Japan's current progress of GHG reduction

SBI50, Bonn, 24 June 2019
Outline of the Presentation

- GHG Emissions and Trends
- Current Progress Status on Emission Reduction Target
- Policies and Measures
- Japan's Long-Term Strategy
- Summary
GHG Emissions and Trends
Japan's GHG emissions in FY2017 are 1,292 million tons-CO₂:

- GHG emissions have been decreasing for four consecutive years.
- Returning to levels before the Great East Japan Earthquake that caused a nuclear power plant accident in 2011.

The decoupling has been observed between GHG emissions and economic growth:

- GHG intensity of GDP has been decreasing for five consecutive years.

(Source) National Greenhouse Gas Inventory Report of Japan (April, 2019), Global Warming Countermeasures Plan

Note: The values of GHG emissions are based on the 2019 GHG inventory submission, which were revised from the values reported in the BR3.
The largest emission source is the energy sector, which covers around 90% of total GHG emissions.

Since 2014, CO₂ emissions from the energy sector have decreased due to the progress in energy saving activities and the decrease in thermal power generation.

**Emissions by gas in FY 2017**
(excluding LULUCF)

- Energy: 88.1%
- IPPU: 7.8%
- Agriculture: 2.6%
- Waste: 1.6%

**Emissions trends by sector**

(Source) National Greenhouse Gas Inventory Report of Japan (April, 2019)

Note: The values of GHG emissions are based on the 2019 GHG inventory submission, which were revised from the values reported in the BR3.
In emissions trends by gas, CO₂ covers over 90% of total GHG emissions.

Methane (CH₄) and Nitrous oxide (N₂O) emissions have decreased as a result of implementation of policies and measures.

In recent years, the increase in fluorocarbon emissions is an issue to be resolved.

(Source) National Greenhouse Gas Inventory Report of Japan (April, 2019)

Note: The values of GHG emissions are based on the 2019 GHG inventory submission, which were revised from the values reported in the BR3.
Current Progress Status on Emission Reduction Target
## Current Progress Status on Japan's Emission Reduction Target

- **2020 target**: 3.8% or more emission reduction by FY2020 against FY2005 (Updated on May, 2016)
- **2030 target (Japan’s 1st NDC)**: 26.0% reduction by FY2030 against FY2013 (25.4% reduction against FY2005)

<table>
<thead>
<tr>
<th><strong>Current status (FY2017)</strong></th>
<th><strong>2020</strong></th>
<th><strong>2030</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Current status</em> (FY2017)</td>
<td>-10.6% (excluding LULUCF: -6.5%) against FY2005</td>
<td>-12.4% (excluding LULUCF: -8.4%) against FY2013</td>
</tr>
<tr>
<td><strong>Emission reduction target</strong></td>
<td>3.8% or more reduction against FY2005</td>
<td>26.0% reduction against FY2013 (25.4% reduction against FY2005)</td>
</tr>
<tr>
<td><strong>Covered gases</strong></td>
<td>CO₂, CH₄, N₂O, HFCs, PFCs, SF₆ and NF₃</td>
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<tr>
<td><strong>GWP</strong></td>
<td>IPCC AR4</td>
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</table>
Policies and Measures
Japan’s official general plan for global warming prevention; in order to promote global warming countermeasures comprehensively and strategically.

Decided by the Cabinet on May 13, 2016

Prescribes the targets of emissions reduction and removal of GHG, the basic matters on measures to be taken by businesses and the public etc., and policies to be implemented by the National Government and Local Government.

