METI
Ministry of Economy, Trade and Industry

Outline of Strategic Energy Plan

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Agency for Natural Resources and Energy

The 6th Strategic Energy Plan Table of Contents

Overview of the Strategic Energy Plan

- In the new Strategic Energy Plan, the key theme is to show **the path of the energy policy** to realize **carbon neutrality by 2050 (announced in October 2020),** and reduce greenhouse gas emissions by 46% in FY 2030 from its FY 2013 levels, while continuing strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50% **(announced in April 2021).**

  - In the midst of the global move for decarbonization, it is important for Japan to **lead international rule making** and improve international competitiveness through **decarbonization technology that has been fostered so far and innovation further contributing to decarbonization.**

- At the same time, another important theme is to overcome the challenges Japan's energy supply-demand structure faces. **On the major premise of safety,** efforts **will be made for energy security and economic efficiency of energy while promoting climate change countermeasures (S+3E).**

- Strategic Energy Plan mainly consists of parts of **(1) Progress in the past decade after the accident at TEPCO's Fukushima Daiichi Nuclear Power Station**, **(2) Challenges and responses for achieving carbon neutrality by 2050**, and **(3) Policy responses towards 2030 looking ahead to 2050**.

Points of Progress in the past decade after the accident at TEPCO's Fukushima Daiichi Nuclear Power Station

- On the 10th anniversary of the Great East Japan Earthquake and the accident at the Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi Nuclear Power Station(FDNPS), the starting point of the energy policy is **to take measures keeping in mind the experience, regrets and lessons learned in the accident at the TEPCO's FDNPS.**
- As of March 2021, **22 thousand disaster victims are evacuated. It is the responsibility of the Government, which has promoted the energy policy with nuclear power,** to do our utmost to **achieve the reconstruction and recovery of Fukushima** while reflecting on and responding to the pain felt by the people affected by the accident at TEPCO's Fukushima Daiichi Nuclear Power. In continuous use of the nuclear power, the Government **take safety as top priority, never forgetting that we fell into the trap of the so-called "myth of safety",which resulted in the failure to prevent a disaster like this.**
- Decommissioning of FDNPS is the basic premise of Fukushima's reconstruction. However, it is a globally unprecedented and difficult project. Not depending on the nuclear business operators completely, the Government **stands at the front line**, bring together wisdom from inside and outside of Japan and **is committed to working on it with unwavering determination aiming at its completion between 2041 and 2051.**
- **On the premise of** strictly secured safety and **thorough measures to respond to adverse impacts on reputation** which will be provided by the Government as a whole, **the discharge of the ALPS treated water into the sea is subject to TEPCO's receiving necessary approval from the Nuclear Regulatory Authority (NRA). The actual discharge is envisaged to be launched approximately after two years of the announcement of the basic policy on handling of the water stored in the Fukushima Daiichi NPS.**
- The evacuation order has been lifted on all regions except for the Restricted area. The number of evacuees and the size of the areas under the evacuation orders have declined by 70% compared with the initial figures. No matter how long it takes, with an awareness that it is the Government's responsibility **to lift the evacuation orders in the all Restricted area in the future** and to reconstruct and revitalize the affected areas, **the government proceeds with the improvement of living environment for lifting the evacuation order on the specified reconstruction and revitalization base areas**. **Also, for the areas outside the specified reconstruction and revitalization base areas, in the 2020s, the government will decontaminate the areas necessary for the return of residents and work to lift the evacuation orders**, after carefully confirming each resident's intention to return, so that residents with the intention to return can do so.
- Aiming at self-reliant industrial development of Hama-dori region, etc., **reconstruction of businesses/regular vocations and creation of new industries by putting Fukushima Innovation Coast Framework into practice** will be continuously promoted in tandem. In parallel with promoting the return of refugees, we are also focusing on attracting consumption from people outside the region by increasing tourists and travelers. Aiming at **achieving the Fukushima Plan for a New Energy Society, the Government will work on** further introduction and expansion of **renewable energy and hydrogen as two pillars** as well as **their implementation to the society.**
- In aiming at achievement of **the carbon neutrality by 2050** and **a new GHG emission reduction target by 2030,** as a country having experienced the accident at TEPCO's Fukushima Daiichi Nuclear Power Station, the Government will **give the top priority to safety of the nuclear power** and **reduce dependency on the nuclear power as much as possible** while expanding renewable energy.

