, results and major measures for energy efficiency improvement.

The energy consumption cut between FY2013 and FY2019 came to 16.55 million kL, covering some 25% of the target energy consumption cut at 62 million kL. If the remaining 75% were to be cut by 2030, energy consumption would have to be reduced some 1.5-fold faster.

¹ Agency for Natural Resources and Energy, Strategic Energy Plan

https://www.enecho.meti.go.jp/committee/council/basic_policy_subcommittee/opinion/data/01.pdf

Table 1 Target energy consumption cut and major measures by sector

In 10,000 kL of crude oil equivalent	2019 results	2030 targets	Major measures
Industry sector	332	1,042	Introduction of low-carbon industrial furnaces and other efficient equipment
Commercial sector	414	1,227	Achievement of net zero energy for new houses and buildings, promotion of insulation retrofit, diffusion of efficient equipment
Residential sector	357	1,160	
Transport sector	562	1,607	Improvement of vehicle fuel efficiency and transport systems
Total	1,655	6,200	

Source: Agency for Natural Resources and Energy “FY2030 Energy Supply and Demand Outlook (Appendix)”

(2) Transition to non-fossil energy sources: power generation mix

The target energy consumption cut through energy efficiency improvement and a downward economic outlook revision reflecting the COVID-19 pandemic are estimated to allow total power generation in FY2030 to decline by about 10% from FY2019 to about 934 billion kilowatt hours. Non-fossil power sources account for 59% of the total power generation, representing a substantial increase from 44% for the previous plan (Figure 1).

Most non-fossil power sources are renewable energy capturing 36-38% of total power generation. In particular, the share for solar photovoltaics featuring a short lead time has been substantially raised from the previous plan to 14-16% through positive zoning under the revised Act on Promotion of Global Warming Countermeasures and the enhanced solar PV introduction for the public sector and airports.

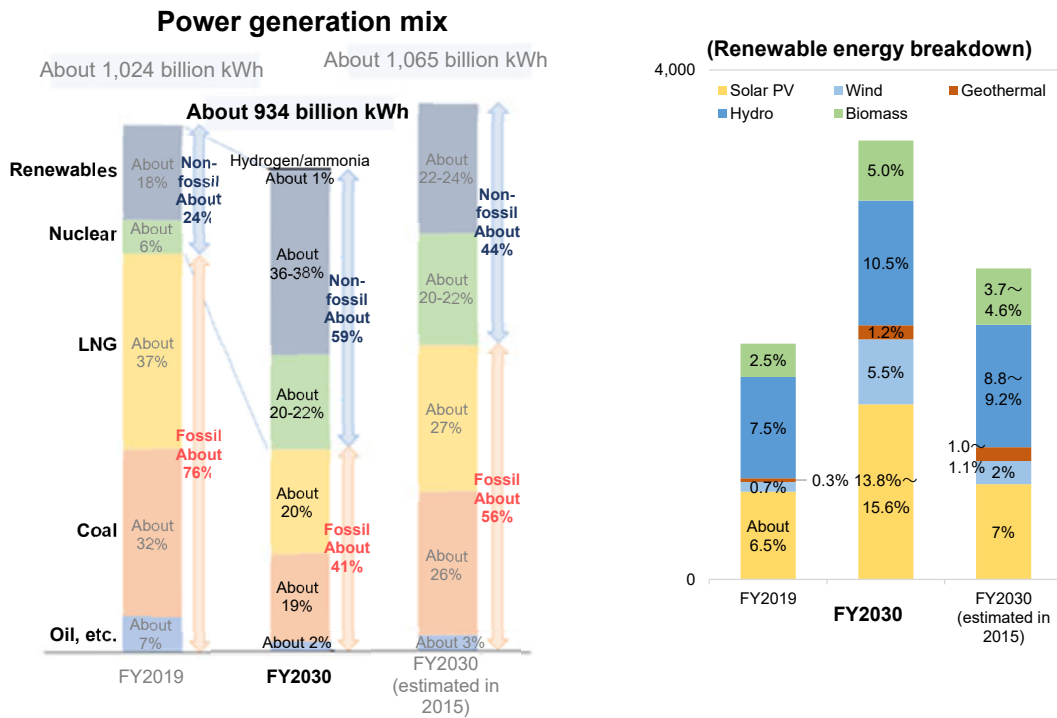


Figure 1 Power generation mix and renewable energy breakdown

Source: Agency for Natural Resources and Energy “FY2030 Energy Supply and Demand Outlook (Appendix)” The renewable energy breakdown was prepared by the author, based on the source.