## Contents

- **Direction to pursue:**
  - **Actions to achieve mid-term target** (26% reduction by FY 2030)
  - Strategic actions towards long-term goal (80% reduction by 2050)
  - Actions toward global GHG reduction

- **Basic concept:**
  - Integrated improvements of the environment, economy and society
  - **Steady implementation of measures** listed in Japan’s NDC
  - Enhancement of R&D and contribution to global GHG emissions reduction through Japan’s leading technologies
  - Transformation in consciousness of all actors, evocation of action and enhancement of collaboration
  - Response to Paris Agreement (consideration of long-term and strategic actions)
  - Importance of PDCA cycle
Progress management of Plan for Global Warming Countermeasures

- Strictly implement the progress management in three stages to achieve 26.0% reduction target in 2030.
  1) National level
     Disclose the national total GHG emissions twice a year (preliminary figure in November or December, confirmed figure in April (submitted to UNFCCC)).
  2) By gas and by sector
     Targets are established by gas and by sector, and the progress are reviewed annually at the Global Warming Prevention Headquarters.
  3) For individual measures
     Individual evaluation indexes are established and reviewed annually at Global Warming Prevention Headquarters.

(Note: If the progress is delayed, consider possible further actions including enhancing and strengthening the measures or adding new measures)
→ The results of evaluation are confirmed by a council composed of experts and then disclosed to the public.
➢ Based on these results, the Plan is considered to be revised every three years.

Examples of measure evaluation indexes for individual measures

<table>
<thead>
<tr>
<th>Measure evaluation index</th>
<th>Results in FY2017</th>
<th>Milestone in FY2020</th>
<th>Target in FY2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accumulated introduction capacity of co-generation</td>
<td>10,600MW</td>
<td>11,340MW</td>
<td>13,200MW</td>
</tr>
<tr>
<td>Introduction of high-efficiency lightning (LED)</td>
<td>160 million (Commercial)</td>
<td>180 million (Commercial)</td>
<td>320 million (Commercial)</td>
</tr>
<tr>
<td></td>
<td>240 million (Residential)</td>
<td>240 million (Residential)</td>
<td>440 million (Residential)</td>
</tr>
<tr>
<td>CO₂ intensity of electricity sector</td>
<td>0.496 kg-CO₂/kWh</td>
<td>—</td>
<td>0.37 kg-CO₂/kWh</td>
</tr>
<tr>
<td>Share of next-generation vehicle in new car sales</td>
<td>35.7%</td>
<td>50%</td>
<td>70%</td>
</tr>
</tbody>
</table>
Industrial organizations voluntarily set up emission reduction targets, prior to the Government’s target setting, and promoted efforts for their achievement from 1997.

Action plans comprise 4 pillars:
1) emission reduction targets from domestic business operations (2020 reduction target, 2030 reduction target)
2) development/diffusion of low-carbon products;
3) contribution at the international level through contribution to other sectors through technology transfer
4) development/introduction of innovative technologies.

Electric, Oil & Gas, Iron & Steel, Chemical, Electronics & Machinery, Automobile, etc., 115 major industrial associations have been seriously tackling with climate change actions through their action plans.

<table>
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<tr>
<th>Examples of 2030 reduction target</th>
<th>Target indicator</th>
<th>Baseline year</th>
<th>2030 reduction target</th>
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<tr>
<td>Japan Iron and Steel Federation</td>
<td>CO2 emissions</td>
<td>BAU</td>
<td>-9 Mil t-CO2</td>
</tr>
<tr>
<td>Japan Chemical Industry Association</td>
<td>CO2 emissions</td>
<td>BAU</td>
<td>-2 Mil t-CO2</td>
</tr>
<tr>
<td>Japan Paper Association</td>
<td>CO2 emissions</td>
<td>BAU</td>
<td>-2.86 Mil t-CO2</td>
</tr>
<tr>
<td>Japan Cement Association</td>
<td>Energy intensity</td>
<td>2010</td>
<td>Less than -49MJ/t-cem (more than -1.4%)</td>
</tr>
<tr>
<td>Liaison Group of Japanese Electrical and Electronics</td>
<td>Energy intensity</td>
<td>2012</td>
<td>More than -16.55%</td>
</tr>
<tr>
<td>Industries for Global Warming Prevention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan Automobile Manufacturers Association / Japan</td>
<td>CO2 emissions</td>
<td>1990</td>
<td>-38%</td>
</tr>
<tr>
<td>Auto-Body Industries Association</td>
<td></td>
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<td></td>
</tr>
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</table>
Energy conservation standards according to the Top Runner Program have been implemented for automobiles and household electrical appliances according to Act on the Rational Use of Energy as amended in 1998.