Points of challenges and responses to realize carbon neutrality by 2050

- Towards 2050, **efforts for energy sector accounting for over 80% of greenhouse gas emissions** are important.
  - Even taking into account the industrial structure where manufacturing industry accounts for 20% of the nation's GDP and the natural conditions, **realizing carbon neutrality is not easy**. In order to overcome challenges, **all-out efforts at all sectors of society such as industry, consumers and the government** are required.

- Power sector will steadily be decarbonized **through decarbonized power sources under practical use** as well as **pursue innovation in the thermal power generation, etc. by means of hydrogen/ammonia-fired power generation and the carbon storage/utilization based on CCUS/Carbon Recycling .**

- Non-power sector will **electrified by decarbonized power sources**. Sectors where electrification is not feasible (e.g. high-temperature heat demand) will promote decarbonization through the use of hydrogen, synthetic methane and synthetic fuels. Particularly **in industry sector**, **innovations are essential** such as hydrogen-reduced iron making and artificial photosynthesis.
  - **The Government strives to make all-out efforts toward decarbonization innovations using "Green Innovation Fund" and so on so that it will lead to enhancement of competitiveness in Japan's industries.**
  - Fields where carbon dioxide emissions are unavoidable at the end will be addressed by **DACCS, BECCS and forest sink measures**.

- Through our efforts towards carbon neutrality by 2050, **it is essential to support the economic activities by ensuring stable and cost-efficient energy supply on the major premise of safety.** On this premise, **we will address maximum introduction of renewable energy as major power sources on the top priority ; societal implementation of hydrogen and CCUS will be promoted**; and **necessary amount of nuclear power will be continuously utilized on the major premise of ensuring safety and public trust.**

- Including these efforts, **all options will be pursued** to realize carbon neutrality by 2050 with striving to maintain global competitiveness and restrain national burden by securing stable and cost-efficient energy supply.

Points of the policy responses towards 2030 [Basic Plan]

- The major principal of the energy policy is to **first and foremost ensure stable supply**, and **realize low cost energy supply by enhancing its efficiency on the premise of safety**. It is also important to make maximum efforts to **pursue environment suitability (S+3E)**.

Points of the policies towards 2030 [Demand side's efforts]

- Further pursuit of **thorough energy efficiency improvement**
  - **In the industrial sector,** the index and the target values of **the Benchmark Program will be reviewed** to urge business operators to improve their energy efficiency, **the development and the introduction of energy efficient technologies** will be promoted under the new "Energy Efficient Technological Strategies".
  - **In the commercial and residential sectors**, **mandating to meet and enhancing the energy efficiency standards based on the Act on the Improvement of Energy Consumption Performance of Buildings** , and **strengthening the Top Runner equipment/building material standards** will be addressed, in order to enable new housings and buildings built from 2030 to meet ZEH/ZEB efficiency standards.
  - **In the transport sector**, the introduction and dissemination of **electrified vehicles and its infrastructure** will be promoted and **the electrified vehicle-related technologies (e.g. batteries) and supply chains** will be enhanced, **the applications of AI and IoT** will be promoted to encourage the collaboration of shippers and carriers **for overall optimization of freight transportation**.
- Consideration of **new systems to encourage energy transition on demand side**
  - **The amendment of the Act on the Rationalization etc. of Energy Use**, which is aimed at rational use of fossil energies, will be considered. In the new system, **the rationalization of overall energy consumption** including non-fossil energies and **the enhancement of non-fossil energies** will be promoted in parallel.
  - New framework will be established to assess business operators who **enhance the usage rate of non-fossil energies** or **optimize their energy demand in response to the fluctuation of energy supply.**
- **Sophistication of the secondary energy structure** including effective use of distributed energy resources such as batteries
  - **Aggregation businesses utilizing distributed energy resources** such as storage batteries will be promoted; and **efficient energy use, enhanced resilience and activation of the local community** by local production for local consumption will be promoted **by microgrid implementation**.