The share for nuclear among other non-fossil energy sources is left unchanged at 20-22%. To achieve this share by FY2030, around 17 nuclear reactors would have to be restarted in the remaining nine years, following the 10 reactors that have already been restarted (Figure 2). Hydrogen and ammonia are planned as new energy sources to account for some 1% of the power generation mix. Most of the ammonia may be co-fired with coal at existing coal-fired power plants.

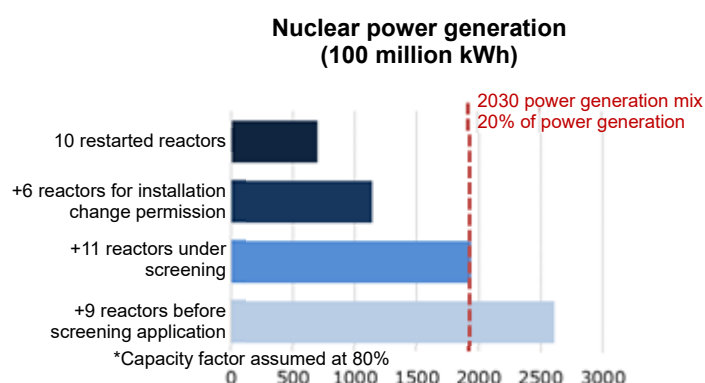


Figure 2 Nuclear power generation outlook

Source) Prepared by the author from Japan Atomic Industrial Forum, Inc. “Data collection: Nuclear energy in Japan”

If the target power generation mix is realized, the power supply and demand situation will change dramatically. Following are conceivable challenges.

(1) Rise in output control frequency and fall in capacity factors for fossil-fired power plants

The relationship between the projected power supply capacity and demand will change dramatically from the present to FY2030. Combined capacity of nuclear, hydro, solar PV and wind power plants slipped below the annual average demand in FY2020 but will exceed the average and maximum demand in FY2030 (Figure 3). This means that the output control frequency will increase as surplus power supply in high capacity factor periods for wind and solar PV plants, as well as low demand periods, becomes more frequent. Even if surplus power supply is prevented, nuclear, hydro, solar PV and wind capacity will cover most demand more frequently, leading to lower capacity factors for fossil-fired power plants.

During output control periods in which supply will exceed demand, regional wholesale electricity prices will fall close to zero. If such periods become more frequent, power generators’ profit from the electricity wholesale market may decrease.