32 equipment and materials are subject to these standards.

When standards are set
Energy Conservation Standards according to Top Runner Program

Judgment made with weighted average for each product category.

Example of Top Runner Program

Fuel economy (km/L)

- 19 km/L
- 18 km/L
- 17 km/L
- 16 km/L
- 15 km/L
- 14 km/L
- 13 km/L
- 12 km/L

Target fiscal year

1. Passenger vehicles
2. Air conditioners
3. Lighting equipment
4. TV sets
5. Copying machines
6. Computers
7. Magnetic disk units
8. Freight Vehicles
9. Video cassette recorders
10. Electrical refrigerators
11. Electrical freezers
12. Space heaters
13. Gas cooking appliances
14. Gas water heaters
15. Oil water heaters
16. Electric toilet seats
17. Vending machines
18. Transformers
19. Electric rice cookers
20. Microwave ovens
21. DVD recorders
22. Routers
23. Switching units
24. Multifunction devices
25. Printers
26. Electric water heaters
27. AC motors
28. Lamps
29. Showcase
30. Insulation materials
31. Sashes
32. Multi-paned glazing
In considering the target energy mix, the government estimates the feed-in tariff cost at 3.7 – 4.0 trillion yen for expanding renewable energy after cutting electricity costs from present levels.

After the FIT introduction, the FIT cost in FY2019 already reached about 3.6 trillion yen (with FIT surcharges totaling about 2.4 trillion yen). Cost-efficient renewable energy expansion is required for achieving both the maximum expansion of renewable energy and the containment of FIT surcharges.

**Concept of electricity costs in the target energy mix**

- **9.7 trillion yen**
  - Fuel cost cuts through nuclear restart, renewable energy and more efficient fossil fuel-fired power generation
  - About 5.3 trillion yen (Fossil fuels, nuclear)

- **9.2 trillion yen**
  - Costs for renewable energy expansion
  - About 3.7-4.0 trillion yen
  - FIT cost (Renewable energy)

- **0.5 trillion yen**
  - Grid stabilization cost
  - About 0.1 trillion yen

**Surcharge trend after FIT system introduction**

- **FIT cost in the target energy mix**
  - 3.7 – 4.0 trillion yen

- **FY2013**
  - (Note) The FIT cost represents the cost accompanying renewable energy introduction and expansion. The cost includes some avoidable costs equal to fuel cost cuts.
  - 57 yen/month

- **FY2014**
  - 91 yen/month

- **FY2015**
  - 195 yen/month

- **FY2016**
  - 586 yen/month

- **FY2017**
  - 686 yen/month

- **2018FY**
  - 754 yen/month

- **2019FY**
  - 866 yen/month

- **2020FY**
  - 974 yen/month

Source: “Long-term Energy Supply and Demand Outlook Appendix”
Japan's policies and measures (4)
Legislations and Regulations for Fluorocarbons

- Act on the Protection of the Ozone Layer Through the Control of Specified Substances and Other Measures (Ozone Layer Protection Law): enacted in 1988. In order to implement obligation to reduce production and consumption of fluorocarbons based on Montreal Protocol, **manufactures and imports of fluorocarbons are controlled**. Pursuant to the Kigali amendment, **HFCs** become among those **subject to be controlled from 2019**.

- Act on Rational Use and Proper Management of Fluorocarbons (Fluorocarbons Emission Restraining Law): Aiming for restraining emission of fluorocarbons, the Act **provides comprehensive approaches throughout the lifecycle of fluorocarbons**, including periodical inspection of commercial refrigeration and air-conditioning equipment using fluorocarbons, in addition to recovery of fluorocarbons from these equipment at the time of disposal. **The Act was amended on May 2019 for further improvement of the system of the recovery at the disposal.**