Points of policy responses towards 2030 [Renewable energy]

- On the major premise of S+3E, utilization of renewable energy **as the major power source** will be ensured; the **top priority** will be put on renewable energy; and **maximum introduction of renewable energy** will be promoted while **managed excessive national burden and co-living with local communities** are being sought.

[Specific efforts]

- **Ensuring optimal siting while living in harmony with local communities**
  → **Introduction and expansion of solar photovoltaic/onshore wind** will be addressed by setting of renewable energy promotion zones **("positive zoning")** based on the amended Act on Promotion of Global Warming Countermeasures; and **acceleration of offshore wind projects** based on the Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities will be addressed.

- **Enhancement of business discipline**
  → **Enhancement of safety measures** by steady implementation of technical standard dedicated to solar photovoltaics and strengthening of accident reporting in small power sources; and backup for local communities in **developing the ordinances** aiming at smooth co-living will be addressed.

- **Cost reduction and market integration**
  → **Integration of renewable energy into the market** will be addressed by **policy collaboration of bidding system, mid- to long-term target prices** and **FIP system** that enhances renewable power suppliers to sell electricity according to the market price.

- **Overcoming power grid constrains**
  → **The bulk systems** such as cross-regional interconnection lines, etc. will be **upgraded by the master plan in "push-type approach"** and **non-firm access will be extended to local grid networks, The rules for use of power grids** will be reviewed so that renewable energy can use the bulk system preferentially to coal-fired power, etc.

- **Rationalization of regulations**
  → **Assessment will be optimized** towards **smooth introduction of wind power generation** and **review of regulations operations of Natural Parks Act, Hot Springs Act, and Forest Act** towards **introduction and expansion of geothermal power** will be addressed.

- **Promotion of technological development**
  → **R & D and societal implementation of advanced solar photovoltaic** mountable on the building walls and less resilient roofs will be accelerated; development of **element technology of floating wind power generation** will be accelerated; and **development of deep drilling technology** to leverage **supercritical geothermal resources** will be addressed.

Points of policy responses towards 2030 [Nuclear]

- **Sincere regrets for the accident of TEPCO's Fukushima Daiichi Nuclear Power Station** is the start point of nuclear policy
  - On the premise that **safety comes before everything else** and **every possible effort is made to resolve people's concerns**, judgment as to whether nuclear power plants meet the new regulatory requirements will be left to the Nuclear Regulation Authority (NRA) and **in case that the NRA confirms the conformity of nuclear power plants with the new regulatory requirements, which are of the most stringent level in the world, the Government will follow NRA's judgment and will proceed with the restart of the nuclear power plants. In that case, the Government will make best efforts to obtain the understanding and cooperation of the host municipalities and other relevant parties.**
- Stable use of nuclear power will be promoted on the major premise that public trust in nuclear power should be gained and that safety should be secured.
  - **Restart of operation with safety as top priority:** launch of **restart acceleration task force**; **bringing human resources and knowledges together**; and **maintaining and improving technological capability**
  - **Measures for spent nuclear fuel: promotion of construction/utilization of interim storage facilities and dry storage facilities, etc. to increase storage capacity**; and **technology development for reducing the volume and harmfulness of radioactive waste**
  - **Nuclear fuel cycle: makes efforts towards the completion and operation of Rokkasho Reprocessing Plant by public and private partnership** obtaining understanding of relevant municipalities involved and international society; and **further promotion of plutonium-thermal (MOX(Mixed Oxide) fueled) power generation**
  - **Final disposal: steady implementation of literature surveys** in two municipalities of Hokkaido, and **commencement of surveys in as many areas as possible across Japan**
  - **Efforts for various challenges, etc. in proceeding with long-term operation with secured safety :**
    Fulfilling conservation activities and considering of various issues depending on each role of public and private sectors
  - **Public understanding:** interactive dialogue including regions where electricity is consumed; and easy-to-understand polite public relations/public hearing
- Building up trustful relationship with local community of the site
  - Perception will be shared and trustful relationship will be deepened through **polite dialogue with local community of the site**; and **support matching its reality** will be provided by **picturing of the region's future profile including multistreaming of local industry and creation of new industries and employment**.
- Promotion of R & D
  - By 2030, while making the most of the private sector's ideas and wisdom**, development of fast reactor will be steadily promoted by utilizing international cooperation**; **small modular reactor technology will be demonstrated through international cooperation**; and **component technologies related to hydrogen production at high temperature gas-cooled reactor will be established**; as well as **R&D of nuclear fusion** will be promoted through international collaboration such as ITER Project, etc.

