Energy Policy
toward net-zero GHG emissions by 2050

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1. PM Declaration toward 2050

- In Oct 2020, PM Suga declared Japan’s intention to aim for net-zero GHG emissions by 2050.

- In order to bring about a transformation of industrial structures, GOJ formulated Green Growth strategy in December 2020. (5 policy Tools, 14 Growth Sectors)

- The Strategic Energy Plan is currently under review.
### 2. Points of the 5 policy tools

| Grant funding | ✓ **Green Innovation Fund**: 2 trillion yen over 10 years  
|               | ✓ Stimulate **15 trillion yen** worth of private R&D and investment. |
| Tax incentive  | ✓ Tax incentives to stimulate **1.7 trillion yen** worth of private investment over 10 years. |
| Guidance policy on Finance | ✓ Formulate guidelines for transition finance and establish a scheme for **long-term funds with an interest subsidy (1 trillion yen in 3 years)** in business scale basis) to attract global ESG investment. |
| Regulatory Reform | ✓ Consider regulatory reform in areas such as **hydrogen, offshore wind power, and mobility/batteries**.  
|                  | ✓ Discuss issues concerning carbon border adjustment and related policies with a view to ensuring global level playing field |
| International Collaboration | ✓ Cooperation with various players, including both developed and emerging countries, on **innovation policy, joint projects** including third countries, **standardization and rule-making**, and providing wide variety of **solutions toward de-carbonization**  
|                      | ✓ World wide promotion efforts through “**Tokyo Beyond-Zero Week**” |
## 3. 14 Growth Sectors

### Energy
- Offshore wind power
  - Wind turbines, parts, floating wind turbines
- Fuel ammonia
  - Combustion burner
    - (as fuel in transition period to hydrogen-powered society)
- Hydrogen
  - Turbines for power generation, hydrogen reduction steel-making, carrier ships, water electrolyzers
- Nuclear power
  - SMR (Small Modular Reactor), nuclear power for hydrogen production

### Transport/Manufacturing
- Mobility and battery
  - EV (electric vehicle), FCV (fuel cell vehicle), next generation batteries
- Semiconductor and ICT
  - Data centers, energy-saving semiconductors
    - (demand-side efficiency)
- Maritime
  - Fuel-cell ships, electric propulsion ships, gas-fueled ships
- Logistics, people flow and infrastructure
  - Smart transportation, drones for logistics, fuel-cell construction machinery
- Foods, agriculture, forestry and fisheries
  - Smart-agriculture, wooden skyscrapers, blue carbon
- Aviation
  - Hybrid electric, Hydrogen-powered Aircraft
- Carbon Recycling
  - Concrete, biofuel, plastic materials

### Home/Office
- Housing and building,
  - Next generation PV
    - (perovskite solar cell)
- Resource circulation
  - Biomaterials, recycled materials, waste power generation
- Lifestyle-related industry
  - Local decarbonization business
Japan will aim at increasing power generated by renewables up to 22-24% by 2030 and “will make renewables primary generation source”.

### Power generation ratio (%)

- **2010**: 645% Thermal, 10% Renewables incl. hydro, 25% Nuclear
- **2018**: 77% Thermal, 17% Renewables incl. hydro, 6% Nuclear
- **2030**: 56% Thermal, 22-24% Renewables incl. hydro, 20-22% Nuclear

- **Hydro**: 8.8-9.2%
- **Solar**: 7.0%
- **Wind**: 1.7%
- **Biomass**: 3.7-4.6%
- **Geothermal**: 1-1.1%
5. Renewable electricity introduction in Japan