**Fluorocarbons Manufacturer**

**Product Manufacturers Using Fluorocarbons**

**Refrigerator and Air Conditioner Users**

**Filling/Recovery Operator**

**Destruction/Recycling Operator**

**Recovery of Fluorocarbons at Equipment Disposal**

**Periodical Inspection**

**Report Leakage Amount**

**Comprehensive Approaches throughout the Lifecycle of Fluorocarbons**

- Reduction of Environmental Impact of Fluorocarbons Used to Designated Products
- Periodical Inspection of Equipment and Report of Leakage Amount
- Recovery of Refrigerant Fluorocarbons at Equipment Disposal
- Appropriate Destruction or Recycle of Recovered Refrigerant Fluorocarbons and Others

**Ozone Layer Protection Law (Amended in 2018)**

**Fluorocarbons Emission Restraining Law**
Japan's policies and measures (5)
Joint Crediting Mechanism (JCM)

Progress:
- 17 partner countries with 146 projects in the pipeline
- Credits already issued from 21 projects
- 69 MRV* methodologies

(Example of pipeline projects)

- **Waste heat recovery in cement industry**
  - (Indonesia)
  - 149,063tCO2/y.

- **Waste to Energy plant**
  - (Myanmar)
  - 4,125tCO2/y.
  - Start operation: Jun. 2017

- **Operation Optimization in Utility Facility**
  - (Indonesia)
  - 34,956t
  - Start operation Dec. 2017

- **Low carbonization of mobile communication station**
  - (Indonesia)
  - 146t
  - Start operation: Apr. 2017

MRV: measurement, reporting and verification
Japan's Assistance

Actions for Cool Earth: ACE 2.0

➢ Mobilize JPY 1.3 trillion of climate finance in 2020 to commit USD 100 billion goal

Innovation for Cool Earth Forum: ICEF

➢ Annually host a global conference on innovative technologies to tackle climate change

Partnership to Strengthen Transparency for Co-Innovation (PaSTI)

➢ Promote climate change actions from non-state actors such as private sector and local governments

➢ Highlight added-values to existing initiatives on transparency, and promotes engagement of the private sector by identifying incentive mechanisms

Olkaria geothermal plant, Kenya
Japan's Long-Term Strategy
Process of Formulation of Japan’s Long-term Strategy

Long-term Strategy based on the Paris Agreement
“All Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2 (2°C goal, efforts to limit the temperature increase to 1.5 °C, etc.), …” (Article 4, para19)

Under the instruction of the prime minister, meetings on a Long-Term Strategy under the Paris Agreement as Growth Strategy were held to discuss fundamental approach. In April 2019, a recommendation for the government was compiled.

Following the recommendation, relevant ministries developed a draft of the strategy. Invited views from members of councils, public comments, and opinion exchange with young generation and local communities.

In June, Long-Term Strategy under the Paris Agreement as Growth Strategy was approved by the cabinet.
Chapter 1: Basic Concept

**Vision:** Proclaiming a “decarbonized society” as the ultimate goal and aiming to accomplish it ambitiously as early as possible in the second half of this century, while boldly taking measures towards the reduction of GHGs emissions by 80% by 2050

* an unconventional vision of an “ideal future model”
* contributing to the achievement of the long-term goals of the Paris Agreement, including efforts to limit the temperature increase to 1.5°C

**Basic Principles of Policy:**
Realizing “a virtuous cycle of environment and growth” towards the vision with business-led disruptive innovation, Swift implementation of actions from now, contributing to the world, **Action Towards a bright Society with Hope for the Future**

[Factors: Achievement of SDGs, Co-creation, Society5.0, the Circulating and Ecological Economy, leading country in solving problems]

Chapter 2: The Vision of Each Sector and the Direction of Measures

1. **Energy**
Pursuing every option for promoting energy transitions and decarbonization

2. **Industry**
Decarbonized manufacturing

3. **Transport**
Contribution to the challenge of “Well-to-Wheel Zero Emission”

4. **Community and Living**
Realizing carbon neutrality, resilient and comfortable communities and lives by 2050/creating the “Circulating and Ecological Economy”

5. **Measures for Carbon Sinks**
Conserving the natural environment and creating sustainable new values in agriculture, forestry and fisheries industries to secure sufficient carbon sink for decarbonized society
1. Promotion of Innovation
Promoting innovation for practical application and wider usage of cross-sectoral decarbonization technologies that lead to drastic reduction of GHG, achieving cost that allows commercialization