Points of policy responses towards 2030 [Thermal]

- As to thermal power generation, **on the major premise of its stable power supply**, **thermal power ratio in power generation mix will be lowered as much as possible** **while assuring installed capacity** in a manner that keeps supply capability to cope with instantaneous/continuous power generation reduction in renewable energy and taking into account the following:
  - From the perspective of procurement risk, CO_2 emission per electricity generated, and contribution to improvement in resilience such as stockpiling/ease of storage, **appropriate thermal portfolio will be maintained** in LNG, coal and oil.
  - While promoting next generation/high efficient thermal, **fadeout of inefficient thermal** will be steadily addressed; **CO_2 emission reduction measures such as co-firing with decarbonized fuels e.g. ammonia/hydrogen, etc. and CCUS/Carbon Recycling, etc.** will be promoted towards its replacement with decarbonized type thermal power generation.
- **An end to new direct government support for unabated international thermal coal power generation by the end of 2021, including through Official Development Assistance, export finance, investment, and financial and trade promotion support.**

Points of policy responses towards 2030 [Electric system reform]

- **Configuration of the electric system for achievement of stable power supply compatible with decarbonization**
  - Against the background that energy security risk associated with decreased supply capability emerges, **steady operation of the capacity market and the method to provide new investments with predictability of long-term income** will be considered to make decarbonization and steady energy supply compatible.
  - **Responsibilities/roles for ensuring energy security will be restudied.**
  - Towards introduction and expansion of renewable energy, to **improve flexibility of the electric systems** and **promote decarbonization of balancing power, practical application of batteries and water electrolysis equipment by cost reduction**; **clear positioning of batteries for power grids in the Electricity Business Act**; and **development of the market** will be addressed.
  - As to **non-fossil fuel value trading market, it will be addressed that the increasing of the number of non-fossil certificate with tracking** and making electricity consumers possible to **purchase it directly from that market instead of the green energy products prepared by the electricity retailers** .
  - **For ensuring energy security in disasters, upgrade of cross-regional interconnection lines, reinforcement of measures for fallen trees based on action plans in disaster responces, preparation against cyber attacks, and assurance of cyber security measures** for power suppliers of new entry as well as existing leading power suppliers will be addressed.

Points of policy responses towards 2030 [Hydrogen/Ammonia]

- Looking ahead to the carbon neutral, **hydrogen will be positioned as a new resource and its societal implementation will be accelerated**.

- In order to supply cost-effective hydrogen/fuel ammonia, **steadily and by large amount in the long term, inexpensive hydrogen from overseas will be utilized** and **hydrogen production base will be established by utilizing domestic resources.**

  - **Commercialization of hydrogen production utilizing international hydrogen supply chain and water electrolysis equipment using excess renewable energy, etc.; and development of innovative hydrogen production technology** utilizing high temperature heat sources **such as photocatalyst/high-temperature gas-cooled reactor** will be addressed.