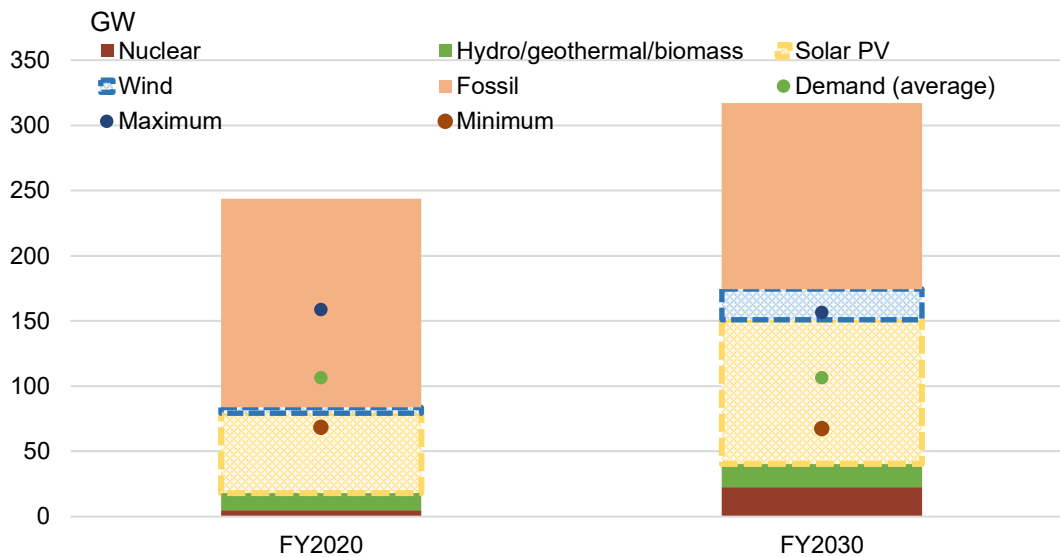


Figure 3 Power supply and demand capacity outlook

Sources) The author estimated FY2020 power supply capacity based on “FY2020 supply plans” by the Organization for Cross-regional Coordination of Transmission Operators, Japan, and projected FY2030 capacity based on “FY2020 supply plans” and “FY2021 supply plans” by the organization and “Strategic Energy Plan” by the Agency for Natural Resources and Energy. The author estimated power demand based on “FY2020 supply plans” by the organization and data at power utilities.

(2) Securing stable supply

FY 2030 supply capacity excluding variable renewables, which means stable supply capacity, is projected to total 183 gigawatts, exceeding the projected maximum demand at 160 GW. However, stable FY2030 supply capacity could be lower than projected due to the current policy-oriented reduction of coal power plant capacity or fossil-fired power plant operators’ curtailment of capacity amid the abovementioned deterioration of their business environment. If the lower-than-projected stable supply is combined with a decline in capacity factors for variable renewable energy power plants under bad weather, power generation and transmission equipment troubles or global fossil fuel procurement difficulties seen in 2021 winter and expected in the coming winter, stable power supply may be endangered. Sufficient preparations for such event will be required.

3. 2050 goal and challenges

While the Strategic Energy Plan does not show specific, power generation mix for 2050, it describes challenges and initiatives in power and non-power sectors toward the carbon neutrality goal.

Energy supply and demand will have to undergo a general structural transition to achieve carbon neutrality by 2050. Any moratorium on such transition would be limited. Given the average service life of some 12 years for automobiles, for instance, sales of new gasoline hybrid vehicles as well as new gasoline and diesel vehicles would have to be terminated by the middle of the 2030s. If not, some of such vehicles may be left available to continue emitting CO₂. (If a ban is imposed on sales of new gasoline, diesel and gasoline hybrid vehicles, however, automobile supply chains may be required to undergo a large-scale transition. A sufficient strategy for such transition will have to be formulated.)

Electrofuels and other alternative fuels that do not emit CO₂ may be used for remaining gasoline and hybrid vehicles under a transitional measure. However, technological and economic challenges must be overcome. A similar transition will be required for ships, aircraft and all other energy-consuming equipment. Carbon neutrality will fail to be achieved if the current situation continues. Discontinuous changes will be required to achieve carbon neutrality.

Even if maximum efforts are made, it may be difficult to make machines, vehicles and other products in Japan carbon neutral by 2050. There may be areas where decarbonization is difficult (in the absence of alternative technologies) or any equipment transition by 2050 is unrealistic. Emissions from these areas will have to be offset by direct air capture, biomass carbon capture and storage, and other negative emission technologies.

A power generation mix proposal for 2050 was given at the Strategic Policy Committee to deepen talks, but no specifics are included in the Strategic Energy Plan. In the course of talks at the committee, multiple research institutes provided scenarios for 2050, which were compared for talks on relevant challenges. Talks will have to be deepened to determine desirable future pathways.

4. Conclusion

When the previous (fifth) Strategic Energy Plan was formulated, a dominant view at the Strategic Policy Committee was that goals should be attainable with a high likelihood for 2030 and ambitious for 2050. However, the sixth plan includes the substantially ambitious goal for 2030 as well as 2050. While it is important to make full efforts to achieve the goals, but preparations for failure to achieve the goals (including the securement of alternative power generation capacity and the formulation of fossil fuel supply plans to meet increased fossil fuel demand) may also be required.

The goals of cutting GHG emissions by 46% in 2030 and achieving carbon neutrality in 2050 in the Strategic Energy Plan are considerably ambitious. There are a lot of challenges to overcome to achieve the goals. Rapid efforts are required toward the 2030 and 2050 goals. To realize the virtuous cycle of economy and environment pursued under recent environmental and energy policies, however, Japan should promote relevant measures in a manner to lead and follow other countries and should make arrangements to develop goods and services that are influential in international markets.

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