(1) Progressive environment innovation strategy
(2) Innovation in economic and social systems/Lifestyle innovation

2. Promotion of Green Finance
Appropriate “visualization” of innovation, and mobilization of finance for the innovation by financial institutions

(1) Mobilizing green finance through TCFD* disclosures and dialogues
   * Task Force on Climate-related Financial Disclosures
(2) Promoting initiatives to expand ESG finance

3. Business-led International Application and International Cooperation
Promoting environmental technologies and products that excel/
Promoting “Co-innovation” that benefits both sides in collaboration with partner countries

(1) International application of decarbonization technologies
   linked to policy / institution building and international rule-making
(2) Increasing infrastructure development and investment that contributes to CO₂ emissions reduction
(3) Building platforms for decarbonized societies on a global scale

Chapter 4: Other Measures
- Human resource development
- Just transition
- Government-led initiatives
- Integrative promotion in collaboration with development of a resilient society by adaptation to climate change
- Carbon pricing (expert-driven technical debate is necessary)

Chapter 5: Review and Implementation of Long Term Strategy
- Review: Flexibly considering of the long-term strategy taking circumstances into account and as necessary reviewing it, about every 6 years
- Implementation: Analysis that takes future change in situation into account/Partnerships/Dialogue
Summary
Japan succeeded in reducing GHG emissions in the recent four years, and GHG intensity of GDP have been decreasing for five consecutive years.

Current status on Japan's GHG emissions is 12.4% reduction against FY2013. (Japan's NDC: 26.0% reduction by FY2030 against FY2013)

Japan aims to achieve the FY2030 target by implementing policies and measures based on “the Plan for Global Warming Countermeasures”. Every year, the government strictly reviews the progress of the plan.

Japan formulated a long-term strategy with a vision that proclaims a “decarbonized society” as the ultimate goal and aims to accomplish it ambitiously as early as possible in the second half of this century.
Thank you for your attention.
Japan conducted a factor analysis of energy-related CO₂ regarding the contribution of each factor to changes in emissions.

\[
\text{CO}_2 \text{ emissions} = \frac{\text{CO}_2 \text{ emissions}}{\text{Energy consumption}} \times \frac{\text{Energy consumption}}{\text{GDP}} \times \frac{\text{GDP}}{\text{Population}} \times \text{Population}
\]

**Factor of Carbon intensity**

**Factor of Energy intensity**

**Factor of GDP per capita**

**Factor of population**

**Factors of change of CO₂ emissions in FY2017**

- **Change of energy mix**
- **CO₂ emission factor of fuels**
- **Amount of renewable energy**
- **Types of fuels used in factories, offices and households**

- **Change of Economy**
  - **Industrial structure**
  - **Energy and power saving activities**
  - **Temperature (Climate in summer and winter)**

Unit: MtCO₂

Above: compared to FY2005
Below: compared to FY2013

Change of CO₂ emissions
-90 (-124)

Factor of Carbon Intensity
+89 (-61)

Factor of Energy Intensity
-179 (-63)

Factor of Economic activities
+90 (+42)

Factor of GDP per capita
+83 (+48)

Factor of Population
-7 (+48)

Note: The values of GHG emissions are based on the 2019 GHG inventory submission, which were revised from the values reported in the BR3.
### Basic Act on Energy Policy
- **April 2014**: 4th Strategic Energy Plan
  - Considered at Advisory Committee for Natural Resources and Energy → Cabinet decision
  - **Nuclear**: To be reduced as much as possible
    - **Renewable energy**: To be expanded (to more than 20% of total power generation)
  - Considered every 3 years (Revised as necessary)
- **July 2015**: Long-term Energy Supply and Demand Outlook (Energy Mix)
  - Considered at Advisory Committee for Natural Resources and Energy → Decision by Minister of Economy, Trade and Industry
  - **Nuclear**: 20-22% (30% before the Great East Japan Earthquake)
  - **Renewable energy**: 22-24% (double the present level)
  - To be revised as necessary for considering the Strategic Energy Plan
- **July 2018**: 5th Strategic Energy Plan
  - Plans for 2030 and scenario for 2050
  - For 2030: To achieve energy mix target
  - For 2050: Challenges towards energy transitions and decarbonization