  - **Supply amount of hydrogen will be increased** by **reducing its supply cost to the similar level to those of fossil fuels**.

    Cost: reduction from current 100 yen/Nm^3 to 30 yen/Nm^3 in 2030, and not more than 20 yen/Nm^3 in 2050.

    Supply amount: increase from current approx. 2 million tons/year to max. 3 million tons/year in 2030, and 20 million tons/year in 2050.

- Use of hydrogen on demand side (power, transport, industry and consumer sectors) will be expanded.

  - **In power generation sector** expected to large amount of hydrogen demand, aiming at **introduction/expansion of 30%-hydrogen co-firing in gas-fired power generation or hydrogen-fired power generation** and **20%-ammonia co-firing in coal-fired power generation, demonstration of co-firing/single fuel firing will be promoted** and the environment for appropriate assessment of non-fossil value will be prepared. In addition, **1% hydrogen/ammonia will be positioned in power generation mix in FY2030.**

  - **In transport sector, hydrogen station will be strategically streamlined for further expansion of FCVs and future FC trucks.**

  - **In industry sector, large scale diversion of manufacturing process such as** hydrogen-reduced iron making and **technology development of burners and large and highly functional hydrogen-fired boilers** based on its combustion characteristics will be addressed.

  - **In buildings sector, technology development towards cost reduction** will be addressed **for further introduction and expansion of stationary fuel cells** including pure hydrogen fuel cell.

Points of policy responses towards 2030 [Resources/Fuels]

- **Stable and seamless procurement of necessary resources and fuels into the future** will be ensured while promoting smooth transition to carbon neutrality
  - In addition to ensuring stable supply of oil, natural gas and mineral resources, **"comprehensive resource diplomacy" will be newly deployed to integrally promote establishment of hydrogen/fuel ammonia supply chains and secure suitable sites for CCS advantage of the networks having been fostered with resource-rich countries in the past diplomacy**. In addition, active involvement in **realistic energy transitions in Asia** will be demonstrated.
  - **Functional enhancement of JOGMEC** will be considered so that it can **play a role in developing technology and supplying risk money** for **introduction of decarbonized fuels/decarbonization technology such as hydrogen, ammonia and CCS.**
  - Independent development ratio of **oil and natural gas** will be aimed to increase from 34.7% in FY2019 **to more than 50% in 2030** and **more than 60% in 2040**. Further, **domestic resource development including methane hydrate** will be addressed.
  - As to **mineral resources, financial support for Japan's interest in rare metals, etc.** with a concern of supply disruption **will be enhanced**. **By securing overseas interests and promoting base metal recycling**, **securing mineral resources of equivalent amount in domestic demand will be aimed by 2050.** In addition, **development of domestic marine mineral resources such as Sea-floor polymetallic sulphides and rare-earth yttrium rich mud, etc** will be addressed.
- **Resilience of the fuel supply system will be enhanced** and **efforts for decarbonization will be promoted** to cope with not only ordinary but also emergency situations.
  - In order to make energy supply solid in emergency situations such as disaster, **stockpiling function of oil and LP gas will be maintained**; **productivity of refineries will be improved** by cooperation between businesses inside and outside complexes; and **decarbonization such as use of CO_2 free hydrogen in the refineries** will be addressed.
  - Transition of **service stations supplying energy to the local community** to **"comprehensive energy hub" involved in supply, etc. of energy to EVs and FCVs** and **"local community infrastructure" providing services meeting local needs** will be addressed while supply of oil products being continued.
  - We will pursue **the shift to natural gas** on demand side and **decarbonization of gas through methanation** and other means, which play a significant role in **decarbonizing heat demand**. We will also work to further **strengthen the resilience of gas**.

Points of outlook for energy supply and demand in FY2030 (1)

- In the light of new GHG emission reduction target in FY2030, this outlook shows **energy supply and demand on the ambitious assumption that various challenges in both aspects of supply and demand** in promoting thorough energy conservation and expansion of non-fossil energy **will be overcome**.