Source: Agency for Natural Resources and Energy
<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Before FIT (June 2012)</th>
<th>After FIT [A] (as of September 2019)</th>
<th>Target [B] (FY2030)</th>
<th>Progress [A]/[B]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geothermal</td>
<td>0.5GW</td>
<td>0.6GW</td>
<td>1.4 - 1.6GW</td>
<td>40%</td>
</tr>
<tr>
<td>Bioenergy</td>
<td>2.3GW</td>
<td>4.3GW</td>
<td>6.0 - 7.3GW</td>
<td>64%</td>
</tr>
<tr>
<td>Wind</td>
<td>2.6GW</td>
<td>3.9GW</td>
<td>10GW</td>
<td>39%</td>
</tr>
<tr>
<td>Solar PV</td>
<td>5.6GW</td>
<td>52.4GW</td>
<td>64GW</td>
<td>82%</td>
</tr>
<tr>
<td>Hydro (middle or small)</td>
<td>9.6GW</td>
<td>9.8GW</td>
<td>10.9 – 11.7GW</td>
<td>86%</td>
</tr>
</tbody>
</table>
7. Major Challenges toward further renewables expansion

1) Introduction of Offshore Wind Power

- **Offshore Wind Promotion Act**
  - came into force in April 2019
  - Round 1 auctions in four sites are in progress now under this act

- **Japan’s Vision for offshore wind power**
  - The strategy newly formulated in December 2020 in collaboration with the government and private sector
  - Introduction Target; **10GW by 2030, 30-45GW by 2040**
    - Approx. 1GW awarding capacity per year for 10 years
  - Cost target; **8-9 yen/kwh by 2030-2035**
  - Inward investment to build the reliable supply chain
  - Long-term plan to strengthen the power grid
  - Technology roadmap including floating
8. Introduction Target by area (images)

*Figures for 2030 are based on projects that are undergoing environmental assessment (as of end of October 2020, including some projects for which environmental assessment has been completed).

*Figures for 2040 are based on LCOE (Levelized Cost of Energy) and other data from the NEDO Report on the Support Project for the Development of Floating Wind Farms (Study of Offshore Wind Power Generation Costs), reviews by experts, and the status of environmental assessments by power producers. In preparing this map, the potential of floating wind power farms was not factored in.
Long-term Grid reinforcement plan based on cost-benefit basis

Maximum use of existing grid (“Connect and Manage”)

9. Major Challenges toward further renewables expansion

2) Grid constraints

Inter-regional grid constraints

Frequency: **60Hz**

- **Hokkaido**: 5GW
- **Tohoku**: 14GW
- **Kansai**: 27GW
- **Hokuriku**: 5GW
- **Kyushu**: 15GW
- **Chugoku**: 10GW
- **Shikoku**: 5GW
- **Okinawa**: 2GW
- **Chubu**: 25GW
- **Tokyo**: 53GW

**Frequency**: **50Hz**

- **Frequency Converter**: 1.2GW
- **Large electricity demand areas**

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- Large electricity demand areas
10. Major Challenges toward further renewables expansion

3) Higher Cost

- Expanding auction scheme for solar PV, wind and bioenergy
- Reforming FIT scheme suitable for the characteristic of each power source
- Introduction of FIP

Increasing FIT Surcharge in Japan

Source: METI, Subcommittee on Massive Integration of RE and Next-Generation Electric Power Network (2019)
Source: METI, News Release (2020)
### 11. FIT tariffs

#### Tariff transition

**Wind (offshore)**
- Price target for 2030: 8-9 JPY (only bottom fixed)

**Solar (~10kW)**
- Price target for 2025: Market price

**Solar (~10kW~)**
- Price target for 2025: 7 JPY

**Biomass (wood biomass, 20MW~)**

**Wind (onshore)**
- Price target for 2030: 8-9 JPY

**Hydro (200kW~1,000kW)**

**Geothermal (15MW~)**

#### Target of auction

**< Solar for non-residential >**

<table>
<thead>
<tr>
<th>Year</th>
<th>10kW~</th>
<th>10kW~ 2,000kW</th>
<th>10kW~ 500kW</th>
<th>10kW~ 50kW</th>
<th>10kW~ 13 JPY</th>
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<tbody>
<tr>
<td>2016</td>
<td>24 JPY</td>
<td>21 JPY</td>
<td>18 JPY</td>
<td>14 JPY</td>
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<tr>
<td>2017</td>
<td>10kW~</td>
<td>10kW~ 2,000kW</td>
<td>10kW~ 500kW</td>
<td>10kW~ 50kW</td>
<td>10kW~ 13 JPY</td>
</tr>
<tr>
<td>2018</td>
<td>10kW~</td>
<td>2,000kW</td>
<td>14 JPY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>500kW~</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>250kW~</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**< Biomass >**
- For biomass liquid fuel: since 2018 FY
- For wood biomass over 10MW: since 2018 FY
12. Major Challenges toward further renewables expansion

4) More flexibility needs

- Enhancing conventional flexibility sources
  (Thermal power, pumped storage, interconnection, etc.)
- Exploring new flexibility sources
  (Renewables, virtual power plant, demand response, etc.)