### Strategic Energy Plan and Energy Mix
- **October 2003**: 1st Strategic Energy Plan
- **March 2007**: 2nd Strategic Energy Plan
- **June 2010**: 3rd Strategic Energy Plan
- **July 2018**: 5th Strategic Energy Plan

(Reference)
### <Policy targets for 3E+S>

#### Energy self-sufficiency (Energy security)
Energy self-sufficiency rate: About 25%, higher than before the Great East Japan Earthquake (about 20%).

#### Efficiency (electric power cost) (Economic Efficiency)
Lower compared to present.

#### Greenhouse gas emissions (Environment)
A GHG emission reduction target comparable to EU and the U.S.

### Primary energy supply

<table>
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<tr>
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<th>Fossil fuels</th>
<th>Nuclear</th>
<th>Renewables</th>
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<td>FY2010</td>
<td>81% (Natural gas 18%)</td>
<td>11%</td>
<td>8%</td>
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<td>FY2017</td>
<td>87% (Natural gas 23%)</td>
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<td>11%</td>
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<td>FY2030</td>
<td>76% (Natural gas 18%)</td>
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### Power generation

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<td>FY2017</td>
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<td>56% (LNG 27%)</td>
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### Energy Mix (July 2015)～Realizing 3E+S simultaneously～

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(Reference) Energy supply and demand outlook for FY2030:
Energy demand and primary energy supply

**Energy demand**
- Electric power: 25%
- Heat, Gasoline, Town gas, etc.: 75%

**Primary energy supply**
- 489 billion l
  - Renewables: 13-14%
  - Nuclear: 10-11%
  - Natural gas: 18%
  - Coal: 25%
  - LPG: 3%
  - Oil: 30%

**Thorough energy efficiency and conservation**
- 50.3 billion l (13% lower than before the implementation of energy conservation measures)

**Economic growth**
- 1.7%/year

**Final energy consumption**
- 326 billion l

**FY2013 (Actual value)**
- 361 billion liters of crude oil equivalent

**FY2030 (After energy conservation measures)**
Energy supply and demand outlook for FY2030:
Electricity demand and power source mix

Electric power demand

- 2013: 966.6 TWh
- Forecasted: 980.8 TWh

(Economic growth 1.7%/year)

Thorough energy efficiency and conservation
196.1 TWh
(17% lower than before the implementation of energy conservation measures)

Power source mix

(Total electricity generated)
1,065 TWh

- Renewable energy: 22-24%
- Nuclear: 20-22%
- LNG: 27%
- Coal: 26%
- Oil: 3%
- Geothermal: 1.0-1.1%
- Biomass: 3.7-4.6%
- Wind: 1.7%
- Solar PV: 7.0%
- Hydro: 8.8-9.2%

<Ref.: FY2017>
Geothermal...0.2%
Biomass...2.0%
Wind...0.6%
Solar PV...5.2%
Hydro...8.0%
A process for taking action while always monitoring the latest changes and technologies is required for developing “a flexible scenario into which diversity is taken into account”

**Concrete actions (Targets)**

- Optimal energy mix in 2030
  - Self-sufficiency rate: 6% → Approx. 25%
  - Electricity cost reduction
  - CO₂ emission reduction by 25%

**Ambitious vision (Goals)**

- Aim to achieve decarbonization, not limited to achieving a low-carbon society
Section 1 Structural Issues Faced by Japan

1. Vulnerability due to high dependency on overseas energy resources
   Worsening of the situation due to suspension of nuclear power plants; Japan’s energy self-sufficiency rate for FY2016 remaining around 8%

2. Mid- to long-term changes in the energy demand structure (population decline, etc.)
   Demand decrease due to population decline; Possible changes in energy demand structure due to digitalization, such as the dissemination of AI, IoT and VPP

3. Instability of resource prices (increased energy demand in emerging countries, etc.)
   Changes in demand trends (China, etc.) and in supply structure (shale revolution) → Oil price in 2040 estimated to be 60 to 140 dollars (IEA)

4. Increasing global greenhouse gas emissions
   32 billion tons in 2016 → Approx. 36 billion tons in 2040 (IEA’s New Policy Scenario); Momentum caused by the Paris Agreement and SDGs

Section 2 Changes in Energy Environments

1. Start of inter-technology competition for decarbonization
   Efforts to create a decarbonized energy system by combining technologies for renewable energy, electricity storage, digital control, etc.