- In implementing the measures towards this ambitious outlook, **degree and timing of implementation of the measures need to be carefully considered for stable supply of energy not to be impaired.** (e.g. If fossil fuel power sources are immediately curtailed at a stage prior to full introduction of non-fossil fuel power sources, stable supply of electricity can be impaired.)

		(FY2019 ⇒ previous energy mix)		**Energy mix in FY2030 (ambitious outlook)**	
Energy efficiency improvement		(16.55 million kl ⇒ 50.30 million kl)		**62 million kl**	
Final energy consumption (without energy conservation)		(350 million kl ⇒ 377 million kl)		350 million kl	
Power generation mix Electricity generated : 1,065 TWh ⇒ Approx. 934 TWh	**Renewable energy**	(18% ⇒ 22-24%)	solar 6.7% ⇒ 7.0% wind 0.7% ⇒ 1.7% geothermal 0.3% ⇒ 1.0~1.1% hydropower 7.8% ⇒ 8.8~9.2% biomass 2.6% ⇒ 3.7~4.6%	**36-38%** **※If progress is made in utilization and implementation of R&D of renewable energy currently underway, 38% or higher will be aimed at.**	
	Hydrogen/Ammonia	(0% ⇒ 0%)		**1%**	
	Nuclear	(6% ⇒ 20-22%)		**20-22%**	(details of renewable) solar 14～16% wind 5% geothermal 1% hydropower 11% biomass 5%
	LNG	(37% ⇒ 27%)		**20%**	
	Coal	(32% ⇒ 26%)		**19%**	
	Oil, etc.	(7% ⇒ 3%)		**2%**	
(＋ non-energy related gases/sinks)					
GHG reduction rate		(14% ⇒ 26%)		**46%** **Continuing strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%**	

Points of outlook for energy supply and demand in FY2030 (2)

- Outlook for 3E **if ambitious outlook is achieved**,

  - **Energy Security**

    Energy self-sufficiency rate (*1) ⇒ **Approx. 30%** (Previous energy mix: roughly 25%)

  - **Environment**

    Energy-related CO_2 reduction rate among GHG reduction targets ⇒ **Approx. 45%** (Previous energy mix: 25%)

  - **Economic Efficiency**

    Electricity cost on the assumption that (1) introduction and expansion of cost-reduced renewable energy and (2) price decline of fossil fuels as IEA's outlook (*2) are achieved.

    ⇒ Entire electricity cost **Approx. 8.6-8.8 trillion yen** (Previous energy mix: 9.2-9.5 trillion. yen) (*3)

    Per kWh **Approx. 9.9-10.2 yen/kWh** (Previous energy mix: 9.4-9.7 yen/kWh) (*4)

*1 In addition to resource self-sufficiency rate, it is also important to improve the "technology self-sufficiency rate" (the degree to which energy supply is covered by the country's own technology against domestic energy consumption) through securing core technologies in the supply chain in the country and leading the innovation of such technologies in the world.

*2 World Bank and EIA (U.S. Energy Information Administration) expected rise in prices of fossil fuels in the latest outlook.

*3 Based on the WG for verification of power generation cost (adopting the value of the Stated Policies Scenario (STEPS) in IEA "World Energy Outlook 2020"), we estimate that FIT purchase cost, fuel cost and grid stabilization cost will be approximately 5.8-6.0 trillion yen, 2.5 trillion yen and 0.3 trillion yen, respectively. (The grid stabilization cost includes only the loss due to the decrease in thermal efficiency and the startup and shutdown costs of thermal power generation caused by the introduction of renewable energy sources with natural variability. It may increase depending on actual grid conditions).

*4 It is calculated mechanically to be "Electricity cost" divided by "amount of electricity demand excluding transmission loss, etc. from amount of power generation". This is different from electric charge. Actual electric charge is difficult to predict accurately because they include transmission charges and is greatly affected by the operating conditions of power sources, fuel prices, and electricity demand.