Supply and demand balance in Kyushu
(8th March 2020)

Source: Kyushu Electric Power Co., INC
13. Hydrogen; Key technology for carbon neutrality

- Decarbonized electricity (Grid flexibility and storage, generation)
- Effective utilization of Fossil Fuel (+ CCUS/Carbon recycling)
- Development of sector-coupling (decarbonization of heat, methanation, e-fuel, etc.)
14. Hydrogen Roadmap (under consideration)

**Current**
- FCVs & stationary fuel cells already commercialized
- Hydrogen used in the desulfurization process in oil refinery
- Almost all of the hydrogen is fossil-fuel based, with CO2 emission

**- 2030**
- Fuel cells in other mobility, such as commercial vehicles
- Hydrogen power generation (starting demo by the first half of 2020s)
- International large-scale supply chain (starting demo after FY 2025)

**2030-2050**
- Reduce cost through increasing use of hydrogen in power sector
- Establish technology to use hydrogen in industry, such as hydrogen-based reduction for steel making
- Expand domestic Green hydrogen by deploying electrolyzers

**2050**
- Contribute to the carbon-neutrality by expanding use of hydrogen in a variety of sectors, including steel industry and heat using process

* A revision of the National Hydrogen strategy is being considered.
15. Development of Hydrogen technology/projects

**H₂ Mobility**

- **H₂ Station Network**
  - *135 Stations
  - 2013～

- **H₂ Applications**
  - 101 FC buses
  - 2016～

- **Joint Venture for H₂ Infrastructure Development**
  - 2018～

- **R&D**
  - MIRAI 2 on Sale
    - 2019～
  - 10MW Electrolyser started operation
    - 2019～

**Local/regional projects**

- **Fukushima prefecture**
  - 2020.3
  - "F HER"
  - 10MW Electrolyser started operation

- **Creating Hydrogen Hubs**
  - "Hydrogen Utilization Study Group in Chubu"
    - "Hydrogen Utilization Council in Kobe/Kansai area"
    - 2020

- **Hydrogen power generation**
  - 30% H₂ blending by 2025 and 100% H₂ by 2045
  - 2025～
16. Development of International Hydrogen Supply Chain

**Hydrogen Energy Supply Chain Project**
- The LH2 carrier ship plans to transport hydrogen to Japan in 2021.

**Brunei Project**
- Dehydrogenation Plant in Japan completed in May 2020.
- Integrated supply chain has been established.

Hydrogenation (TOL → MCH)  Dehydrogenation (MCH → TOL)
17. Energy Outlook of net-zero GHG emissions in 2050

- **2018**
  - Non-electricity: 1.06 billion ton
- **2030 mix**
  - Non-electricity: 0.93 billion ton (▲25%)
- **2050**
  - Emission reduction + Removals = net zero (▲100%)
  - (Future discussion will not be limited to this reference value)

※values are the amounts of CO2 derived from energy

- **Non-electricity**
  - Consumer: 0.11 bil ton
  - Industry: 0.3 bil ton
  - Transport: 0.2 bil ton

- **Electricity**
  - 0.45 bil ton
  - 0.36 bil ton

- **Carbon removal**
  - 30-50% increase of electricity demand

- **Decarbonized electric sources**
  - Fossil fuel
  - Hydrogen, methanation, synthesis fuel, biomass
  - Decarbonized electric sources (50~60%)
  - Nuclear
  - Thermal +CCUS/ (30~40%)
  - Carbon Recycling
  - Hydrogen/ammonia (10%)
  - Plantation, DACCS

- **Future discussion will not be limited to this reference value**

*Analyzing scenarios further, discussion continues towards revision of the Strategic Energy Plan.*
Thank you