2. Geopolitical risks increased by technology changes
   Energy structure remaining subject to geopolitical risks; Geopolitical risks coming to the surface; Dependence on China for solar panels

3. Intensified competition between nations and firms
   Setting of ambitious visions by the national government; Individual firms’ activities to pursue new technologies; Responses of financial and capital markets

Section 3 Achievement of an Optimal Energy Mix by 2030 and Its Relation with the 2050 Scenario

● Efforts to achieve an optimal energy mix by 2030 only half done

(i) Energy efficiency
   Estimated to achieve energy reduction of around 50 million kl in FY2030
   The amount of reduction as of FY2016 around 8.8 million kl

(ii) Zero-emission power source ratio
   Estimated to be around 44% in FY2030
   The ratio as of FY2016 being 16% (renewable energy: 15%; nuclear power: 2%)

(iii) Energy-derived CO2 emissions
   Estimated to be around 0.93 billion tons in FY2030
   The emissions as of FY2016 around 1.13 billion tons

(iv) Electricity cost
   Estimated to be 9.2 trillion to 9.5 trillion yen in FY2030
   The cost as of FY2016 around 6.2 trillion yen

(v) Energy self-sufficiency rate
   Estimated to be 24% in FY2030
   The rate as of FY2016 around 8%

● Ideas towards 2030

   - Predictive future with a reasonable likelihood (realistic and feasible)
   - Visionary infrastructure and vision (future and potential)
   - Existing infrastructure and vision

   Straight-line efforts to achieve realistic targets (PDCA cycle)

- Concrete actions (Targets)
  - Self-sufficiency rate: 35% by FY2030
  - Reduction in CO2 emissions

- Ambitious visions (Goals)
  - Aim to achieve decarbonization, not limited to achieving a low-carbon society

● Ideas towards 2050

- Changeable infrastructure and vision
- Human-resource development
- Technological innovation
- Upgraded infrastructure

Multiple scenario with diverse options (PDCA cycle)
## Chapter 2 Basic Policies and Measures towards 2030

### Section 1 Basic policies

1. **Confirmation of the basic viewpoint (3E+S):** To ensure environmental suitability while improving economic efficiency, on the premise of safety and with energy security as the top priority; To aim to achieve an optimal energy mix by 2030 under the principles of 3E+S

2. **Building of a "multilayered and diversified flexible energy supply-demand structure" and policy direction:** Full utilization of AI and IoT

3. **Position of each energy source in the primary energy structure and its policy direction:** Position of each energy source; Policy direction to achieve an optimal energy mix by 2030; Preparation for utilizing renewable energy as the major power source

4. **Principles of the secondary energy structure:** Facilitation of strategic development of the system and infrastructure based on the Basic Hydrogen Strategy

### Section 2 Policy measures towards 2030

1. **Promotion of securing of resources:** Promotion of independent development of fossil fuel and mineral resources and establishment of a robust industrial system

2. **Realization of a thorough energy efficient society:** Integrated implementation of the Act on Rationalizing Energy Use and support measures

3. **Efforts for the utilization of renewable energy as the major power source:** Efforts to reduce costs, overcome system constraints, and secure sufficient load following capacity

4. **Re-establishment of the nuclear energy policy:** Reconstruction and revitalization of Fukushima; Continuous pursuit of safety and establishment of stable business environment

5. **Efficient and stable use of fossil fuel:** Promotion of effective use of high-efficiency thermal power generation

6. **Fundamental reinforcement of measures for realizing a hydrogen society:** Implementation of measures based on the Basic Hydrogen Strategy

7. **Promotion of energy system reform:** Promotion of competition; Development of market environments for responding to public issues and balancing public interests

8. **Enhancement of resilience of the domestic energy supply networks:** Strengthening of the preparedness against disaster risks such as earthquakes and snow damage

9. **Improvement of the secondary energy structure:** Promotion of cogeneration; Utilization of storage batteries; Dissemination of next-generation vehicles

10. **Development of energy industry policy:** Enhancement of competitiveness and international expansion; Promotion of a distributed energy system based on the idea of local production for local consumption

11. **International energy cooperation:** Strengthening of collaboration with the US, Russia and Asian countries; Contribution to significant CO2 emission reduction in the whole world

### Section 3 Promotion of technology development

1. **Formulation of plans and roadmaps for energy-related technology development:** Promotion of energy and environmental innovation strategies

2. **Technical challenges to be addressed:** Discovery and cultivation of innovative seeds of renewable energy; Innovation of nuclear technologies based on social demand; Reduction of hydrogen costs; Development of methanation technologies

### Section 4 Enhancement of communication with all levels of the society

1. **Deepening of understanding of all levels of the society:** Ongoing efforts to improve PR activities and ways of information provision; Positive publication in an easy-to-understand manner

2. **Transparent policy planning processes and enhancement of two-way communication:** Utmost disclosure of policy planning processes; Enhancement of two-way communication; Communication concerning nuclear power through a regional symbiosis platform
Chapter 3 Efforts for Energy Transitions and Decarbonization towards 2050

Section 1 Ambitious multiple track scenario - Pursue every option

● Comparison with major countries
  - UK: Combining multiple means for decarbonization, such as expanded use of renewable energy, shift to gas, and continuous use of nuclear power → Effectively reducing CO2 emissions
  - Germany: Pursuing decarbonization only through energy saving and expanded use of renewable energy → CO2 emission reduction stagnating due to dependence on coal

● Energy environments unique to Japan (poor in resources, lacking international interconnections, facing area constraints) → Adoption of ambitious multiple track scenario to pursue every option

Section 2 Designing of the 2050 scenario

1. Sophisticated 3E+S
   ○ Safety: With safety as the top priority, achieve innovation by technology/governance reform
   ○ Energy Security: Raise resource self-sufficiency rate and technical self-sufficiency rate and ensure diversity of choice
   ○ Environment: Work towards environmental suitability and decarbonization
   ○ Economic Efficiency: Mitigate the cost burden on the people and enhance domestic industrial competitiveness

2. Scientific review mechanism
   Regularly ascertain the latest technological trend and circumstances and flexibly correct and decide development goals and relative priorities of each option

3. Cost/risk verification and dynamism among decarbonizing energy systems
   Shift from cost verification by power source to cost/risk verification among decarbonizing energy systems
   - Comparison of all costs actually required (including costs for supply and demand adjustments and system reinforcement, etc.) is difficult through cost verification by power source.
   - Verify technologies and costs of energy systems as a whole, including heat and transportation systems, and achieve dynamic energy transitions

Section 3 Issues faced by each option and priorities in response thereto

● Renewable energy: Aim to develop and utilize renewable energy as the major power source, economically independent and decarbonized; Development of high-performance low-price storage batteries
● Nuclear power: Practical option for decarbonization; Pursuit of safe reactors and development of back end technologies for restoring social trust
● Fossil fuel: Major power source during the transitional period until the achievement of decarbonization; Shift to gas; Fadeout of inefficient coal use; CCS and shift to hydrogen

Section 4 All-out efforts to realize the scenario

● All-out efforts: Public-private collaborative efforts to constantly promote technological innovation and foster and secure human resources
● Measures for the global issue of underinvestment: Steady designing and creation of a mechanism to secure required investment
● Implementation scenario: Intensive allocation of policy resources to achieve energy transitions and decarbonization; Implementation of political measures such as market reform and system reform; Efforts to make international collaboration; Enforcement of the industry and reconstruction of energy infrastructure; Reconstruction of a fund flow mechanism